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VALPRO path.

NEW VALUE LANDSCAPES FOR PLANT PROTEIN PATHWAYS

D5.3 Exploitation, IPR and Business Models Catalogue I

valpropath.eu

Co-funded by the European Union

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Abstract:	The Exploitation, IPR and Business Models Catalogue I represents a comprehensive overview of the VALPRO Path exploitation strategy, detailing methodological approaches, tools, and the exploitation-related activities undertaken to date. This document also serves as a good internal guideline for monitoring and planning exploitation and business meddling activities. This document is the first iteration of the Exploitation, IPR and Business Models Catalogue which will be updated in M48.

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List of Abbreviations and Acronyms	
BRC	Global Standard for Food Safety
CAGR	Compound Annual Growth Rate
CA	Consortium Agreement
CBM	Collaborative Business Modelling
DMIS	Data Management Information System
ER	Exploitable Asset
EU	European Results
EFSA	The European Food Safety Authority
FaaS	Farming-as-a-service
FMIS	Farm Management and Information System
FTO	Freedom To Operate
GA	Grant Agreement
HORECA	Hotels, Restaurants, and Cafés
IP	Intellectual Property
IPR	Intellectual Property Rights
IPS	Innovative Production System
IFS	International Food Standard
KPI	Key Performance Indicator
KER	Key Exploitable Result
KT	Knowledge transfer
LCA	Life Cycle Assessment
LCC	Life Cycle Cost
LCSA	Life Cycle Sustainability Assessment
MVP	Minimum Viable Performance
PVP	Plant Variety Protection
R&D	Research and development
S-LCA	Social Life Cycle Assessment
UVP	Unique Value Proposition
USP	Unique Selling Point
WP	Work Package

Table 1: List of Abbreviations and Acronyms

Executive Summary

This deliverable is the first iteration of the Exploitation, IPR and Business Models Catalogue, (D5.3 due in M24) for the VALPRO Path Project, an Innovation Action supported by the Horizon Europe Programme of the European Commission (Grant agreement ID: 101059824). General information on the project, including its objectives and partners, facts, and results, can be found on https://valpropath.eu/.

The deliverable offers an overview of the VALPRO Path exploitation strategy, detailing methodological approaches and the exploitation-related activities undertaken to date. Its aim is to develop a robust roadmap for the exploitation and market deployment of the project's results, aligning with both individual and joint exploitation plans of the partners, as well as the project's overall sustainability plan. The primary exploitation objectives include identifying and validating Key Exploitable Results (KER), developing collaborative business models, and establishing sustainable market strategies, all while ensuring effective Intellectual Property Rights (IPR) management and risk mitigation.

The initial step towards achieving this objective has been the establishment of an exploitation methodology plus the development and adaptation of tools to address the specificities of the project and its business cases. This was followed by a systematic validation and close monitoring of the progress of the project's KER through established mechanisms, including the online Exploitation and IP Catalogue, semi-structured interviews with project partners, and the Minimum Viable Performance (MVP) metric for tracking business case progress.

Secondly, the Collaborative Business Modelling (CBM) approach is introduced through the CAPTURE, CO-CREATE, and DELIVER cycles, along with the tools used in each cycle to facilitate effective business model creation and validation. This approach is applied to 5 business cases identified in Innovative Production Systems (IPSs), leveraging also the methodology for value-chain business modelling. The tools used are presented in Annex I – Collaborative Business Modelling Tools.

A comprehensive market analysis of the European plant-based food market, including a competitive landscape, is presented in Annex I – Market Analysis as the basis for the CBM. This analysis details the market research methodology and key findings while the market is segmented by geography and application, with a focus on areas such as meat analogues, bars, beverages, and Farming-as-a-Service (FaaS) and legume pasta.

This deliverable is intended to be a living document, updated as new insights and perspectives emerge. The second iteration of the deliverable will present key findings related to the exploitation prospects of the project's commercial and non-commercial results, as well as individual and joint exploitation plans. It will also refine business models within D5.4 Exploitation, IPR, and Business Models Catalogue II, to be published in M48.

1. Introduction

1.1. Project Summary

With an emphasis on underpinning economic value through nutrient use efficiency, protein quality, circularity, and biodiversity, VALPRO Path is built on the principles of co-designing, demonstrating, and evaluating new business models in an iterative manner. Supporting elements will co-develop and exploit beyond state-of-the-art technical and logistical innovations, demonstrating and evaluating innovation potential through specific value chains across 5x "living lab" Innovative Production Systems (IPSs), designed to foster multi-actor engagement and interactive innovation across diverse regions, crops and economic opportunities. For newly developed solutions and practices to fit the needs of the European plant protein market, VALPRO Path will create business models for each specific pilot providing them with key insights regarding the market analysis, competitor analysis and target users.

The main idea of VALPRO Path revolves around creating added value for new and sustainable plant-protein pathways. Resilient systems incorporate built-in diversity and continuous innovation, offering options along with mitigation and compensation strategies. As an industry-driven consortium, VALPRO Path aims to co-create novel value propositions based on data and validated learnings provided by the IPSs. These insights will feed into the work packages to support stakeholders active in the growing market for plant-based proteins in food and feed.

The backbone of the work carried out in a multi-stakeholder environment are the business cases validating concepts in real-life surroundings involving farm enterprises, farm networks, and producer organisations, leveraging current innovations for novel value chain developments. Access to practical and theoretical knowledge and expertise is facilitated by digital tools, technological solutions, and innovative processing technologies to offer opportunities to reduce food loss, increase value, and connect with new customer types, creating shorter loops between farm and fork.

1.2. Document Scope

The first version of the VALPRO Path Exploitation, IPR and Business Models Catalogue presents the methodological approach used throughout the process for efficiently implementing exploitation, business modelling and IP activities, to empower stakeholders to transition from current practices to a more innovative production and processing of protein crops and reshape plant-protein value chains.

D5.3 Exploitation, IPR and Business Models Catalogue I aims to:

- Provide an overview of the VALPRO Path exploitation and business modelling approach,
- Identify market trends related to the plant-protein landscape in Europe, as well as to capture growth prospects and market opportunities,
- Present and elaborate on the project's expected results, commercial and non-commercial, highlighting Key Exploitable Results (KER),
- Outline the project's IPR management strategy, as well as all IP related activities implemented so far.

The strategic approach will systematically be validated through iterations and adjusted to follow the timeline of the business cases implemented within IPSs as demonstrating activities. The approach will be updated with monitoring insights and results in the second iteration of the Exploitation, IPR and Business Models Catalogue (D5.4) due in M48 when additional 5 business cases will go through the business modelling process as they are prioritised throughout 2025.

2. VALPRO Path Exploitation and Sustainability Approach

2.1. VALPRO Path Exploitation and Sustainability Strategy

The VALPRO Path project strives to balance profitability with environmental and social responsibility, by showcasing effective and innovative agronomic solutions focusing on high-value protein crops in Europe through 5x IPSs:

- **IPS1:** Realising the potential of on-farm technology and processing to deliver added value,
- **IPS2**: Varietal selection based on regional suitability and nutritional characterization,
- **IPS3:** Agronomic practices that mitigate yield loss and create crop synergies,
- **IPS4:** Promoting new practises for farm-to-shelf nutrient tracking and sustainability,
- **IPS5:** Demonstrating the value of building synergies with cross regional applications.

As a result, the VALPRO Path exploitation and sustainability strategy envisions close collaboration with WP3, focusing on industry-driven pilot initiatives that promote the diversification of plant protein cropping systems and value chains. Through IPSs, these initiatives are supporting the exploration of new business models supporting sustainability alongside the inclusion of multi-actor ventures. The multi-actor approach used in implementing different IPSs is key to identifying viable business opportunities and developing collaborative business models that rely on contributions and added value creation from various actors positioned along the plant-protein value chain.

The VALPRO Path exploitation and sustainability strategy employs the Lean Startup Methodology[1], which combines business hypothesis-driven experimentation with the active involvement of stakeholders in each IPS, using a feedback loop known as validated learning. VALPRO Path tests hypotheses through an iterative process following the cycle: **CAPTURE – CREATE – DELIVER**. As IPSs and business cases identified as business opportunities progress at different pace, the cycles are adapted to each business case to monitor progress and capture co-created value.

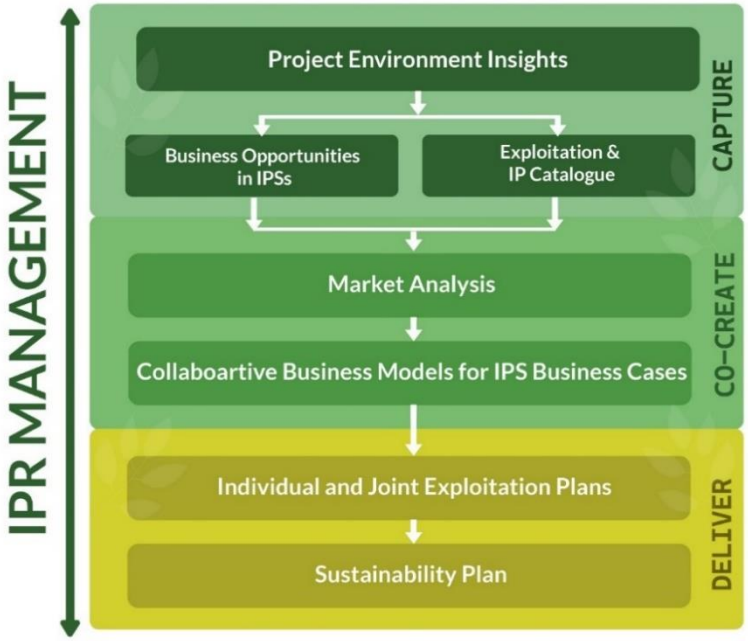


Figure 1: Overall VALPRO Path Exploitation and Sustainability Approach

To enable the most extensive use of all exploitable results and maximise project impact, a comprehensive exploitation and sustainability strategy has been planned and elaborated. Figure 1 presents the overall exploitation and sustainability approach of the VALPRO Path project, while each section is elaborated in more detail in separate sections of this deliverable.

The main goal of **the VALPRO Path Sustainability Plan** is to develop an effective way to exploit all commercial and non-commercial project results during and beyond the lifespan

[1] Ries, Eric (2014) [2011]. The lean startup: how today's entrepreneurs use continuous Innovation to create radically successful businesses. Crown Publishing. ISBN 9780307887894.

of the project. To that end, the VALPRO Path exploitation and sustainability strategy will focus on achieving the following objectives:

The objectives in the CAPTURE cycle are to:

- Identify viable business opportunities within each IPS and develop business validation metrics in close cooperation with the WP3 leader, IPS leaders, and industry partners.
- Identify and systematically validate KERs that are foreseen in the project (commercial and non-commercial) through iterative sprints – with periodic updates to inform and finetune the ongoing exploitation and sustainability strategy.

The objectives in the CO-CREATE cycle are to:

- Conduct a market analysis to understand the market contexts, challenges, competitive landscapes, target markets and the market positioning for the commercial KERs.
- Develop collaborative business models for business cases defined within each IPS and follow up on their progress in iterations using the business validation metrics.

The objectives in the DELIVER cycle are to:

- Develop joint and individual exploitation plans for project partners who are foreseen to have market exploitable assets during the project's time frame and fine tune the business models in close collaboration with business case participants after collecting validated knowledge.
- Plan the main actions to be taken by the project consortium to ensure the sustainability of the project and its findings after the end of the project.

To ensure the sustainability of the VALPRO Path project, the following chapters will detail the pathways to achieve these objectives to ensure the project's long-term viability.

2.2. Relevant Target KPIs

The exploitation activities will be regularly evaluated and monitored during and after the end of the project. A series of KPIs, related to future exploitation of projects results has been already defined by the VALPRO Path consortium as described below:

Key Performance Indicators (KPIs)	Target value
Joint exploitation strategy set up for VALPRO Path	1
Business models aligned with pilots' framework and specific value chain (On-farm processing, Supply Chain and End-to- End) value chain division points	≥ 10
Number of decision-support tools incorporated in the VALPRO Path service portfolio	≥ 3
Number of high value products for the marketplace with a '0' carbon label, coming from IPSs 1, 2 and 3	≥ 5
Exploitation of cross-regional scheme on protein consumption	10% potential market increase in EU

Table 2: Exploitation KPIs and Target Values

The KPIs emphasise establishing a collaborative strategy for utilising project results and adapting business models to fit the IPSs' framework and specific points in the value chain, including on-farm processing, supply chain, and end-to-end segments. In other words, VALPRO Path's KPIs help define and organise the activities for engaging the project's target groups and identifying the market for the commercial outcomes.

2.3. Deliverables Planning

To timely prepare and submit the deliverables for T5.3 and T5.4, which focus on exploitation and business modelling activities within WP5, the work and progress required at each project stage needs to be defined, along with an indicative timeline. These activities will be coordinated by FSH as the WP leader, with support from all project partners, under T5.3: Exploitation & IPR Management and T5.4: Go-To-Market Assessment and Business Modelling. These tasks commence at the beginning of the project and end in M48. An overview of WP5 deliverables is presented in the table below.

Del. No.	Deliverable Name	Lead Partner	Due Month
D5.1	Dissemination, Exploitation and Communication Plan I	FSH	M3
D5.2	Dissemination, Exploitation and Communication Plan II	FSH	M48
D5.3	**Exploitation, IPR and Business Models Catalogue I**	**FSH**	**M24**
D5.4	**Exploitation, IPR and Business Models Catalogue II**	**FSH**	**M48**
D5.5	Practice Abstracts – batch I	FSH	M24
D5.6	Practice Abstracts – batch II	FSH	M48
D5.7	Policy Brief	TEAGASC	M48

Table 3: Overview of WP5 Deliverables

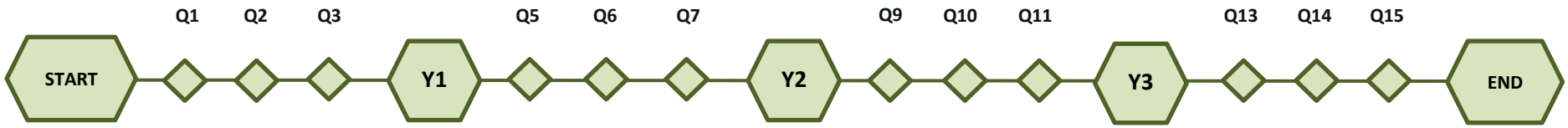
D5.1 and D5.2 provide the primary references for communication activities, offering guidelines for partners to disseminate and exploit results, and include an action plan for planned synergies with complementary initiatives. D5.5 and D5.6 will summarise all published Practice Abstracts in batches, while the Policy Brief in D5.7 will be available at the end of the project in M48. Additionally, D5.3 and D5.4 present the main reports on implemented exploitation and business modelling activities, aimed at ensuring the sustainability of VALPRO Path results.

In the initial months of the project, the preliminary list of exploitable results and all exploitation related KPIs set in the Grant Agreement (GA) were highlighted, along with the means of KPI verification (D5.1). The main exploitation pathways were introduced by presenting the Lean Startup Methodology, to be deployed in exploitation and business modelling activities, relying on the validation of initial hypotheses associated with the MVPs and validated through iterative cycles of CAPTURE_CO-CREATE_DELIVER. In D5.1, the main questions related to the characterization of exploitable results were identified, to be later mapped using the Exploitation and IP Catalogue (see chapter 3.1). From a market perspective, exploitable assets were identified, outlining the steps towards their successful commercialisation, and determining the current IPR status.

The second iteration of the Exploitation, IPR, and Business Models Catalogue (D5.4), due in M48, will build upon the findings presented in D5.3 (M24), while refining the business models and associated market perspectives for the 2024 prioritised business cases and summarising insights for those prioritised to begin in 2025. The business cases addressed in this deliverable have already commenced before the submission date but will be fine-tuned based on validated learnings over the next two years of the project. Additionally, five business cases identified in 2024 but with a start date in 2025 will be analysed from both market and business modelling perspectives in the upcoming period.

2.4. Timeline

The figure below is a visual representation of a tentative timeline for exploitation and sustainability activities to be pursued within T5.3: Exploitation & IPR Management and T5.4: Go-To-Market Assessment and Business Modelling. Please note that the work that refers to dissemination and communication activities is not included in this timeline, as the purpose of this Gantt chart is to capture strictly exploitation and sustainability activities.



T5.3
M1-M48

D5.1 — **D5.3** — **D5.2 & D5.4**

Q2: Exploitation and IP questionnaire & Guidelines
Q3: Distribution of the Exploitation and IP Questionnaire
Q3: IP workshop 1

Q7: Exploitation & IP Catalogue update I
Q8: Exploitation pathways for non-commercial results

Q9: IP scan process
Q9: IP workshop #2 (M27)
Q11: Exploitation & IP Catalogue update II
Q12: Exploitation pathways for non-commercial results - Update

Q13: IP considerations
Q13: Individual and Joint exploitation plans
Q14: Individual IP sessions
Q15: Exploitation & IP Catalogue update III
Q15: Sustainability plan

T5.4
M1-M48

D5.1 — **D5.3** — **D5.2 & D5.4**

Q4: Business modelling approach definition
Q4: Intro Workshop #1

Q5: Business opportunities & Validation metrics
Q6: Definition of business cases & Market analysis questionnaire
Q7: Market analysis for 2024 business cases & Business modelling workshops
Q8: Collaborative Business Models for 2024 business cases

Q10: Funding opportunities exploration & Market analysis for 2025 business cases
Q11: Funding opportunities workshop
Q12: Business Modelling workshops

Q13: Collaborative Business models for 20205 business cases
Q13: Validation of final business models & Financial analysis
Q13: Individual and Joint exploitation plans
Q15: Sustainability plan

3. VALPRO Path Cycles

VALPRO Path tests hypotheses underpinning the identified business case through an iterative process following the CAPTURE, CO-CREATE and DELIVER cycles. These cycles are adapted to each business case to monitor progress and capture co-created value. In the CAPTURE cycle, insights from the internal project environment are harnessed to identify viable business opportunities within each IPS, in collaboration with the WP3 leader, IPS leaders, and industry partners. This phase also involves developing business validation metrics and maintaining the VALPRO Path Exploitation and IP Catalogue, which provides an overview of initially identified exploitable results with periodic updates to inform the ongoing exploitation strategy. The CO-CREATE cycle builds upon these initial assumptions by facilitating the development of CBMs within each IPS, ensuring at least one business case is identified per IPS. Their progress is tracked using MVP metrics from the previous cycle, with a focus on validated learning and the creation of both individual and joint exploitation plans. This phase also includes market analysis to assess the commercial potential of VALPRO Path solutions. Finally, the DELIVER cycle is centred on finalising agreements for exploitation and co-creating final business models in close collaboration with project management and industry partners. This cycle explores various commercial and non-commercial pathways for the exploitation of VALPRO Path solutions, ensuring a comprehensive and sustainable strategy for bringing these innovations to market.

Each cycle anticipates the use of tools to take forward the exploitation efforts. The toolbox used in the VALPRO Path exploitation and sustainability approach is explained in more detail in Annex I.

3.1. CAPTURE Cycle

Exploitation and IP Catalogue

The VALPRO Path project aims to develop exploitation pathways for a range of commercial and non-commercial results mapped during the early stages of project implementation but also developed at later stages of the project. To continuously identify and systematically validate these exploitable results, an Exploitation and IP Catalogue was established. This catalogue captures ERs and monitors and manages them throughout the project.

Given the innovation-oriented nature of the project, compiling the Catalogue is intended to be a comprehensive, iterative, and ongoing process. Initially, a summary of the main commercial and non-commercial results was captured and validated in M10. An update request was shared with project partners in M22, and the Catalogue will continue to be iteratively updated by partners, with the final findings reported in D5.4 in M48.

Throughout the project, any new commercial and non-commercial ERs will be added to the updated versions of the Catalogue. Feedback from the consortium has facilitated the exploration and suggestion of potential exploitation pathways and IP protection measures for each exploitable result, considering the organisations' existing business models, market positions, and marketing strategies. For results developed jointly by two or more project partners, joint exploitation plans will be co-created by all participating organisations.

Business Opportunities in IPSs

To support the mission embodied in *"The right crop in the right place for the right market,"* the project consortium has established IPSs, each targeting a different aspect of the plant-protein value chain. These aspects are divided as follows: i) On-farm processing (beginning); ii) Supply chain (middle); and iii) End-to-end.

The IPSs aim to demonstrate the diversification of plant protein cropping systems and value chains through industry-focused pilot initiatives supporting the creation of new circular business models. The IPS-specific objectives will be achieved by integrating crops, agronomic practices, technologies, and digitalization across farm, storage, logistics, and processing levels. Each IPS is grounded in its own value chain, offering insights and fostering a co-learning feedback loop both within the individual chain and between IPSs, following the previously established value chain division.

- **On-farm processing:** Co-created with breeders and producers, the focus is on the beginning of the value chain, developing new strategies to pre-process materials and add value at the farm before shipping the pre-ingredients.
  Project partners involved as producers and processors: FSDC, Beotanics, TEAGASC, MTL, MP

- **Supply chain:** Co-created with FMIS partners in IPSs, a set of digital tools will be used to assess, monitor, and evaluate carbon emissions and nutrient balance for crops. Once the crop variety with the best performance in terms of sustainability and marketability is identified, the goal is to design a pathway for further supply chain shipping and crop utilisation.
  Project partners involved in FMIS and logistics: FarmB, Agricolus, UNITO

- **End-to-end:** Co-created with consumer-facing partners in the IPSs, the aim is to obtain feedback on potential barriers and weak points in the market strategy for a plant-based protein-rich final product.
  Project partners involved as end users: FSDC, Kerry, PepsiCo, APT

FSH developed a business modelling methodology aimed at generating 10+ IPS-related business models to facilitate the commercialization of VALPRO Path solutions. This approach was presented during a Consortium meeting in M11, where FSH introduced the business modelling approach and provided IPS stakeholders with guidelines for MVP business validation. The emphasis was on iterative processes for data collection to track IPS progress. Guidelines and a detailed timeline for IPS stakeholders were provided. The recording of the meeting, along with supplementary materials, was subsequently distributed to all project partners for their reference.

To support this endeavour, FSH created and distributed an MVP Business Validation General Questionnaire designed to capture insights into potential business opportunities across various IPSs. The questionnaire aimed to delineate the positioning of IPS innovations within the plant-protein value chain, articulate the challenges they aim to address, specify their objectives, and define the metrics for MVP within each IPS's business cases, aligning them with identified business opportunities. The business modelling approach was scheduled to align with the commencement of IPS activities in M12. The MVP Business Validation General Questionnaire template was distributed to IPS leaders in M11, after the Consortium meeting when the VALPRO Path business modelling approach was presented.

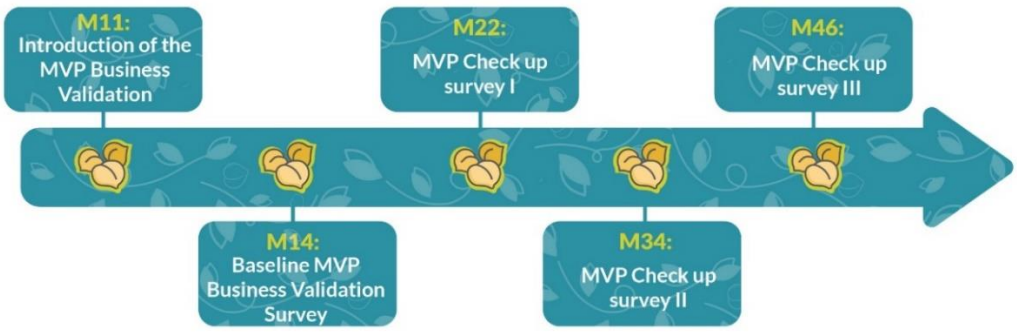


Figure 2: VALPRO Path MVP Business Validation Survey Timeline

At the IPS Coordination Meeting in M13, participants from all five IPSs were presented with exemplar business cases and metric suggestions. The objective was to engage IPS participants in defining business opportunities within each IPS, discussing the baseline values (where applicable), and devising methodologies for data collection following the timeline presented in the figure above.

The set timeline applies to both business cases prioritised for 2024 and those for 2025. However, business cases commencing in 2025 will have two iterations to report their progress. To streamline data collection at the business case level, metrics for tracking progress are included in the IPS reporting template, developed in close collaboration with the WP3 leader and IPS leaders. Partners involved in a business case will report their progress using the IPS reporting template. The progress needs to be reported the latest by the MVP checkup dates – checkup I (M22), checkup II (M34), checkup III (M46).

The suggested business validation areas for the metrics, as outlined in Figure 3, were discussed in M13 with the entire consortium, supplemented by several individual meetings to refine metric options for specific business cases and IPSs. Figure 3 closely reflects on the suggested metric areas, aligning them with the KPIs established in the GA. The metrics have been defined for the business cases prioritised to start in 2024 and they all fall into some of the areas following the value chain division while at the same time considering the sustainability aspect of the business cases. In the definition of the appropriate metrics, the MVP Business Validation Survey has been used while the business validation metrics are presented in Chapter 5 for each business case.

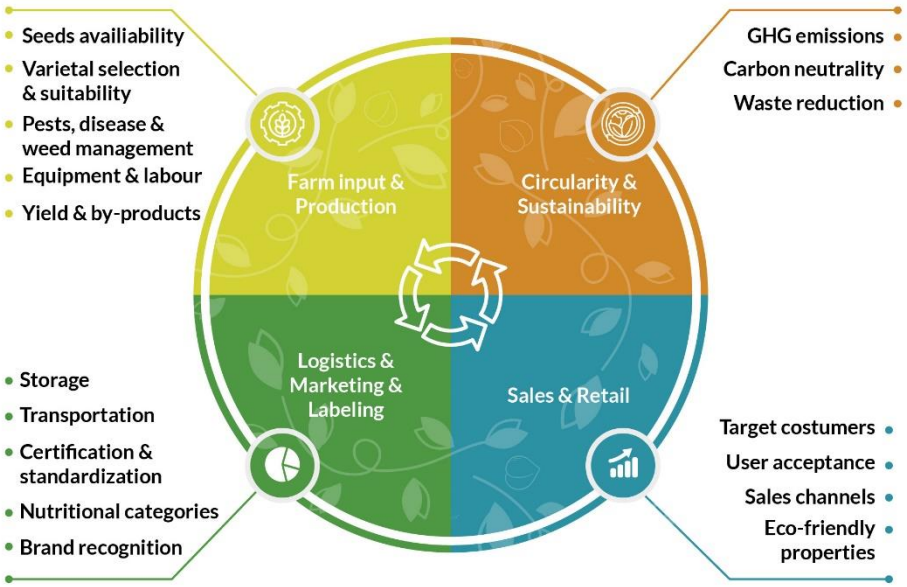


Figure 3: VALPRO Path MVP Business Validation Areas for Metrics

The work done from M13 until M17 has supported the development of the final list of business cases confirmed in M17 at a Consortium meeting while they were previously discussed at the AGM in Rome in M14 when all project partners were present. The business cases are based on the activities planned within each IPS, as demonstrated in the D3.1 Report on Full IPS Implementation I. Defining the business cases within IPSs in the project was crucial as it laid the groundwork for other exploitation-related activities addressed in T5.4. The final list of business cases addressed is presented in Table 4.

No.	Business case	IPS	Due in
IPS1.1	Production of plant-based burgers	IPS1	2024
IPS1.2	Adding value to European peanut	IPS1	2025
IPS2	Varietal selection for different pedo-climatic regions	IPS2	2024
IPS3.1	Intercropping field peas and faba beans	IPS3	2024
IPS3.2	Production of confectionery products using combinations of pea and bean flour	IPS3	2025
IPS4.1	The development of more informative labelling for plant protein foodstuffs	IPS4	2024
IPS4.2	Utilisation of precision agriculture to monitor crop performance	IPS4	2025
IPS4.3	Development of a nutrient tracking tool	IPS4	2025
IPS5.1	Value added production of artisan legume-based pasta	IPS5	2024
IPS5.2	Development of a new bagging system to support quality and integrity of product transport	IPS5	2025

Table 4: Overview of 10 Business Cases in IPSs

The identified business cases target various pain points in the plant-protein value chain. Some, such as the *Development of a nutrient tracking tool* (IPS4.3) and *Adding value to European peanut* (IPS1.2), span the entire value chain, as illustrated in Figure 4 where the position of business cases in the plant-protein value chain division is presented. VALPRO Path solutions arising from these business cases are categorised as products, decision support tools, advisory services, models and technologies.

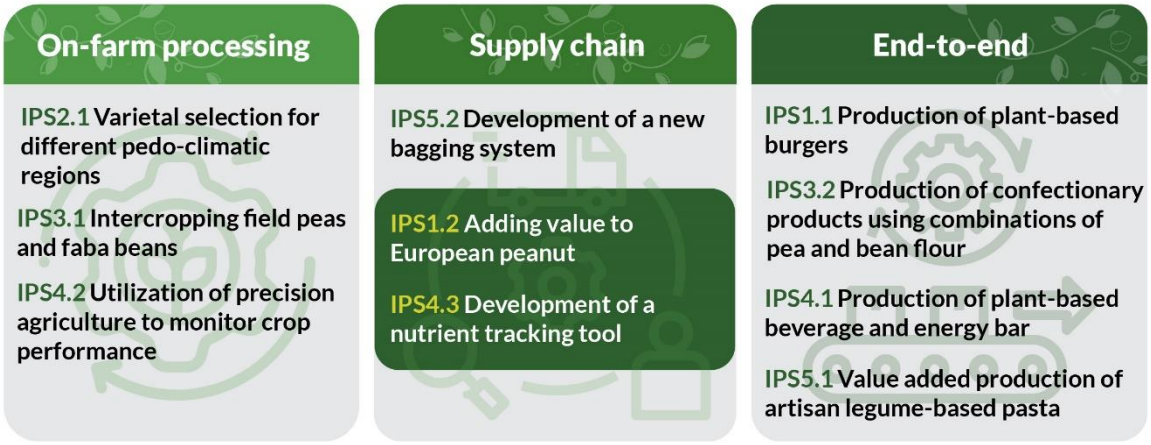


Figure 4: VALPRO Path Business Cases across Value Chain Division

In the ***On-farm processing*** segment of the plant-protein value chain, most solutions consist of decision-making tools, advisory services, and cutting-edge technologies used in precision agriculture. The ***Supply chain*** segment focuses on logistical solutions, exemplified by the development of a new bagging system contributing to cross-regional applications in the plant-protein sector. The ***End-to-end*** segment of the value chain involves the production of plant-based protein-rich final products for various market categories, including meat alternatives, confectionery products, beverages, and other food applications for plant-based proteins. These VALPRO Path solutions are the primary focus of the business modelling process addressed in the Co-create cycle.

3.2. CO-CREATE Cycle

The VALPRO Path project involves multiple project partners across various segments of the plant-protein value chain, including producers, processors, retailers, and end-users. The methodological approach to VALPRO Path business modelling in the Co-create cycle emphasises collaborative efforts among value chain partners, aimed at fostering innovation within the European plant-protein value

chain and facilitating the generation of sustainable societal impact. Consequently, VALPRO Path business models depart from traditional models that focus solely on individual company performance, instead prioritising the creation of collective and sustainable value.



Figure 5: Plant-protein Value Chain Division and Participants in VALPRO Path

The project has established a **VALPRO Path Methodology for Value Chain Business Modelling** relying on co-creation among multiple stakeholders in the plant-protein value chain. Key IPS scientific and industry partners within specific segments of the value chain cooperate to develop **Collaborative Business Models (CBM)** tailored to bring innovation into various parts of the value chain. CBM fosters cooperation among stakeholders while startups, SMEs and companies can harness the power of collective intelligence, share resources and expertise at the same time achieving sustainable growth. A stakeholder network develops the CBM, mutually adding value to the model by each party involved.

Collaborative business modelling Qs	Business modelling Qs
▪ How will the collaborative business create, market and deliver value to customers and consumers? ▪ How will it use relationships to generate profitable and sustainable revenue streams? ▪ How will the business focus on profitability, competitiveness and sustainability? ▪ Can the business partners work together in the short, medium and long term to benefit each other?	▪ What is offered to the customers? ▪ How are the target groups? ▪ How is the value proposition created? ▪ How is revenue generated?

Table 5: Questions in Collaborative Business Modelling

The aim is to illustrate the creation of value for consumers and ensure that the subsequent capture of value is distributed equitably among all stakeholders. Achieving this requires an understanding of each stakeholder's role in delivering value from farm to consumer and a collaborative effort to establish sustainable operational practices. The main questions that need to be answered in CBM when compared to the business modelling process are presented in Table 5. To answer these questions, a set of business modelling tools adapted to the needs of the VALPRO Path project are used such as the Market Analysis Questionnaire, Value Chain Innovation Mapping Tool, Value Proposition Statement, and the Business Model Radar explained in more detail in Annex I.

Steps in Collaborative Business Modelling

The sessions outlined in the figure below align with the phases of the CBM framework, aiming to elicit insights on the components delineated within CBM. These joint sessions are designed to offer guidance on tools that aid the business case consortium in the CBM process facilitated by FSH.



Figure 6: Guidance for CBM in VALPRO Path

SESSION 1 – Market Analysis
This session introduces the Market Analysis Questionnaire, a tool facilitating market analysis. It covers the importance of market analysis, provides instructions for completing the questionnaire, and outlines the key sections participants need to address. The questionnaire gathers information on marketability intentions for VALPRO Path solutions, including geographical scope, market dynamics, competition, technological factors, potential by-products, regulatory impacts, and stakeholder insights.
For whom: IPS leaders and business case participants

Progress made: This session was hosted online during the IPS Coordination meeting in M19 when IPS leaders and business case participants were present. It was convened to advance the identification of potential markets and customers related to the business cases. In the beginning of M18 the Market Analysis Questionnaire was distributed to business case participants and IPS leaders. However, to further advance the work, the session was organised in M19 to provide further guidance on the topic. Business case participants relevant for the 2024 prioritised business cases have presented their work on the IPS Coordination meeting in M21.

SESSION 2 – How to do Collaborative Business Modelling?
This session aims to onboard VALPRO Path participants, focusing on familiarising them with the CBM process, its motivations, and desired outcomes. Facilitated by FSH, it fosters open dialogue to identify early challenges and assess stakeholders' familiarity with business modelling, determining the need for additional support. The session also aligns individual objectives with the collective goal of fostering sustainable impact, laying the foundation for collaborative efforts that create shared value.
For whom: IPS leaders and WP leaders

Progress made: This session took place during the Spring meeting in Brussels (BE) in M19 when WP and IPS leaders were present. However, since not all business case participants have attended the meeting, a quick recap of the session was done during the introduction into the DESIGN workshops performed in M21 and M22.

SESSION 3 – Workshop 1: EXPLORE
This session uses CBM tools tailored to the VALPRO Path project to validate its Value Chain Business Modelling methodology. Building on insights from session 1, workshop 1 focuses on practical implementation, using the Value Chain Innovation Mapping Tool and the Value Proposition Statement. The Innovation Mapping Tool analyses the food product value chain, identifying pain points and gains. By the workshop's end, stakeholders should reach consensus on the innovation's functionality, value proposition, and technical responsibilities. The Value Proposition Statement helps

articulate the innovation's value and target customers, ensuring clear, co-created value and aligned stakeholder efforts.
For whom: IPS leaders and WP leaders

Progress made: The EXPLORE workshop took place during the Spring meeting in Brussels (BE) in M19 when WP and IPS leaders were present. However, since not all business case participants have attended the meeting, a quick recap of the results of the workshop were presented to actively engage all the business case participants into the business modelling process. This was done during the introduction into the DESIGN workshops performed in M21 and M22.

SESSION 4 – Workshop 2: DESIGN
The DESIGN workshops were performed separately per each business case as identified in Table 6. In this workshop, business case participants engage in joint development of the CBM, building upon insights generated from previous sessions. To facilitate this process, the Business Model Radar tool is employed. The resulting CBMs aim to outline how the innovation in question will be practically realised, which stakeholders will be involved (including their roles and activities), and how costs and benefits will be distributed within the collaborative network. FSH takes on the role of the facilitator to ensure collaboration while driving the discussion.
For whom: IPS leaders and business case participants

IPS	2024 Business case	Date & Time	IPS leader	Business case participants	No. of participants
IPS1	Production of plant-based burgers	9 May 2024 at 9.30 am CET	UNITO	FSDC, BEOTANICS, farmB, UNITO, AU	8
IPS2	Varietal selection for different pedo-climatic regions	15 May 2024 at 2.00 pm CET	AU	AU, TEAGASC, ZALF, UNITO, BEOTANICS; NTUA, CSIC, AGRICOLUS, farmB	11
IPS3	Intercropping field peas and faba beans	20 May 2024 at 12.30 pm CET	TEAGASC	TEAGASC, AU, CSIC, AGRICOLUS	7
IPS4	The development of more informative labelling for plant protein foodstuffs	27 May 2024 at 1.00 pm CET	TEAGASC	PepsiCo, Kerry, BEOTANICS, farmB, MTL	9
IPS5	Value added production of artisan legume-based pasta	11 June 2024 at 2.00 pm CET	UNITO	AU, MP, ATP, Kerry	9

Table 6: Overview of the DESIGN Workshops Schedule

Progress made: The DESIGN workshops were held in an online setting during M21 and M22 with active participation from business case participants supported by the Project Coordinator, the Project Manager and IPS leaders. The workshops were held online to achieve greater participation from the relevant stakeholders and accommodate their schedules more easily. Work was done using a digital workspace platform that enables visual collaboration among teams – MURAL.

By utilising the CBM methodological approach tailored to meet the needs of the VALPRO Path project, FSH aims to facilitate the creation of collective value through co-creation among diverse stakeholders involved in the plant-protein value chain, employing various tools throughout the process.

3.3. DELIVER Cycle

This cycle encompasses activities focused on refining and adjusting business models based on progress and MVP validation throughout the project to be presented using the Business Model Canvas template. The Business Model Canvas acts as a roadmap for implementing the business strategy as it helps plan the go-to-market strategy and pinpoints the key assumptions requiring validation.

In its facilitation role, with the backing of IPS leaders, FSH will lead the preparation of the Canvas based on input collected when preparing the Business Model Radar. FSH will extend invitations to all business case participants engaged in crafting VALPRO Path solutions to provide feedback on the draft versions of the business models while finetuning is possible based on MVP validation results and progress track. The Canvas for all 10 business cases will be incorporated in D5.4 Exploitation, IPR and Business Models Catalogue II in M48.

4. VALPRO Path Market Analysis

To comprehensively understand the current situation in Europe, it is essential to take into consideration the market. This includes identifying commercial potential for VALPRO Path food products and tools, practices, and technologies validated within the project's framework.

The business cases in VALPRO Path involve diverse plant-protein sources and their various applications in food products. Additionally, a range of decision-making tools, advisory services, and supportive technologies have been introduced to foster innovation for both end consumers and farmers, who are at the beginning of the plant-based protein value chain. This deliverable focuses specifically on the food products and decision support tools from the 2024 prioritised business cases as detailed in the table below.

No.	Business case	Business cases by protein source	Business cases by application
IPS1.1	Production of plant-based burgers	Lentil, chickpea	Meat analogues
IPS2	Varietal selection for different pedo-climatic regions	Field pea, faba bean, lentil, chickpea, lupin, peanuts, soybean	Decision support tool
IPS3.1	Intercropping field peas and faba beans	Field pea, faba bean	Advisory service
IPS4.1	The development of more informative labelling for plant protein foodstuffs	Lupin	Bars/ Beverages
IPS5.1	Value added production of artisan legume-based pasta	Lentil, chickpea	Pasta

Table 7: Overview of VALPRO Path Business Cases by Plant-protein Source and Application

The business cases addressed in IPS2 and IPS3 focus on innovations in protein crop production, specifically pre-farm gate practices. These were analysed in terms of agronomic practices and tools that support protein crop cultivation. Other business cases were analysed as plant-based food products across different categories.

The identification of business cases within each IPS and the scope of the market analysis was based on data from the MVP Business Validation General Questionnaire, the Market Analysis Questionnaire, and insights gathered from one-on-one and group sessions and interviews. These responses provided foundational insights for subsequent research. The market analysis considered the commercial potential of the VALPRO Path products, services, and tools as presented in the table below.

	Business case IPS1.1	Business case IPS2	Business case IPS3.1	Business case IPS4.1	Business case IPS5.1
Scope:	Production of plant-based burgers	Varietal selection for different pedo-climatic regions	Intercropping field peas and faba beans	The development of more informative labelling for plant protein foodstuffs	Value added production of artisan legume-based pasta
Place:	Italy	Europe	Ireland	Europe	Italy
Crops addressed:	Lentil, chickpea	Pea, lentil, lupin, chickpea, soybean, peanut	Field pea, faba bean	Lupin	Lentil, chickpea
Type of result:	Food product	FaaS	FaaS	Food product	Food product

IPS leader:	UNITO	AU	TEAGASC	TEAGASC	UNITO
Focal organisation[2]:	FSDC	AU	TEAGASC	PepsiCo	ATP
Business case participants:	BT, FarmB, UNITO, AU	TEAGASC, UNITO, ZALF, BT, CSIC, FarmB, Agricolus	AU, CSIC, Agricolus	TEAGASC, Kerry, BT, FarmB	MP, Kerry, AU, UNITO

Table 8: Overview of VALPRO Path 2024 business cases

Business case IPS1.1 - Production of plant-based burgers. The VALPRO Path plant-based burger serves as a tangible example showcasing the potential of on-farm technology and processing through existing practices implemented by FSDC in Northern Italy. This business case aims to illustrate how farmers, producers, and agricultural cooperatives can generate added value through market validation of plant-based burgers made from chickpeas and lentils. Distribution capabilities are also assessed alongside the development of marketing strategies to facilitate the exploration of short supply chains. The overarching objective is to create premium-quality, functional ingredients and top-tier end-products that deliver nutritious, fresh, locally sourced, and flavourful dining experiences.

Business case IPS2 - Varietal selection for different pedo-climatic regions. The VALPRO Path varietal selection tool significantly contributes to the objectives of IPS2 by leveraging the insights from stress resilience profiling in WP2 to guide the selection of high-performing protein varieties. It integrates data from national variety trials on major and minor grain legumes, alongside new information on food quality, yield, and agronomic parameters. This comprehensive approach will enable the tool to provide tailored recommendations for specific European regions, ensuring optimal crop performance and resilience. By centralising this science-backed advice, the tool will support farmers and breeders in choosing effective strategies to mitigate vulnerabilities in plant protein systems.

Business case IPS3.1 - Intercropping field peas and faba beans. The first business case in IPS3 focuses on investigating intercropping as an agronomic practice to enhance yields of field peas, which are prone to lodging. Faba beans are integrated into intercropping systems to mitigate lodging risks exacerbated by frequent intense rain and wind events associated with climate volatility. By improving the structural stability of field peas, intercropping introduces new opportunities for food and feed producers. This lays the groundwork for the next business case under IPS3, which will explore the use of pea and faba bean flour—both individually and in combination—in confectionery products, leveraging crop synergies.

Business case IPS4.1 - The development of more informative labelling for plant protein foodstuffs. This business case addresses the growing demand for sustainable and innovative food products that consider both nutritional composition and environmental impact. By leveraging advanced digital tools and spectroscopy technologies, the aim is to develop high-value, near zero-carbon labelled products demonstrated through a plant-based beverage and an energy bar as proof of concept. These prototypes will feature ingredient labels displaying both nutritional composition and carbon use efficiencies, providing consumers with transparent information about the environmental impact of their food choices. This approach sets a new standard for eco-friendly food labelling, offering significant value to end users who prioritise sustainability and informed purchasing decisions.

Business case IPS5.1 - Value added production of artisan legume-based pasta. The business case explored as a demonstration concept for IPS5 aims to create cross-regional partnerships by studying integrated value chains throughout Europe. Three crops—pea, lupin, and chickpea—will be evaluated

[2] A focal organisation in a collaborative business model (CBM) is typically the central entity around which the collaboration is structured and the one interacting with the customers.

for flour production using different milling diagrams, leading to the creation of innovative products such as plant-based pasta by APT. This pasta will undergo comprehensive nutritional and functional property analysis. Additionally, milling by-products will be evaluated for potential feed purposes, further enhancing circularity. The focus on plant-based pasta exemplifies the value of building synergies through the cross-regional applications addressed in IPS5.

4.1. VALPRO Path Competitive Advantages

The table below showcases the competitive advantages defined as *Unique Selling Points* (USPs) for the VALPRO Path business cases prioritised for 2024.

No.	Business case	Targeted market	Unique Selling Point (USP)
1.	Production of plant-based burgers	Italy	**The VALPRO Path plant-based burger** stands out for its commitment to supporting local agriculture, offering a delicious and sustainable alternative made from fresh, locally sourced raw materials.
2.	Varietal selection for different pedo-climatic regions	Europe	**The VALPRO Path varietal selection tool** is an essential resource for agricultural advisors, agronomists, farmers, and policymakers, providing centralised, science-backed information for selecting and recommending top-class protein varieties tailored to specific European regions.
3.	Intercropping field peas and faba beans	Europe	**The VALPRO Path field pea and faba bean intercropping agronomic practices** offers farmers an innovative solution to boost yield and sustainability while minimising lodging risks.
4.	The development of more informative labelling for plant protein foodstuffs	Europe/ Global	**VALPRO Path plant-based beverage and energy bar** cater to environmentally conscious consumers by offering a sustainable alternative that emphasises locally sourced proteins and reduces carbon footprints.
5.	Value added production of artisan legume-based pasta	Italy	**VALPRO Path artisan legume pasta** offers a nutritious and eco-friendly option for vegans, vegetarians, flexitarians, and health-conscious consumers seeking plant-based protein sources.

Table 9: USPs of VALPRO Path Products and Services

The USPs were developed based on the comprehensive insights obtained through an in-depth market analysis. This analysis provided a clear understanding of the market dynamics, consumer behaviour, and the competitive landscape, allowing for the identification of key features and benefits that set VALPRO Path solutions apart from others. For more details on the VALPRO Path Market Analysis, see Annex II.

5. Business Cases Findings

This chapter incorporates the findings of the CBM approach for the VALPRO Path 2024 prioritised business cases outlining some of the key categories tackled in interviews and dedicated workshops with business case participants. The following are presented:

5.1. IPS1.1 Production of plant-based burgers

Problem statement: The current, lengthy value chain in plant-based food production limits farmers' ability to capture added value from high-value end-products like veggie burgers. By transferring processing activities coupled with decentralised technologies to processors, farmers miss potential revenue and efficiency gains. Shortening the value chain through on-farm processing is needed to enhance profitability and sustainability for farmers through placement of premium products.

Business opportunity identified as a hypothesis: *„If the value chain in plant-based production is shortened by introducing extra on-farm activity with decentralised technologies, added value will be created for farmers through high value end-products (i.e., veggie burgers)."*

Position in the value chain division: End-to-end

Customer segmentation: Health and environmentally conscious consumers & Catering industry, micro-SMEs, street vendors.

MVP: Use on-farm processing technology to develop >2 types of end-products using lentil and chickpea with exploitation potential in B2B and B2C business transactions.

Value Proposition Statement: *For vegans, vegetarians, flexitarians, and other health-conscious consumers who want to increase their consumption of locally sourced and fresh plant-based foods, the VALPRO Path* ***plant-based burger*** *is a delicious and sustainable option that offers rich flavours and textures from locally grown plant proteins. Unlike store-bought frozen veggie burgers made from imported legumes offered by big retail chains, the VALPRO Path plant-based burgers* ***support local agriculture and provide a fresher, more flavourful dining experience.***

IPS 1 endeavours to transform the agricultural value chain through the development of innovative business models focused on on-farm processing. A notable example is the production of veggie burgers using lentil and chickpea flour. In this business case, decentralised technologies are pivotal in enhancing value for farmers. This includes the assessment and collaborative development of new food services, retailing, and marketing strategies aimed at rebalancing market influence from traders and retailers to producers and farmers. The business validation metrics for this case study are detailed in the table below.

Business case validation metrics for IPS1.1: Production of plant-based burgers
On-farm technology solutions validated (#)
Labour use per kg of end- product (h/year)
Diversity index in farm labour force
GHG emissions in lentil-based burger production
GHG emissions in chickpea-based burger production
Micro-SMEs distributing developed end-products (#)
Lentil-based product value (EUR/kg)
Chickpea-based product value (EUR/kg)
Lentil-based flour price (EUR/kg)

Chickpea-based flour price (EUR/kg)
Targeted customer groups reached (#)
Results of sensory properties evaluation of lentil-based burgers
Results of sensory properties evaluation of chickpea-based burgers

Table 10: Business Validation Metrics for Business Case IPS1.1

The **value chain innovation mapping for business case IPS1.1** is presented below, highlighting the co-production activities involving various business case participants across different points in the value chain (FSDC, BT, FarmB, UNITO, AU), as well as the relevant stakeholders and the information and value generated from collaborative efforts.

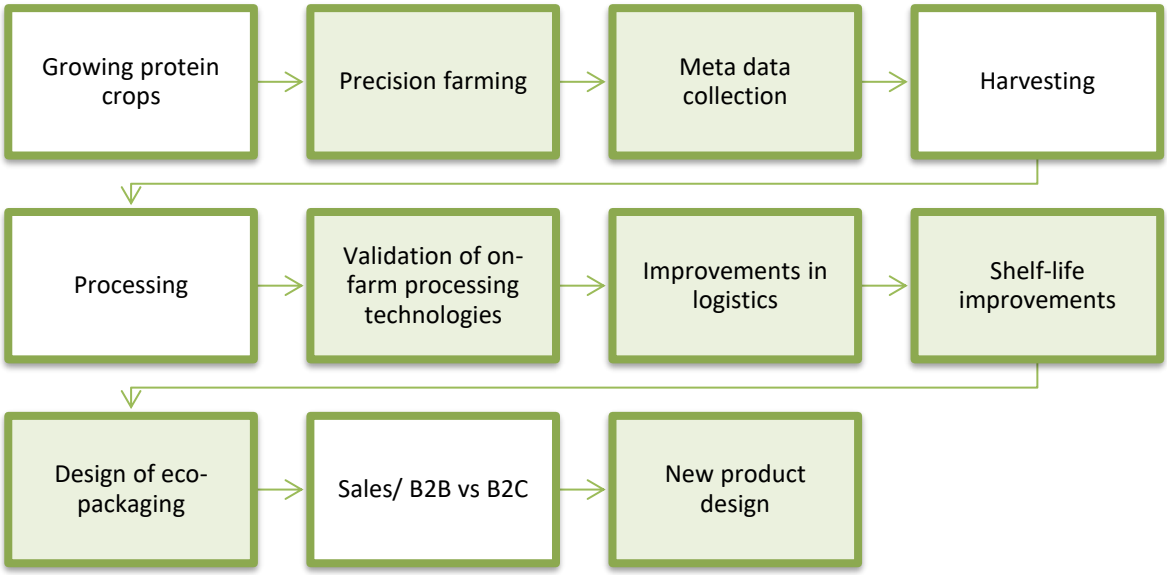


Figure 7: Value Chain Innovation Mapping in Business Case IPS1.1

The collaborative business model leverages the expertise of multiple actors to introduce innovations at different points in the value chain. Innovations before the farm gate focus on precision farming aimed at reducing production costs and collecting metadata to determine product sustainability performance, managed by FarmB. AU contributes to improvements related to extending product shelf-life, designing eco-packaging, and introducing new product formulations, while UNITO leads efforts in enhancing logistical solutions and business modelling. FSDC serves as the main contact point for customers in both B2B and B2C sales.

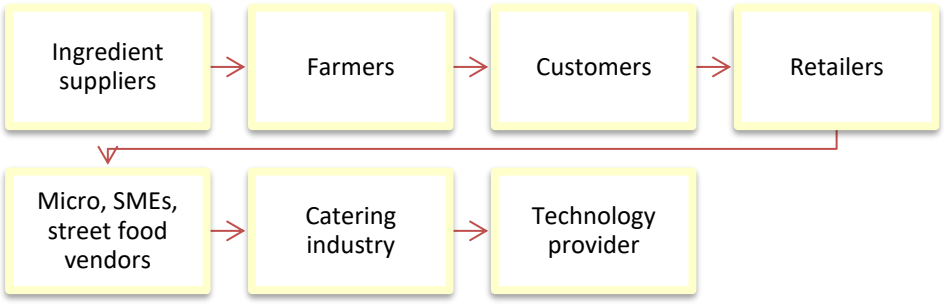


Figure 8: Stakeholders benefiting from VALPRO Path Innovation in Business Case IPS1.1

Stakeholders in the value chain include ingredient suppliers for various protein crops currently not grown on the FSDC farm. Farmers employed by FSDC, who cultivate protein crops, stand to benefit

from the value chain innovations introduced in this business case. The customers are divided into two groups: health and environmentally conscious consumers (B2C) and the catering industry, micro-SMEs such as street vendors, and local restaurants (B2B).

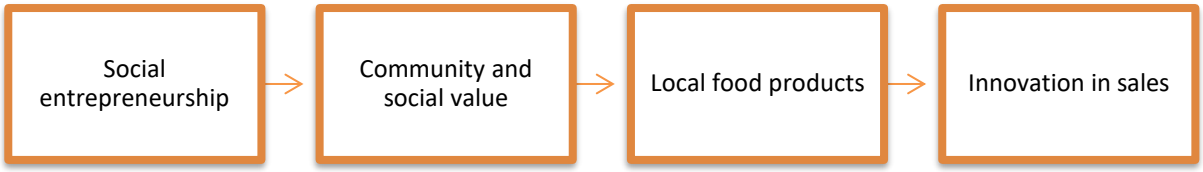


Figure 9: Information and Value from VALPRO Path Innovation in Business Case IPS1.1

The insights and value derived from IPS findings create additional business opportunities and revenue possibilities for social enterprises like FSDC. Additionally, the business case adds community and social value to the end-product, promoting local food products. The information and value generated by all parties involved in the business case are detailed in the business model radar, which outlines fundamental categories for establishing a collaborative business model among all participants.

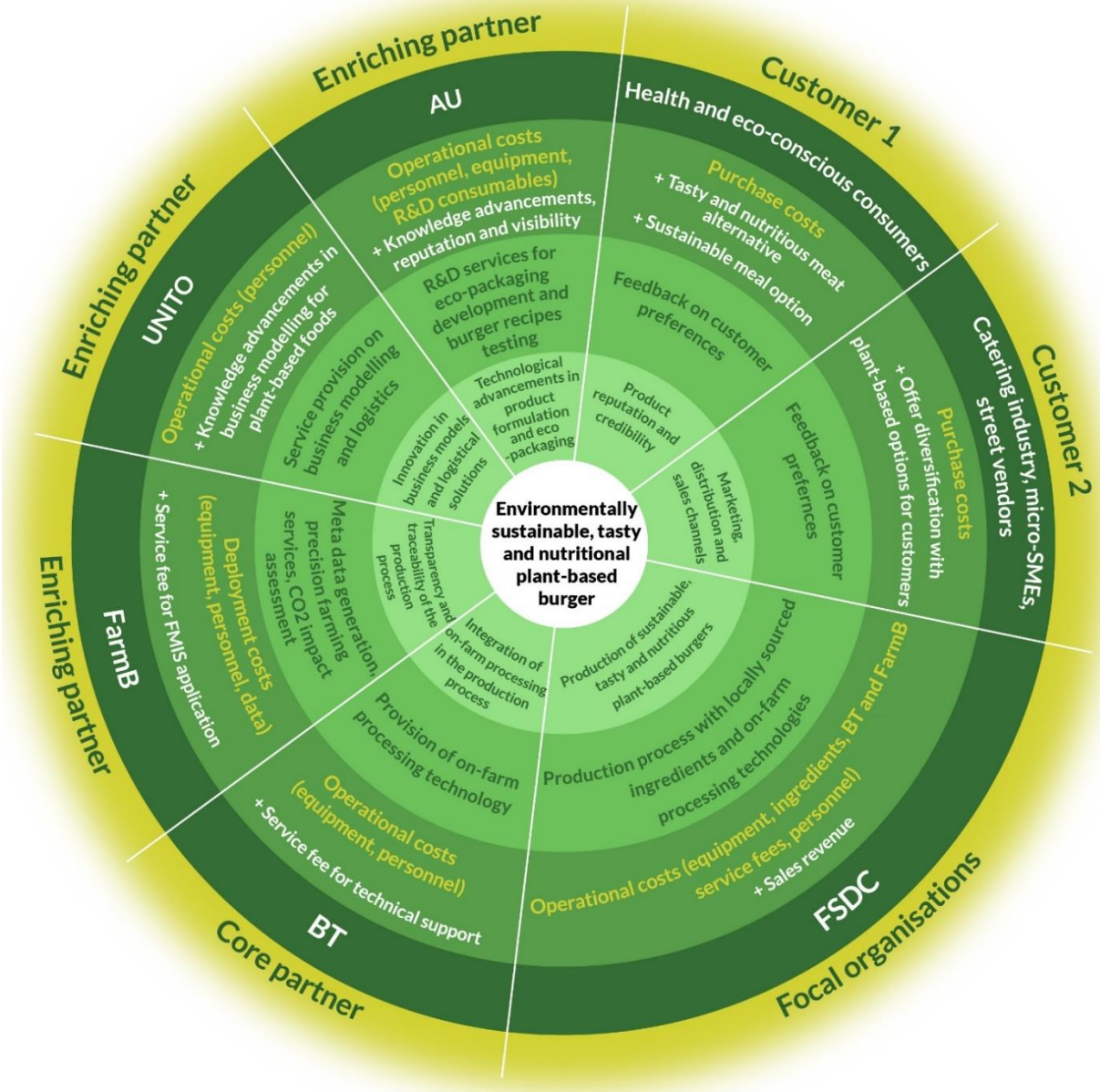


Figure 10: Business Model Radar for Business Case IPS1.1

The potential business models applicable to the VALPRO Path plant-based burger include **Direct-to-Consumer (D2C) platforms**, emphasising direct sales to health-conscious consumers for greater brand control and customer data collection. **Subscription services** offer a recurring revenue stream and deeper customer engagement, ideal for delivering curated plant-based meal experiences. Additionally, **catering services focusing on plant-based options for events** align well with VALPRO Path's commitment to local agriculture and fresher, more flavourful dining experiences. These business models will be explored in more detail in D5.4 Exploitation, IPR and Business Models Catalogue II due in M48.

5.2. IPS2 Varietal selection for different pedo-climatic regions

Problem statement: The selection of protein crop varieties is not optimised for different pedo-climatic regions, resulting in suboptimal yields, quality, and agronomic performance across Europe. By examining protein crops for vulnerabilities, quality composition, yields, and agronomic parameters, there is an opportunity to identify the best-suited varieties for specific regions. This optimization can provide significant added value for food and feed purposes, enhancing productivity and sustainability in protein crop cultivation.

Business opportunity identified as a hypothesis: *„If protein crops are examined for vulnerabilities, quality composition, yields and agronomic parameters, a varietal selection best suited for different pedo-climatic regions will be identified providing added value for food and feed purposes."*

Position in the value chain division: On-farm processing
Customer segmentation: Seed suppliers, farmers, breeders, agronomists, advisors, food processors and producers, food industry

MVP: Up to 3 added value varieties selected for at least 5 pedo-climatic regions (in Denmark, Italy, Germany, Ireland, and Portugal) with nutrient profiles and emissions quantification for each selected variety.

Value Proposition Statement: *For agricultural advisors, agronomists, farmers, and policymakers who want to select, recommend, and grow top-class protein varieties, the VALPRO Path* ***varietal selection tool*** *is an advanced agricultural resource that centralises and provides science-backed advice and information about suitable protein varieties for specific European regions. Unlike making non-informed decisions regarding varietal selection, the VALPRO Path varietal selection tool* ***helps avoid the cultivation of low-performing varieties, ensuring optimal crop performance and regional suitability.***

IPS2 in VALPRO Path focuses on developing a varietal selection tool essential for optimising protein crop selection across diverse European regions. This initiative integrates stress resilience profiling and nutritional characterization data to assess varietal suitability based on regional conditions. Business case participants are collaborating to evaluate strategies enhancing resilience in plant protein systems across different pedo-climatic regions. By combining existing national variety trial data with new insights on minor legume species, nutritional composition, and agronomic parameters, the tool aims to empower seed suppliers, farmers, breeders, food processors, food industry, agronomists and advisors, policy makers with precise recommendations. This approach not only promotes sustainable and resilient production practices but also supports the food and feed industry by ensuring optimal crop performance and quality. Ultimately, the varietal selection tool addresses critical gaps in varietal selection processes, offering science-backed guidance to enhance productivity and sustainability in the plant protein and plant-based food market. The business validation metrics assessed for this business case are presented in the table below.

Business case validation metrics for IPS2: Varietal selection for different pedo-climatic regions
Added value varieties selected for Denmark (#)
Added value varieties selected for Italy (#)
Added value varieties selected for Germany (#)
Added value varieties selected for Ireland (#)
Added value varieties selected for Portugal (#)
Average yield per crop variety per region (kg/ha)
Protein concentration per variety
Total Carbohydrate Content
Glycaemic Index
Presence of antinutrients (Yes/No)
Concentration of antinutritional factors
GHG emissions per variety
Waste recovery rate

Table 11: Business Validation Metrics for Business Case IPS2

The **value chain innovation mapping for business case IPS2** is detailed below, highlighting the co-production activities of various participants at different stages of the value chain (including AU, TEAGASC, ZALF, UNITO, CSIC, BT, FarmB, and Agricolus). This overview also emphasises the involvement of relevant stakeholders and the valuable information generated from their collaborative efforts.

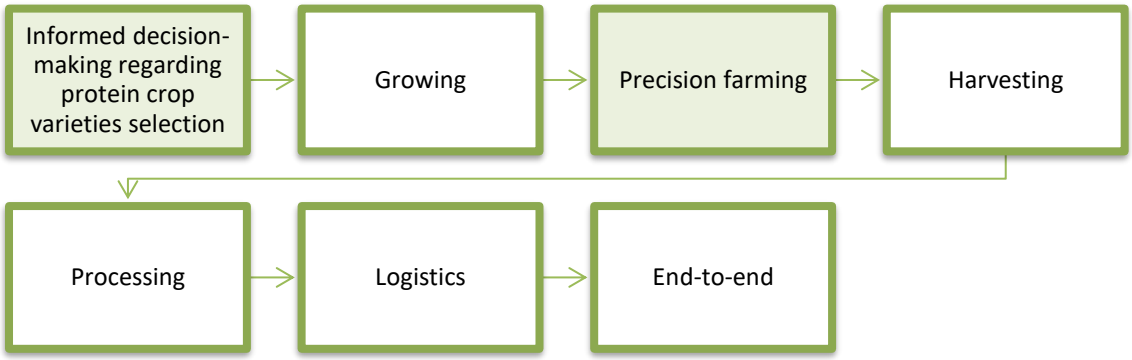


Figure 11: Value Chain Innovation Mapping in Business Case IPS2

The innovation brought by VALPRO Path focuses on activities before the farm gate, addressing the pre-growing phase when protein crop varieties are being selected, and supporting the successful cultivation of crops through precision farming. During this phase, the varietal selection tool will provide farmers and breeders with science-backed, informed decisions on selecting protein crop varieties. Developed from IPS2 findings, the tool relies on extensive data from national and breeding trials, enhanced by protein, carbohydrate, and antinutritional analyses. These collaborative efforts are coordinated by AU, with contributions from TEAGASC, ZALF, UNITO, CSIC, and BT. FarmB and Agricolus manage the tool's integration with precision farming tools. AU also serves as the primary contact point for customers in both B2B and B2C contexts.

Stakeholders in the value chain benefiting from the varietal selection tool include farmers, breeders, seed suppliers, technology providers, food processors, food producers, and the food industry. Advisory recommendations based on the tool's findings and information will also benefit agronomists and agricultural advisors in both the private and public sectors. Policymakers are another key group of beneficiaries, as the systemized data can inform agricultural policies at national and regional levels. The European farming community stands to gain the most, with a positive spillover effect on

consumers through the availability of locally sourced food products with European origin. The commercialization strategy for the varietal selection has a dual approach: i) B2B, targeting seed breeders, food industry, food processing companies, and enterprises in the plant protein and plant-based food sectors; and ii) B2C, catering to individual farmers and breeders involved in protein crop cultivation.

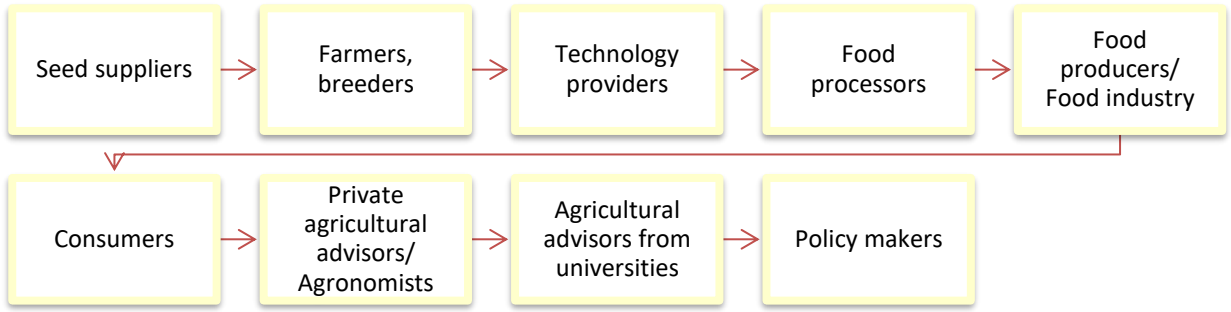


Figure 12: Stakeholders benefiting from VALPRO Path Innovation in Business Case IPS2

The insights extracted from IPS2 findings offer a decision support tool designed to engage and support a broad spectrum of stakeholders in achieving the project mission of "the right crop at the right place for the right market" relying on information related to regional suitability, resilience, nutritional value, genetic resources, etc. to support the recommendation for optimal varieties.

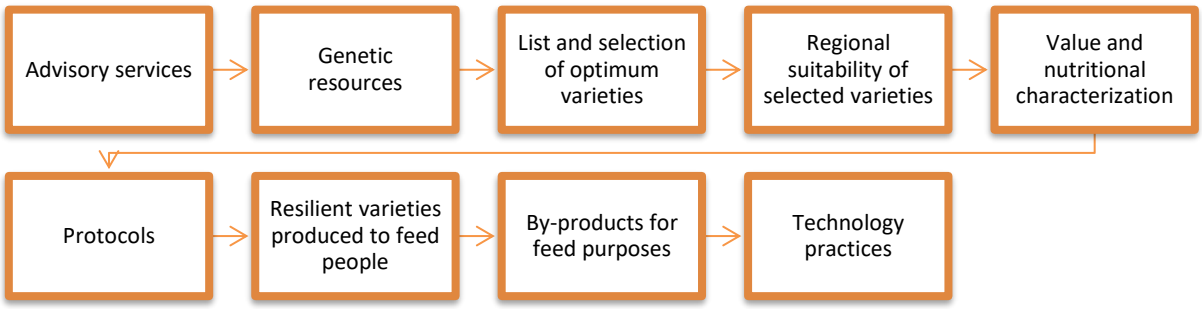


Figure 13: Information and Value from VALPRO Path Innovation in Business Case IPS2

The business model radar details the information and value generated by all parties involved in the business case, outlining fundamental categories essential for establishing a collaborative business model among all participants.

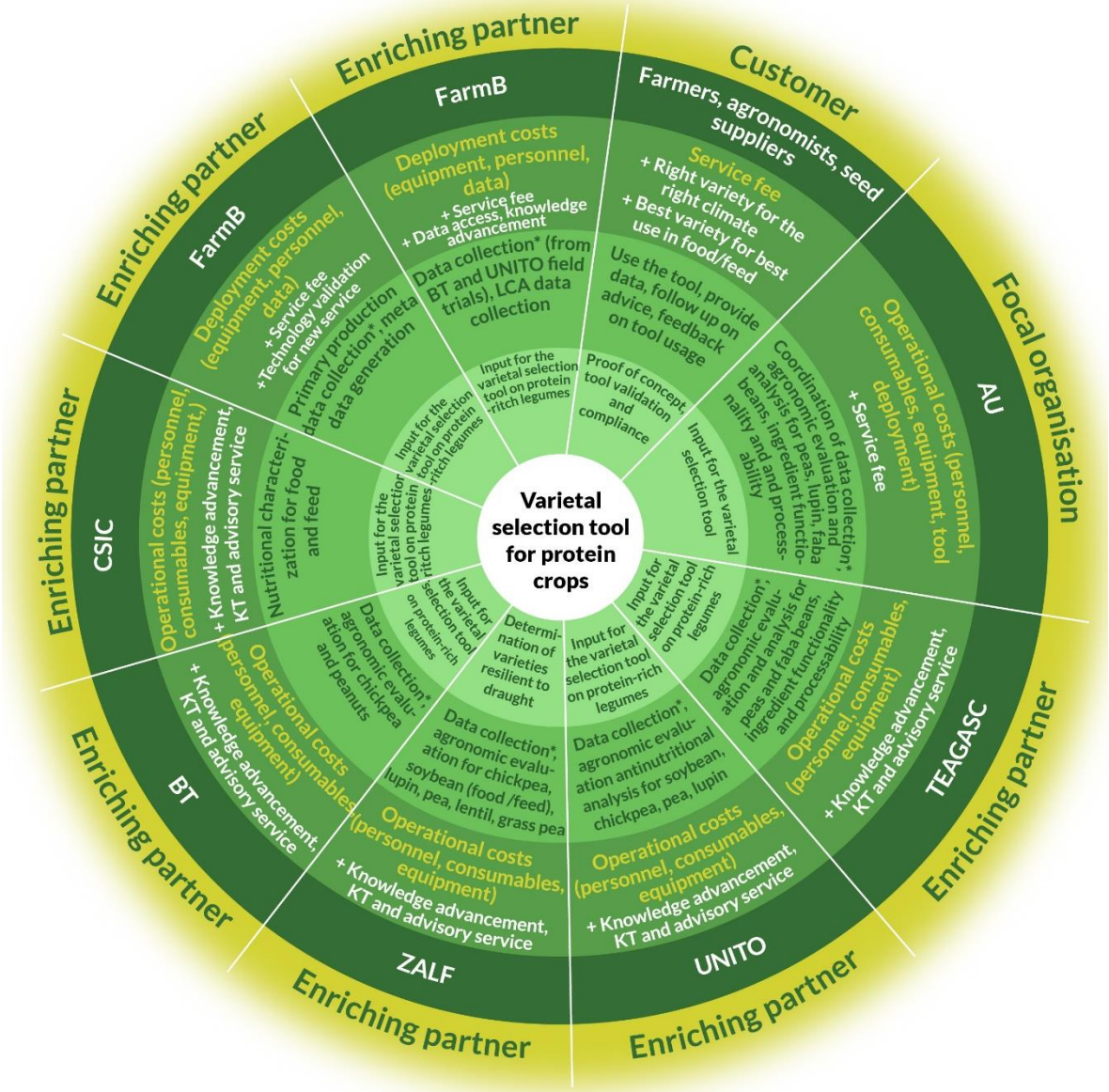


Figure 14: Business Model Radar for Business case IPS2

For a varietal selection tool in agriculture, several effective business models can be employed. A **subscription model** offers customers access to the tool's database and recommendations for a recurring fee, ensuring continuous revenue and support. Alternatively, a **freemium** approach provides basic features for free while charging for premium features or advanced data insights. A **pay-per-use model** allows customers to pay based on the specific varietal analysis needed, catering to varying usage frequencies. **Personalised consulting or advisory services** may be offered based on the varietal selection tool's recommendations while customers may be charged for expert guidance on crop varieties, planting strategies, and optimization based on the tool's analysis. Additionally, AU, as the focal organisation, operates under a **non-profit business model** focused on achieving a mission or social purpose rather than generating profits for owners or shareholders. These business models will be explored in more detail in D5.4 Exploitation, IPR and Business Models Catalogue II due in M48.

5.3. IPS3.1 Intercropping field peas and faba beans

Problem statement: The challenge of yield loss in field peas due to lodging is compounded by the increasing frequency of intense rain and wind events associated with climate volatility. This can cause loss for farmers and producers focusing their efforts on field pea production. The agronomic practice of intercropping between field peas and faba beans is not widely spread among farmers although it offers a solution for lodging. The business case aims to optimise ex-field separation and utilise unrefined pea fractions for food and animal feed applications, enhancing sustainability and profitability for producers and processors. The business case will also evaluate agronomic conditions best suited for intercropping field peas and faba beans.

Business opportunity identified as a hypothesis: *„If intercropping field peas and fava beans is performed, yield loss due to lodging will be mitigated and yield stability of field peas improved."*

Position in the value chain division: On-farm processing

Customer segmentation: Farmers, seed producers, breeders

MVP: Up to 5 high performing pea and faba bean variety combinations identified and characterised, recognizing more than 2 potential uses.

Value Proposition Statement: For farmers who want to produce field peas, **the field pea and faba bean intercropping system** validated in the VALPRO Path project is an innovative agricultural practice that reduces the risks of lodging and increases the yield. Unlike the sole pea crop, the intercropping system enhances productivity and sustainability.

The IPS3.1 business case wants to demonstrate the effectiveness of intercropping field peas with faba beans as a solution for field pea yield loss due to lodging. The assumption is built on the successful proof-of-concept studies by TEAGASC and AU. Faba beans are integrated to enhance the structural stability of field peas, reducing lodging risks. This approach supports the production of high-quality protein sources suitable for animal feed, establishing a new value chain focused on pea production through intercropping. The business validation metrics assessed for this business case are presented in the table below.

Business case validation metrics for IPS3.1: Intercropping field peas and faba beans
Average yield of fava bean per country with intercropped seed rate
Average yield of pea per country with intercropped seed rate
Intercropped seed rate used
Harvestability (Y/N)
Productivity under abiotic stress (% of productivity without abiotic stress)
High performing pea and faba bean variety combinations (#)
Ratio of pea and faba bean for intercropping management
Optimal blend for post-harvest processing
Ash content
Protein content
Gluten quality

Table 12: Business Validation Metrics for Business Case IPS3.1

The value chain innovation mapping for business case IPS3.1 outlines the collaborative co-production activities among participants, leveraging the expertise of each party to create shared value for the end user, specifically the farmer. TEAGASC, AU, Agricolus, and CSIC collaborate closely to innovate

agronomic practices for protein crop cultivation in Ireland and Denmark. This summary also highlights the outcomes of the value chain innovation mapping, depicted in the figure below.

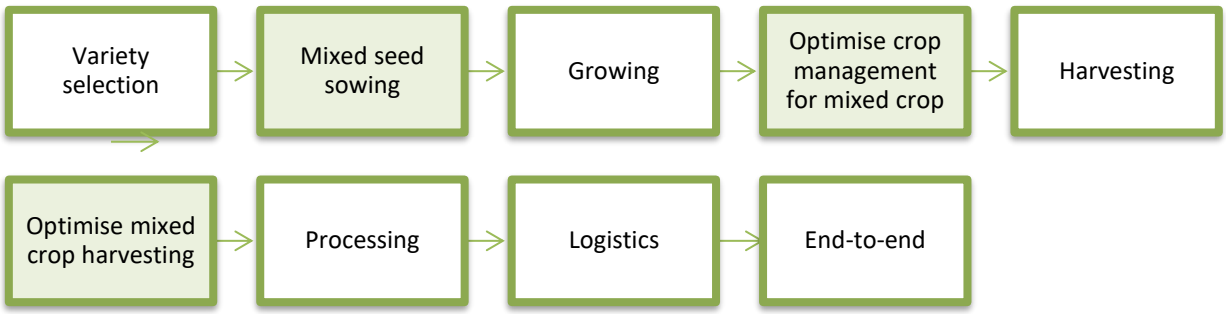


Figure 15: Value Chain Innovation Mapping in Business Case IPS3.1

The innovation introduced by VALPRO Path concentrates on pre-farm gate activities, particularly in the sowing phase and the integration of mixed crops - field peas and faba beans. It also includes optimization efforts related to crop management and the harvesting of mixed crops. The primary goal is to enhance the yield of field peas, recognized as the third most important grain legume after soybeans and beans, and to explore faba beans as a direct supplement for animal feed. Supported by insights from IPS3, the business case involves analysing mixed crops and comparing them to field peas, with a focus on nutritional and functional characterization. AU provides support for agronomic evaluation and data collection, while CSIC contributes expertise in ingredient functionality and processability. Agricolus specialises in crop data collection and lodging assessment using imagery analysis. These collaborative efforts are coordinated by TEAGASC.

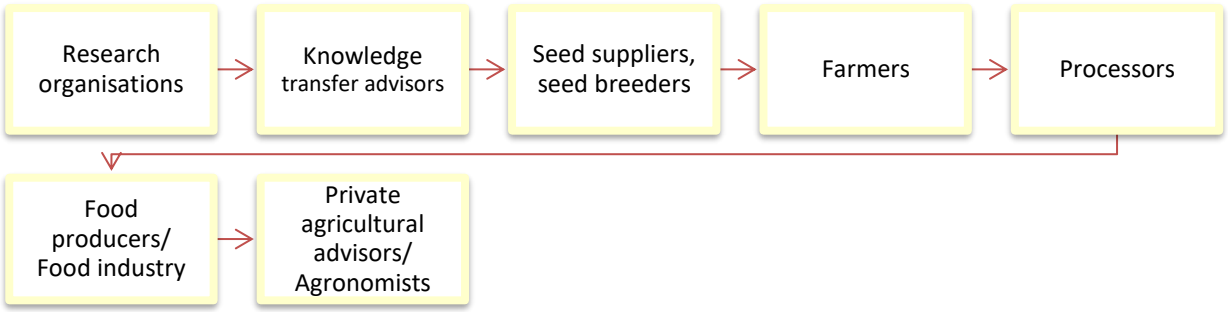


Figure 16: Stakeholders benefiting from VALPRO Path Innovation in Business Case IPS3.1

Stakeholders in the value chain benefiting from intercropping agronomic practices include farmers, processors, food producers, and the food industry. The knowledge and data obtained from intercropping will be incorporated into the "Framing as a Service" model, thereby introducing TEAGASC's advisory services to the market. This business case targets two customer groups: direct users such as farmers, processors, food producers, and the food industry (B2B approach); and indirect users in the agricultural advisory market, including knowledge transfer advisors, research organisations, agricultural advisors, and agronomists, who offer services to end users (B2C approach).

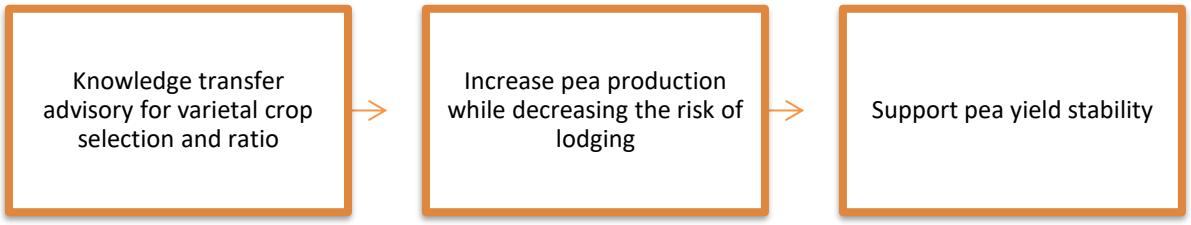


Figure 17: Information and Value from VALPRO Path Innovation in Business Case IPS3.1

The insights gathered in this business case will significantly enrich the agricultural advisory market by providing detailed knowledge on intercropping field peas and faba beans. This includes crucial information on varietal crop selection and optimal crop ratios, aimed at enhancing overall pea production. By intercropping these crops, the risk of lodging—a common problem where plants fall over due to weak stems—can be significantly reduced. Additionally, the practice offers valuable insights for stabilising pea yields, ensuring more consistent and reliable production outcomes. These benefits not only improve the efficiency and productivity of farming operations but also contribute to sustainable agricultural practices by promoting biodiversity and optimising resource use via reduced N fertiliser in the protein crop and in the follow-on crop in the rotation. Ultimately, this enriched knowledge base will empower farmers, processors, food producers, and agricultural advisors with the expertise needed to implement effective intercropping strategies, leading to improved economic and environmental outcomes in the agricultural sector.

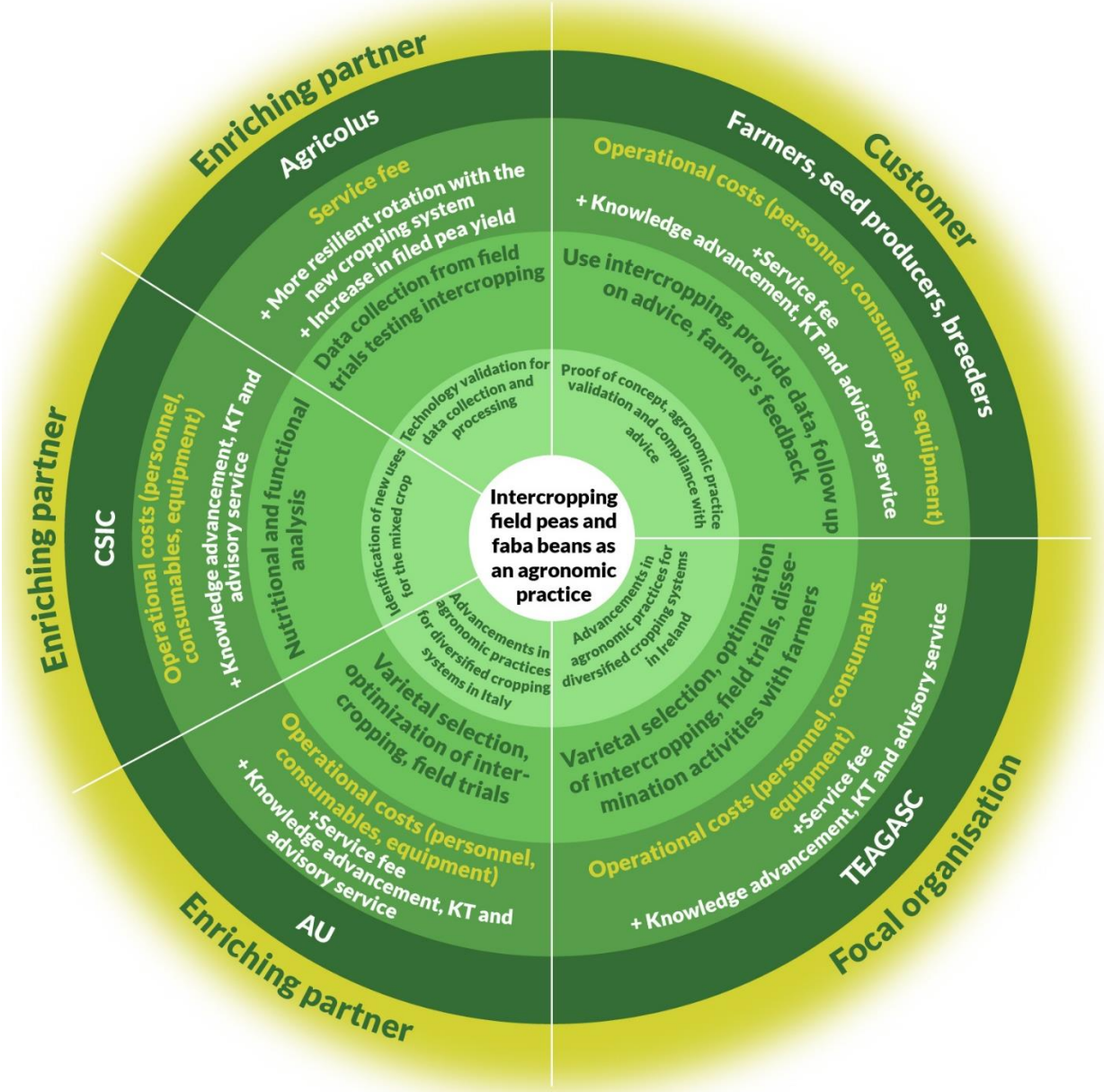


Figure 18: Business Model Radar for Business Case 3.1

The business model radar comprehensively outlines the information and value generated by all stakeholders in the business case, highlighting essential categories crucial for establishing a collaborative business model among participants. The focal organisation is identified as the TEAGASC Crop Advisor which will use webinars, field walks, demonstration days and other means of dissemination to provide advisory services to farmers, breeders, seed suppliers and food processors and producers. However, the TEAGASC Crop Department is engaged in the co-production activities within the CBM for business case IPS3.1.

For advisory services on agronomic practices, several business models can be effectively implemented within the FaaS market. A **subscription model** charges customers a recurring fee for continuous access to advisory services, ensuring steady revenue and fostering long-term client relationships. A **pay-per-consultation model** offers flexibility, allowing customers to pay for individual advisory sessions as needed. The **freemium model** provides basic advisory services for free while offering advanced services for a fee, attracting a broad user base. A **retainer-based model** involves customers paying a fee for dedicated, personalised advisory services with priority access to experts. These models are viable options for TEAGASC, the focal organisation for connecting with consumers within a **non-profit framework**. Detailed exploration of these business models will be presented in D5.4 Exploitation, IPR, and Business Models Catalogue II, due in M48.

5.4. IPS4.1 The development of more informative labelling for plant protein foodstuffs

Problem statement: This business case addresses the growing demand for sustainable and innovative food products that consider both nutritional composition and environmental impact. Despite the availability of advanced digital tools and technologies, there is a significant lack of market products that transparently display comprehensive information on both nutritional value and the environmental impact of their production. To empower consumers to make informed and sustainable purchasing decisions, there needs to be a substantial improvement in the transparency and communication of environmental impact. The market currently faces a critical gap in eco-friendly food labelling, especially in labels that provide detailed information on both nutritional and environmental aspects.

Business opportunity identified as a hypothesis: *„If state-of-the art technology is used in nutrient tracking and environmental impact assessment across the plant-based protein value chain, prototypes of high value innovative products with towards '0' carbon label can be created (i.e., plant-based beverage, energy bar)."*

Position in the value chain division: End-to-end

Customer segmentation: Health and eco-conscious consumers & Ingredient manufacturers and product manufacturer companies, supplier

MVP: Up to 2 plant-based end-products with satisfactory nutritional composition and carbon use developed using inputs from IPS1, IPS2 and IPS3.

Value Proposition Statement: *For environmentally conscious consumers who want to reduce their carbon footprint and support European origin, the VALPRO Path **plant-based food products** are a sustainable alternative that uses plant-based protein sources and provides access to locally sourced proteins. Unlike traditional products of the same type, the VALPRO Path plant-based food products **offer a greener and more regionally supportive option.***

IPS4.1 aims to pioneer new standards in farm-to-shelf nutrient tracking and sustainability through the development of innovative products such as plant-based beverages and energy bars. These products will undergo comprehensive tracking from cultivation and production to product development across logistics to consumers. Spectroscopy technologies will be employed to monitor nutrient flows along the protein journey, while advanced digital tools will track GHG emissions and carbon capture. LCA will complement these efforts across all involved innovative products sourced from IPS1, IPS2, and IPS3. The business case will evaluate its progress based on the validation metrics outlined in the table below.

Business case validation metrics for IPS4.1: The development of more informative labelling for plant protein foodstuffs
GHG emissions (MTCO2e) in plant-based beverage production
GHG emissions (MTCO2e) in plant-based energy bar production
Energy used in plant-based beverage production (kWh/m²/year)
Energy used in plant-based energy bar production (kWh/m²/year)
Water-use in plant-based beverage production (m^3/ha)
Water-use in plant-based energy bar production (m^3/ha)
Stability of nutrient levels across the product lifecycle in the plant-based beverage production (Stabile/ In decline)
Stability of nutrient levels across the product lifecycle in the plant-based energy bar production (Stabile/ In decline)
Protein value of the plant-based beverage (kg/ha)
Protein value of the plant-based energy bar (kg/ha)
Label with nutritional composition and GHG emissions (Yes/ No)
By-products identified in the production of plant-based beverage (#)
By-products identified in the production of plant-based energy bar (#)
By-product uses identified (#)
Level of by-product exploitation (%)

Table 13: Business Validation Metrics for Business Case IPS4.1

The value chain innovation mapping for business case IPS4.1 illustrates collaborative co-production activities among participants. Each party leverages its expertise to create shared value for environmentally conscious consumers of innovative plant-based food products. TEAGASC contributes analytics and methodology development for nutrient tracking. Kerry brings expertise in sustainability, European origin, and plant-based ingredients for novel product formulations. BT collaborates with farmers to source locally produced raw materials and reduce carbon footprint. PepsiCo, as the primary focal organisation, focuses on product formulation, sustainable manufacturing, and distribution practices. FarmB supports nutrient tracking and environmental impact assessments, while MTL assists in product formulation efforts.

VALPRO Path's innovation spans various points in the value chain, with a primary focus on product formulation, new product development, the exploration of sustainable packaging materials and labelling. A pivotal activity involves nutrient tracking throughout the entire value chain for product prototypes, namely the plant-based beverage and energy bar, alongside monitoring GHG emissions and carbon capture. Another critical step involves the valorisation of side streams such as shells, fibre, and starch derived from protein isolate production, utilised in the creation of plant-based food products. The innovative products featured in this business case undergo LCA to provide data supporting the introduction of an eco-friendly food label. This label will integrate nutritional and environmental information about the product and its production process.

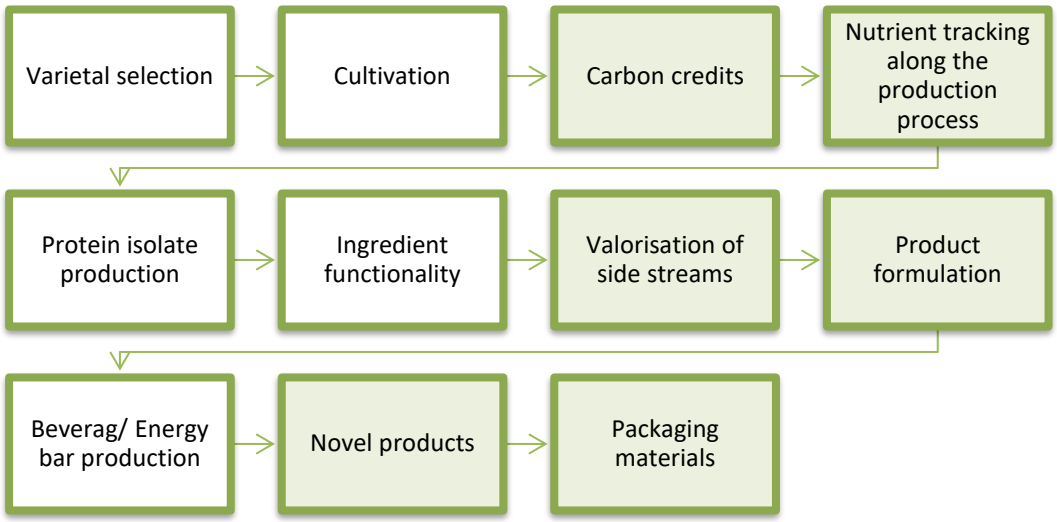


Figure 19: Value Chain Innovation Mapping in Business Case IPS4.1

In this business case, stakeholders fulfil crucial roles across the value chain. Farmers supply essential raw materials for protein isolate production, while processors transform these raw materials into high-quality protein isolates. Suppliers ensure the availability of key ingredients needed for formulation. The food industry, including manufacturers, innovates by developing new products and exploring sustainable packaging solutions. B2C and B2B companies distribute these products, emphasising health benefits and sustainability to consumers and businesses alike. Consumers, in turn, drive demand for nutritious and environmentally friendly options, shaping the market and encouraging ongoing innovation in plant-based food offerings.

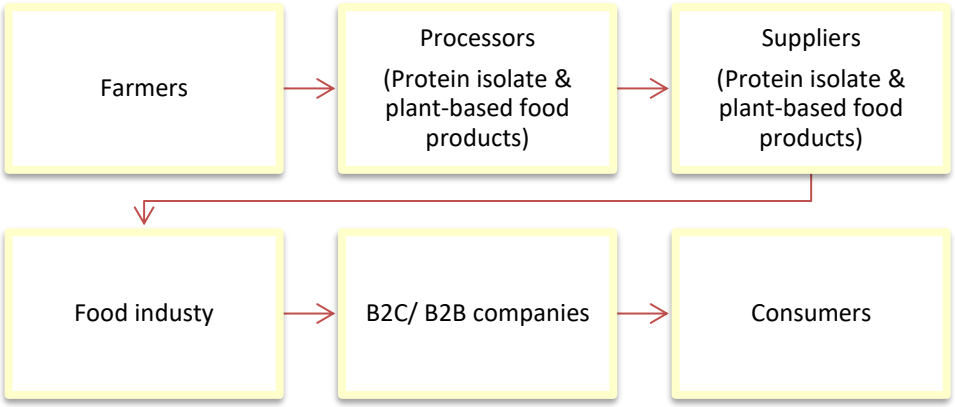


Figure 20: Stakeholders benefiting from VALPRO Path Innovation in Business Case IPS4.1

The business case brings significant value and insights by exploring new uses for crops through protein isolate production, fostering diversification and economic opportunities within agricultural markets. Innovations in crop processing technologies improve efficiency and product quality, enhancing resource utilisation and sustainability. Integrating nutrient content analysis throughout the production chain ensures nutritional optimization in plant-based products, meeting consumer health expectations. Valorising side streams supports circular economy principles, minimising waste and maximising resource efficiency. Efficient waste valorisation strategies not only reduce costs but also generate revenue, optimising financial sustainability. The LCA provides comprehensive environmental insights, guiding decisions to minimise emissions and enhance the eco-friendliness of products. Together, these initiatives underscore the business case's commitment to innovation, sustainability, and holistic optimization across protein crop and food production systems.

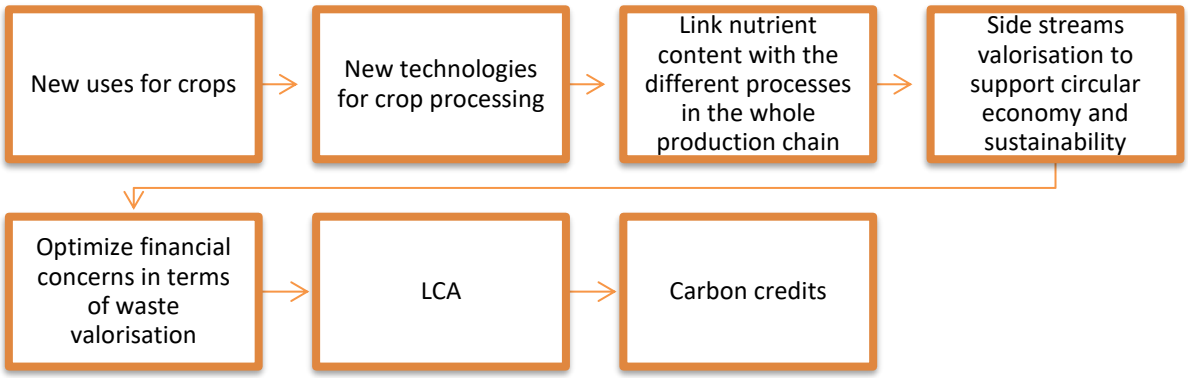


Figure 21: Information and Value from VALPRO Path Innovation in Business Case IPS4.1

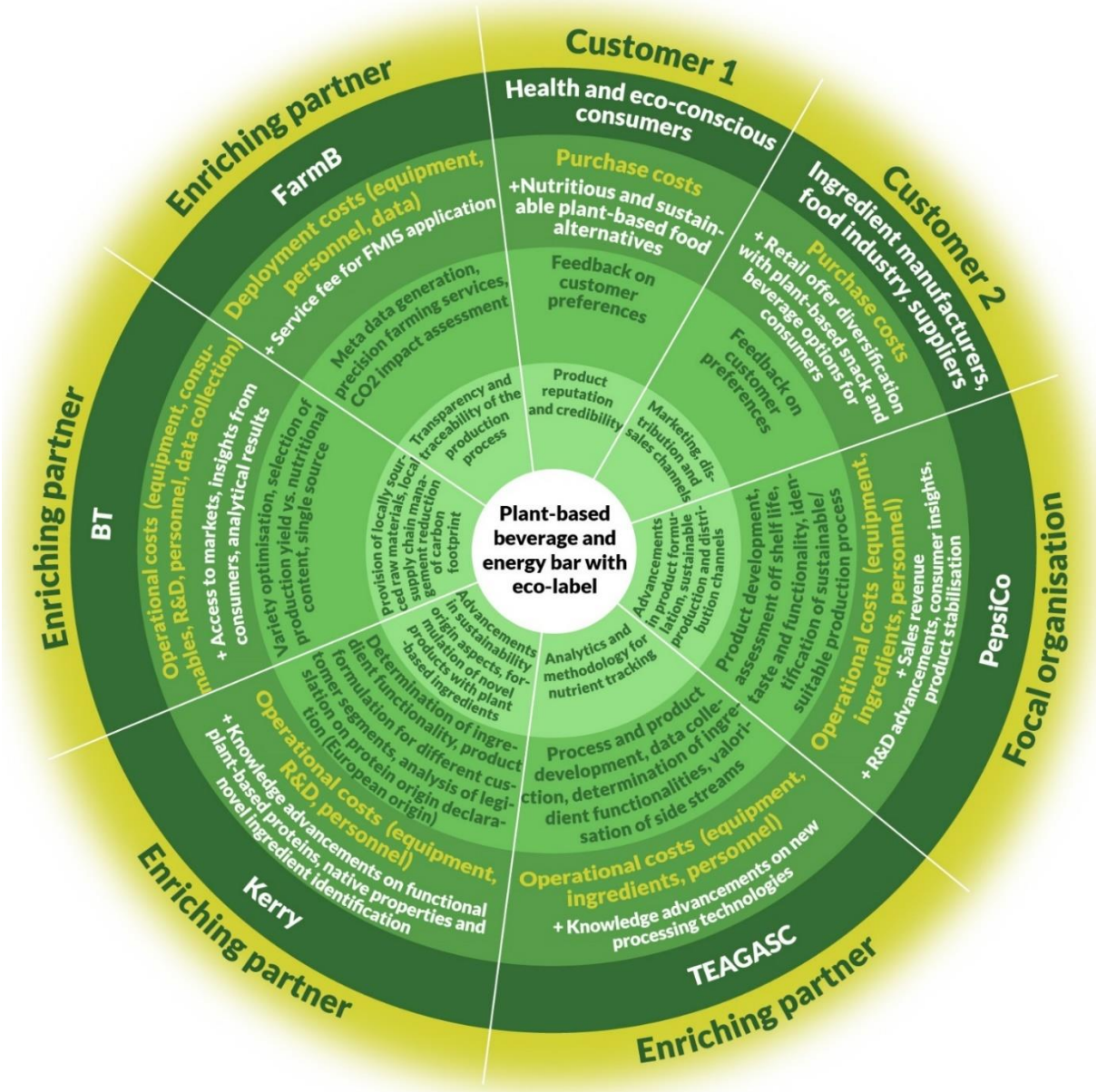


Figure 22: Business Model Radar for Business Case 4.1

The information and value generated by all parties involved in the business case are detailed in the business model radar, which outlines fundamental categories for establishing a collaborative business model among all participants.

For environmentally conscious consumers who want to reduce their carbon footprint and support European origin, the VALPRO Path plant-based food products are a sustainable alternative that uses plant-based protein sources and provides access to locally sourced proteins. Utilising the **wholesale and distribution model**, PepsiCo (as the focal organisation in direct contact with consumers) can leverage existing retail networks for wide distribution, ensuring that their greener and more regionally supportive products reach a broad audience quickly. Additionally, employing a **private labelling model** allows PepsiCo to offer unique, exclusive products under their own brand, increasing profit margins and building brand loyalty among consumers who prioritise sustainability and local sourcing. Detailed exploration of these business models will be presented in D5.4 Exploitation, IPR, and Business Models Catalogue II, due in M48.

5.5. IPS5.1 Value added production of artisan legume-based pasta

Problem statement: The production of artisan legume-based pasta serves as a prototype demonstrating the strategic benefits of synergistic cross-regional applications, often undervalued in current markets. Raw materials sourced for milling originate in one region, while processing occurs in facilities located in another region. The final pasta production takes place in a third location, resulting in a high-quality end-product enriched with numerous health benefits. However, these disruptions across the value chain and potential insecurities in supply may lead to logistical challenges and operational inefficiencies. Such complexities can impact the timely delivery and consistency of the product, posing risks to market stability and customer satisfaction amidst fluctuating demands and expectations.

Business opportunity identified as a hypothesis: *„If different lentil and chickpea flour combinations have good nutritional composition and sensory properties, the flour can be used in the production of innovative food products (i.e., pasta).”*

Position in the value chain division: End-to-end

Customer segmentation: Vegans, vegetarians, flexitarians, gluten-free consumers and other health-conscious consumers & Restaurants and local food businesses

MVP: Production and testing of >4 pasta products with different percentages of plant protein out of optimal lentil and chickpea flour combinations.

Value Proposition Statement: *For vegans, vegetarians, flexitarians, and other health-conscious consumers who want to eat nutritious and sustainable plant-based protein pasta, the VALPRO Path* ***artisan legume pasta*** *is a wholesome and eco-friendly option that incorporates protein-rich legumes into the pasta. Unlike egg pasta or other non-pulse/legume pasta, the VALPRO Path artisan legume pasta* ***supports sustainable production and supply chain management for less environmental impact.***

The business case aims to demonstrate the value of cross-regional partnerships through the development of artisan legume pasta as part of IPS5. It explores integrated value chains across Europe using pea, lupin, and chickpea flour produced with various milling techniques. By innovating plant-based pasta with enhanced nutritional and functional properties, the initiative emphasises sustainability and collaboration. Legume pasta offers numerous health benefits, including high protein, low glycaemic index, gluten-free, high fibre, and essential vitamins and minerals, making it a nutritious alternative to traditional wheat pasta made with eggs.

Business case validation metrics for IPS5.1: Value added production of artisan legume-based pasta
Optimal flour combinations for pasta production reached (#)
Milling diagrams used in testing pasta (#)
New pasta products developed during trials (#)
Protein value of end-products obtained due to the use of processing technologies in the IPS (kg/t)
End-product value (EUR/kg)
Targeted consumer groups reached (#)
Results of sensory properties evaluation in pasta (Positive/Negative)
User acceptance rate (%)

Table 14: Business Validation Metrics for Business Case IPS5.1

The value chain innovation mapping for business case IPS5.1 illustrates collaborative co-production activities among participants, each leveraging their expertise to create shared value for health and environmentally conscious consumers of enriched legume-based pasta. APT acts as the focal organisation in the collaborative business model, overseeing the production of the artisan pasta while MP supplies locally sourced flours and fractionated materials. Kerry supports product formulation and development of ingredient functionalities. AU and UNITO lead the research and development efforts, focusing on flour analysis, product formulation improvement, and exploration of digestibility.

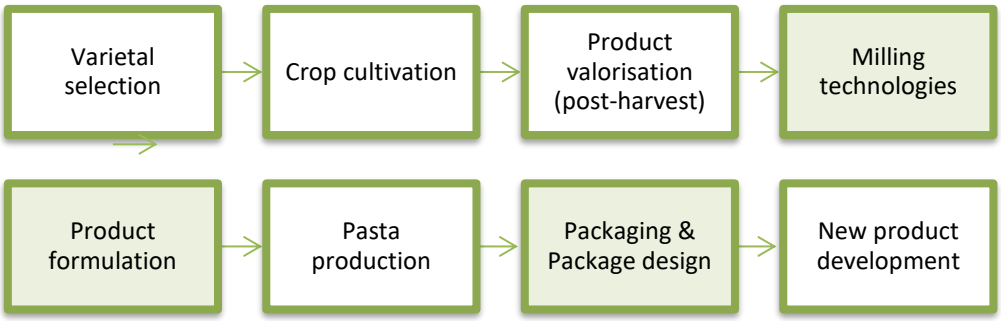


Figure 23: Value Chain Innovation Mapping in Business Case IPS5.1

The value chain for legume-based pasta, enhanced by VALPRO Path's innovations, spans from varietal selection and crop cultivation to sustainable packaging and new product development. After selecting and cultivating high-quality legumes, post-harvest product valorisation prepares the crops for advanced milling technologies introduced by VALPRO Path, which produce nutrient-rich flours while preserving their functional properties. These flours are then used in product formulation to create nutritious and well-textured pasta. During pasta production, the integrity of the ingredients is maintained, ensuring a high-quality final product. Sustainable packaging materials and innovative designs are employed to minimise environmental impact. Throughout this process, the LCA supports sustainability efforts, validating the environmental benefits.

The stakeholders in the business case for legume-based pasta include farmers, who grow high-quality legumes selected for their nutritional properties; post-harvest storage providers, who ensure the legumes are properly stored and preserved after harvesting; processors, who use advanced milling technologies to produce nutrient-rich flours; producers, like ATP, who formulate and manufacture the legume-based pasta; logistics companies, responsible for transporting raw materials and finished products efficiently; wholesale and retail companies, who distribute the pasta to various markets; and consumers, who benefit from the nutritious, sustainable, and innovative plant-based food products. Each stakeholder plays a crucial role in ensuring the success and sustainability of the value chain, from cultivation to consumption.

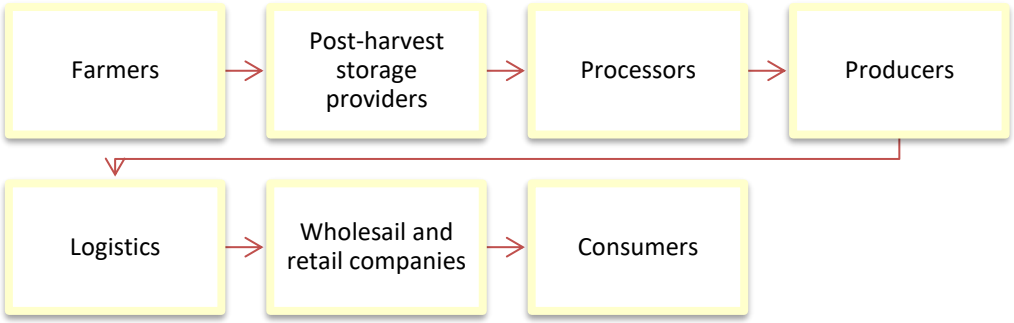


Figure 24: Stakeholders benefiting from VALPRO Path Innovation in Business Case IPS5.1

The business case for legume-based pasta provides significant information and value through several key aspects. Nitrogen fertilisation from legumes enriches soil health, reducing the need for synthetic fertilisers and promoting sustainable agriculture. The nutritional content of the pasta is enhanced through value-added formulations, offering high protein and essential nutrients. Replacing eggs with legumes reduces opportunity costs as legumes are less perishable, leading to extended shelf life and decreased food waste. The use of sustainable packaging materials and designs minimises environmental impact, contributing to CO2 reduction efforts. Additionally, the innovative legume-based pasta supports dietary transitions towards plant-based diets, providing a nutritious, eco-friendly alternative that aligns with growing consumer demand for sustainable food products.

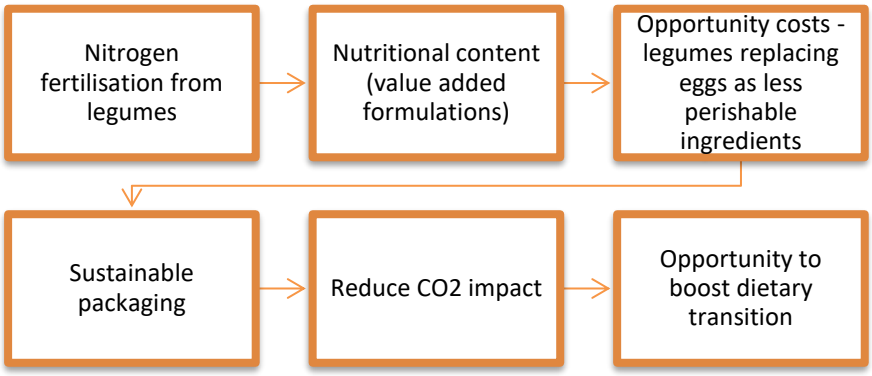


Figure 25: Information and Value from VALPRO Path Innovation in Business Case IPS5.1

The information and value created by each stakeholder in the business case are documented within the business model radar. This tool delineates essential categories that underpin the establishment of a collaborative business model among all participants with value-added legume pasta as co-created value in use.

Artisan legume pasta can be effectively marketed through **direct-to-consumer online sales**, leveraging e-commerce platforms to highlight its nutritional advantages and convenience for health-conscious buyers. **Partnering with specialty food stores and health food markets** provides another avenue, where product samples and educational materials can educate consumers on the pasta's health benefits. **Participating in farmers' markets and pop-up shops** offers direct engagement with local communities seeking fresh, nutritious food options. **Subscription box services** offer a curated approach, delivering artisan legume pasta along with recipe ideas and nutritional information to subscribers interested in gourmet and healthy foods. **Collaborating with restaurants and food service suppliers (B2B approach)** allows the pasta to be featured in health-conscious menus, appealing to diners seeking nutritious dining options. Detailed exploration of these business models will be presented in D5.4 Exploitation, IPR, and Business Models Catalogue II, due in M48.

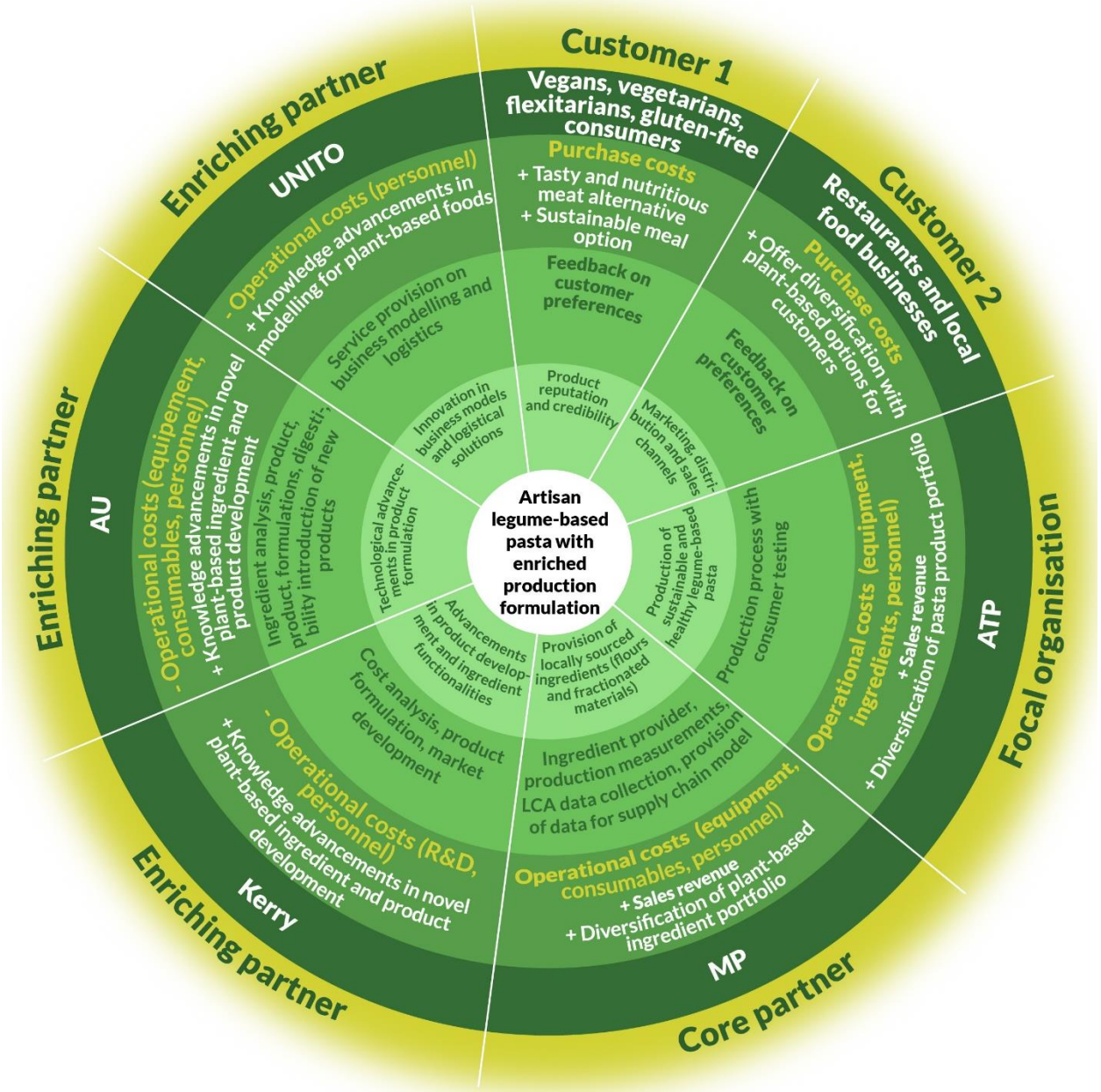


Figure 26: Business Model Radar for Business Case 5.1

6. Exploitation of Non-commercial Results

Non-commercial results, whose exploitation routes should also be investigated and elaborated within the context of this deliverable, encompass scientific, educational, societal, and political dimensions. Scientific outputs such as practices, methods and generated data throughout the project can be utilised by the scientific community for future research. Evidence-based information from project results can aid policymakers and regulators in forming new policies or modifying existing ones. Additionally, certain outcomes can support the development of education and training programs for students, professionals, or the public.

The scientific advancements of VALPRO Path will be exploited:

1. within other ongoing research activities,
2. in new research projects, either in collaboration with third parties or independently,
3. for educational and training purposes, particularly to attract higher education enrolment and produce skilled professionals in protein crop production and food production.

Restrictions on scientific exploitation may be imposed by private partners to safeguard their economic interests. Such limitations will be clearly mentioned (e.g. ethics, rules of personal data, IP, commercial, privacy-related, security-related, compliance with GDPR, etc.). When deemed technically possible, the data will be anonymized, to protect the privacy of users.

6.1. Feedback to policy measures

The LCSA outputs generated through the VALPRO Path project will serve a dual purpose: firstly, informing policy recommendations aimed at enhancing the sustainability of plant protein systems, and secondly, providing a competitive advantage to companies and organisations involved. Feedback collected from IPSs will undergo detailed analysis to identify potential barriers arising from local policy conditions.

Feedback on policy measures within the VALPRO Path project will be communicated through policy briefs summarising strategic outcomes. These briefs aim to encourage governments, industry stakeholders, and researchers to capitalise on opportunities and tackle challenges in promoting sustainable, circular, and transparent production of plant proteins for food and feed within the EU.

6.2. Open Access

VALPRO Path follows an open access policy on data and research outcomes. In the scenario where parts of datasets cannot be shared, the reasons for this will be clearly mentioned (e.g. ethical, rules of personal data, intellectual property, commercial, privacy-related, security-related, compliance with GDPR, etc.). When deemed technically possible, the data will be anonymized, to protect the privacy of users. The Data Management Plan ensures that VALPRO Path activities are compliant with the HE Open Access policy, the Open Research Data pilot recommendations, the FAIR data principles and the GDPR.

The VALPRO Path podcasts and YouTube channel are instrumental in promoting and educating audiences on the plant-based protein market, aligning with the Open Access policy of Horizon Europe. These platforms provide free educational content that covers a wide range of topics central to the VALPRO Path project. They serve as effective tools for disseminating project exploitable results to diverse audiences, including scientists, policymakers, and the public. The podcasts and YouTube

videos not only explain the scientific aspects and technological innovations developed within VALPRO Path but also address social implications and policy implications related to plant-based proteins. By leveraging these platforms, VALPRO Path enhances transparency and accessibility of its research outcomes, fostering broader understanding, collaboration, and adoption of sustainable practices in the plant-based protein sector.

6.3. VALPRO Path Approach

In the context of exploitation and IP activities, the focus will be on the relationship between Open Science and ERs. Open Science practices concerning data and research outputs are addressed in the Data Management Plan. As a general principle, open access to other research outputs, such as software, models, algorithms, workflows, protocols, simulations, electronic notebooks, and others, is not mandatory but strongly recommended. In this context, the principle "as open as possible, as closed as necessary" will be followed.

All ERs, identified and documented according to VALPRO Path exploitation methodology, will undergo assessment to determine their potential for openness to external stakeholders involved in the project. This assessment considers factors such as:

- their nature (e.g., commercial, non-commercial),
- type (e.g., software, models, algorithms),
- stage of development,
- any potential IP issues that may restrict sharing specific results.

Based on this evaluation, specific approaches for certain results will be examined and proposed in consultation with the partners responsible for their development. This process will consider the proposed exploitation pathways and relevant IP considerations (e.g., trade secrets, pending patents).

7. IPR Management

Like any other asset, IP needs to be managed and strategically utilised to ensure smooth cooperation and maximise the impact of project results. Therefore, IPR management plays an essential role throughout the entire lifecycle of research and innovation projects. The VALPRO Path IPR methodology is expected to:

- Enhance the overall IP knowledge of all project partners.
- Identify and provide a clear overview of each partner's existing IP.
- Identify potential avenues for IP protection.
- Facilitate the development of a joint IPR management and exploitation strategy.
- Mitigate potential IP conflicts among project partners and with third parties.
- Strengthen the project's overall Sustainability plan.

Thus, the VALPRO Path project has adopted a comprehensive **IPR Management Strategy** aligned with five distinct project stages as presented in Figure 27, which work in conjunction with the Exploitation and Sustainability Strategy. The objective of this strategy is to identify, manage, and monitor relevant IPR issues related to the exploitation of VALPRO Path's individual and joint results.

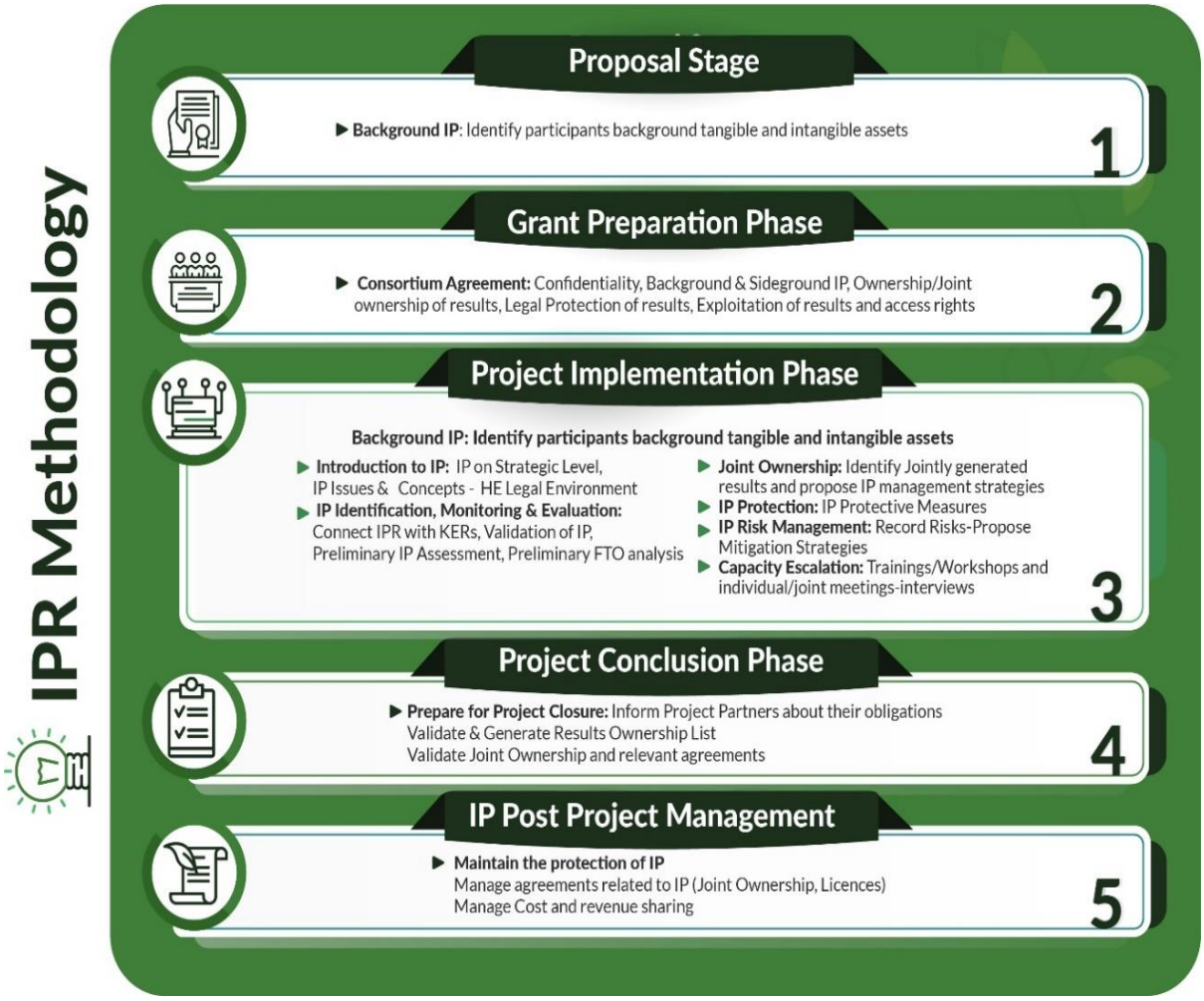


Figure 27: VALPRO Path IPR Methodology

In the previous period, FSH has continuously explored available services and funding from relevant EU bodies and related initiatives, such as the Horizon Results Booster, to support project partners in exploring and managing their IP. FSH has kept the consortium informed about opportunities that

partners might leverage, including four different funding vouchers offered by the SME Fund in 2024. These vouchers were available to EU-based SMEs to protect their IP, specifically for reimbursement of various IP-related activities, as well as IP Scan services.

As part of the **IPR scan process**, an exhaustive Exploitation and IP Questionnaire, along with accompanying guidelines, was developed to support its completion. This questionnaire was distributed to project partners following the first IP workshop conducted online in M9.

The workshop covered several key points, including the clarification of terms related to IP and IPRs, along with the differences between them. It provided an overview of the main IP protection measures and IPR management procedures specific to EU-funded projects, with a focus on VALPRO Path. Also, it highlighted the benefits of IPRs for businesses, including exclusivity, reputation enhancement, commercialization support, and attracting funding and investments. Since the session was scheduled well in advance, at least one representative from each VALPRO Path project partner attended with 23 participants in total. The recording of the workshop and the presentation used during the session were shared on the project's repository, allowing partners to consult the materials at their convenience.

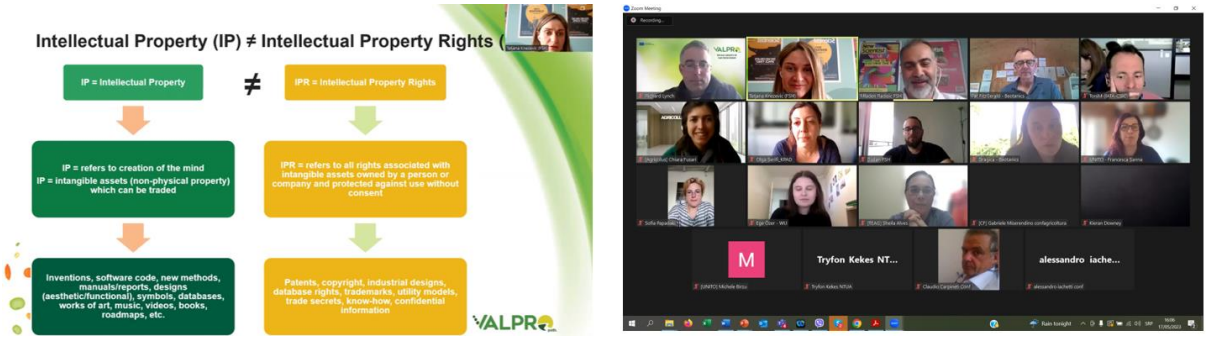


Figure 28: Screenshots from VALPRO Path 1st IPR Workshop

In the next phase of project implementation, T5.3 will launch an **IP assessment** to systematically review the IP owned, used, or acquired by partners. This review aims to assess and manage risk, address issues, and implement best practices in IP asset management. A tailored analysis will be conducted for each partner, resulting in the development of **individual IP Profiles**. Based on these profiles, the status of each partner regarding project innovations and internal IPR management will be mapped and assessed. This process will also involve grouping project partners according to IP maturity levels and suggesting customised actions.

7.1. Definition of Result Ownership

As per the Horizon Europe Framework Programme rules, project results are owned by the partner(s) responsible for their generation. In cases where multiple partners collaboratively produce results, joint ownership is established. VALPRO Path operates as a collaborative project, allowing for the development of results by multiple partners collectively. To formalise joint ownership, partners will reach an agreement through a **Joint Ownership Agreement**. This agreement will outline the allocation and terms governing joint ownership, ensuring compliance with obligations outlined in the GA.

Joint Ownership: If two or more parties have jointly generated results and it is not possible to (i) establish the respective contribution of each beneficiary and (ii) separate them for the purpose of applying for, obtaining or maintaining their protection, the results will be jointly owned by the parties unless stated otherwise in a separate agreement. Joint ownership is governed by GA Article 16.2 and 16.4 (complemented by Annex 5 setting the specific rules on IPR, results and background), with the following additional provisions:

Unless otherwise agreed:

- Each joint owner may grant non-exclusive licences to third parties to exploit the jointly owned results (without any right to sub-license) if the other joint owners are given:
    - at least 45 days advance notice and
    - fair and reasonable compensation.

Access Rights: The partners have identified and agreed upon the background materials essential for the project, as detailed in the CA. Additionally, where applicable, partners have notified each other of any legal restrictions or limitations on accessing specific background materials. Any items not identified through this process are not subject to access obligations regarding background materials.

Access rights to results necessary for the exploitation of a partner's own outcomes will be granted under fair and reasonable conditions. Moreover, access rights to results for internal research, academic teaching, and educational activities will be provided on a royalty-free basis, ensuring unrestricted use at the time and in the future without subsequent charges.

It is important to clarify that any grant of access rights not explicitly covered by the GA or CA is entirely at the discretion of the owning party. Such access rights will be subject to terms and conditions agreed upon between the owning and receiving parties.

7.2. Protection of Results

Each partner within VALPRO Path needs to evaluate the potential for protecting their results and secure appropriate protection if the results are expected to be commercially or industrially exploited. This protection needs to be maintained for a suitable duration and within the relevant territorial scope. Protection is required if it is feasible, reasonable, and justified based on the specific circumstances. When determining the appropriate protection strategy, the partners need to consider their own legitimate interests as well as those of other partners, particularly commercial ones. Partners have the flexibility to choose from various available forms of protection including the following:

- **Patents:** Obtaining patents for novel plant-protein extraction methods, formulations, or specific plant-protein products can provide legal protection against competitors.
- **Trademarks:** Registering trademarks for plant-protein products' brand names, logos, or slogans distinguishes them from competitors and prevents others from using similar marks.
- **Trade Secrets:** Protecting proprietary processes or formulations related to plant-protein production as trade secrets can prevent competitors from replicating them.
- **Copyrights:** Copyright protection can be applied to original content related to plant-protein marketing materials, websites, or packaging designs.
- **Regulatory Exclusivity:** In some jurisdictions, obtaining regulatory exclusivity for novel plant-protein ingredients or products can provide market exclusivity for a certain period.
- **Plant Variety Protection (PVP):** For companies involved in plant breeding, obtaining plant variety protection or plant patents can safeguard newly developed plant varieties used for producing plant-based proteins.
- **Geographical Indications:** If applicable, obtaining geographical indication protection for plant-based products associated with specific regions can prevent unauthorised use of the geographical name by others.

The selection of the most suitable form will be based on the specificities of the VALPRO Path project and the nature of the result, prioritising the option that offers the most effective and adequate protection. While crucial for commercial and industrial purposes, it's important to note that IP protection is not obligatory.

8. Sustainability Plan

The **Sustainability plan** outlines a tailored set of actions aimed at ensuring that both commercial and non-commercial outcomes of the project are effectively utilised by project partners and stakeholders beyond its conclusion, thereby enhancing the project's long-term impact and sustainability.

In the context of the Horizon Europe Framework Programme, a robust **Sustainability plan** needs to articulate how project outcomes will influence science, industry, society, and governmental entities post-project. Project outcomes encompass all tangible and intangible outputs, including data, knowledge, and information, regardless of their form or protectability. These outcomes will be systematically catalogued in the Exploitation and IP Catalogue developed within the framework of the project (for more info refer to Chapter 3).

The main beneficiary groups related to VALPRO Path exploitable results are the following:

1. **Farmers** benefit significantly from project exploitation in several key areas, focusing on innovation, value chain development, environmental impact reduction, farming performance improvement, and on-farm processing capabilities for protein crops. By addressing these needs, farmers and farming communities can enhance their productivity, profitability, and sustainability.
   Relevant project outcomes: New decision-making tools, agronomic practices, technologies and circular business models to be used in protein crop cultivation.

2. **The food industry** benefits from exploitation of project results by having access to validated know-how, sustainable practices, plant-based product promotion, consumer preference responsiveness, and innovative solutions obtained in close collaboration with R&D institutions, new business models and value chain development, contributing to the industry's growth and sustainability.
   Relevant outcomes: New product formulations and ingredients, decision-making tools, validated technologies, circular business models.

3. **Research and academia** benefits significantly from project results in crop, agronomy, and agricultural sciences through interdisciplinary knowledge, advancements in knowledge, involvement in sustainable practices, new product formulations, education on crop system transformation, data collection and validated technologies.
   Relevant project outcomes: New decision-making tools, validated agronomic practices and technologies, reports and data on varietal selection in different European pedo-climatic regions used in protein crop cultivation.

4. **Consumers** benefit from the exploitation of project results through improved health, enhanced food quality and safety, environmental and ethical advantages, economic benefits, innovation and variety in food options, informed decision-making, and positive community and social impacts. These benefits collectively contribute to a more sustainable and healthy food system.
   Relevant outcomes: New products, services, labelling and technology in the plant-protein food market.

5. **Policymakers and authorities** benefit greatly from project exploitation in several ways, allowing them to support farmers and consumers, promote knowledge sharing, facilitate interactions across different regions and drive policy creation.
   Relevant outcomes: Reports, policy papers, and policy recommendations.

6. **Advisors in extension and advisory services, and agricultural consultants** benefit significantly from project exploitation focusing on supporting farmers in technical, economic, and organisational decisions, adapting to smart farming, and delivering high-quality and up-to-date services. Advisors can effectively assist farmers in navigating the complexities of modern agriculture and achieving their production and sustainability goals.
   Relevant project outcomes: New decision-making tools, agronomic practices, technologies and circular business models to be used in protein crop cultivation.

To ensure efficient sustainability, joint and individual exploitation plans will be drafted for each KER and project partner, leveraging their unique interests and expertise within the consortium.

The pursuit of effective sustainability involves several key steps:

- Identifying all project results and evaluating their potential applications. It is important to recognize that not all project results may be sustainable, necessitating agreement within the consortium on which outcomes to prioritise for long-term viability.
- For each result, determining ownership to delineate responsibility for generation and application, with careful consideration of IPR issues.
- Identifying key beneficiaries for each project result and outlining strategies to engage and benefit them.
- Developing strategies to reach these beneficiaries, considering the resources - such as funding, expertise, technology, and training - required to sustain outcomes over time.
- Crafting robust joint and individual exploitation plans to ensure ongoing income generation.
- Exploring post-project funding opportunities available to project partners.
- Formulating funding strategies within the consortium, outlining how resources will be provided or developed to support sustainability activities post-project.
- Anticipating and addressing obstacles to uptake, implementing mitigation measures as necessary.

By systematically addressing these steps, the consortium can effectively navigate towards sustainable outcomes beyond the project's conclusion.

8.1. VALPRO Path Key Exploitable Results

In the context of the VALPRO Path project and its KERs, the Sustainability plan will encompass measures to support their effective utilisation. In the proposal phase two KERs were identified, and commercialisation efforts are planned accordingly.

1. **The VALPRO Path Solution Portfolio** is designed to offer a comprehensive suite of tools and tailored advisory services aimed at assisting farmers in decision-making processes and implementing specialised rotation planning models to optimise land-based protein crop cultivation. Within the portfolio, key components include data acquisition protocols and LCA models, all geared towards enhancing agricultural efficiency and sustainability. To ensure widespread adoption and maximise impact, the exploitation strategy revolves around a **subscription-based model**. This model offers flexibility for users, allowing them to access one, several, or all tools within the portfolio, tailored to their specific needs along the value chain.

The subscription-based business model aims to ensure widespread adoption and maximise impact by offering flexibility to users. Subscribers can access various tools within the portfolio, tailored to their specific needs along the agricultural value chain. This flexibility allows users to select and utilise one, several, or all tools based on their operational requirements and goals. By subscribing, users gain

ongoing access to updated data and models, enabling continuous improvement and adaptation to evolving agricultural practices and environmental standards. This approach not only enhances the profitability and sustainability of farming operations but also supports broader industry adoption of innovative and scientifically validated agricultural practices promoted by the VALPRO Path project.

2. **The Methodology for Value Chain Business Modelling** introduces an innovative approach to business modelling specifically designed for different segments of the value chain: from on-farm processing to supply chain management and end-to-end operations. This methodology will be available on the market as consultancy services aimed at individual farmers, their associations, as well as producers and distributors of plant-based foods, facilitating tailored service provision.

The service provision business model entails offering consulting and advisory services to various stakeholders involved in the production and distribution of plant-based foods, but also in the production of protein-rich crops. This includes individual farmers, agricultural associations, and companies in the plant-based sector. The consultancy services aim to assist these entities in optimising their operations within the value chain, specifically focusing on areas such as on-farm processing, supply chain management, and overall end-to-end efficiency. By providing tailored business modelling solutions, the service helps stakeholders identify opportunities for improvement, enhance productivity, ensure sustainability, and ultimately achieve their business objectives more effectively.

The Sustainability Plan will outline business models for 10 specific cases within various IPSs of the VALPRO Path project, emphasising their commercial viability and potential for replication across Europe. These models will serve as scalable proofs of concept for small-scale innovations at different points in the value chain.

The Replicability and Scalability Potential

The replicability of VALPRO Path business models is significant. Results from IPS1.1, focusing on plant-based burger production, and IPS5.1, on artisan legume-based pasta, demonstrate potential for small-scale replication across diverse pedo-climatic regions, tailored to specific crop varieties and agronomic practices. These business models target agri-food SMEs, farmer cooperatives, and protein crop producers, aiming to enhance farmer value through advanced on-farm processing technologies, precision agriculture services, raw material supply networks, protein ingredient applications, and logistical solutions.

The scalability of VALPRO Path business models, particularly those involving the varietal selection tool (IPS2) and intercropping advisory service (IPS3.1), hinges on participation in the Farming-as-a-Service market and the number of paying customers. Yet, the potential for scalability is also influenced by the rate of repeat customers for VALPRO Path food products like plant-based burgers, artisan legume pasta, and protein-rich beverages and energy bars. Projections for scalability can leverage the incorporation of protein ingredients—whether flour, concentrate, or isolate—from a range of diverse crops, thereby enhancing product formulation and broadening the product range.

9. Exploitation Risk Assessment

Several risks associated with the exploitation plans have been identified so far. These risks and potential mitigation measures are presented in the table below:

Risk	Risk level	Mitigation measures
Low interest for VALPRO Path plant-based food products in the market	Low	The industry partners engaged in collaborative business models already possess consumer connections and market participation. Therefore, the new food products developed within the VALPRO Path project will contribute to diversifying their product offerings, introducing new products, and enhancing existing product formulas.
Low uptake of the VALPRO Path solutions by the market	Low	The VALPRO Path solutions encompass advancements in knowledge, decision support systems, and advanced agronomical practices that offer significant benefits to farmers engaged in protein crop production. To facilitate the uptake of project outcomes among farmer communities, food industries, and food processors across Europe, a robust dissemination and communication plan will be developed to support partners interested in leveraging results effectively post-project.
Difficulties in clear division of tasks and responsibilities between consortium members post-project	Medium	Clear task division among consortium members post-project is facilitated by a structured transition plan delineating roles, responsibilities, and timelines, complemented by regular communication and documented role agreements to ensure clarity and alignment. FSH will organise focused meetings with participants in each business case to evaluate partners' capacities and intentions for post-project exploitation, presenting potential governance and management options for collaborative business models explored in the project.
Participation of non-for-profit institutions in the collaborative business models supporting the commercialization efforts	Medium	To support continued non-profit institutions' participation in collaborative business models for commercialising VALPRO Path results, strategic partnerships with industry representatives will be explored for resource sharing, provision of guidance on legal and regulatory compliance, and facilitation of networking opportunities.
High competition from existing plant-based food products and new market entrants	Medium	Industry partners supported by FSH will focus on creating comprehensive marketing strategies that differentiate their products through unique flavours, textures, or nutritional profiles validated within the project. Continuous market research to stay updated on consumer trends and competitor activities will enable businesses to adapt quickly and maintain a competitive edge in the dynamic plant-based food market.
Provision of high-quality ingredients with low logistical costs post project to VALPRO Path industry partners	High	VALPRO Path plant-based food products are currently produced using high-quality ingredients sourced internally. To scale up for commercialization, larger quantities will be required to meet market demand. FSH will assist partners in their commercialization endeavours by exploring alternative local supply chains, ensuring sufficient and reliable access to ingredients necessary for expanding production capabilities.

Table 15: Risks Associated with the Exploitation of VALPRO Path Results

10. Conclusions and Next Steps

This initial version of the D5.3 Exploitation, IPR, and Business Models Catalogue I provides an overview of the exploitation, IPR, and business modelling approaches to be implemented throughout the project's lifetime. The document aims to outline the exploitation and IPR management strategy and business modelling methodology for the VALPRO Path project, detailing the tools that will be used to achieve the targeted KPIs.

Specifically, the document establishes a foundation for the successful exploitation and protection of the products, services, and solutions developed within VALPRO Path, defining an initial framework of rules and recommendations. It also offers a comprehensive IPR framework covering both the implementation and post-project stages by identifying and analysing the most relevant IPR issues.

D5.4 Exploitation, IPR, and Business Models Catalogue II will present business case findings related to the cases prioritised to start in 2025, along with business models for all 10 identified business cases. On a project level, individual and joint exploitation plans outlining potential exploitation pathways for each project result, including suggested IP protection measures, will be developed. The exploitation and IPR strategy will be updated throughout the project to refine the existing work, capture additional developments, incorporate new findings, and create credible exploitation pathways for the VALPRO Path project results. The VALPRO Path Exploitation and Sustainability Strategy will be fine-tuned to ensure a long-lasting impact of the project. To effectively and efficiently produce all these outcomes, the focus will be on the following activities to be implemented during the following two years of the project following a tentative implementation timeline.

- **Q9 (M25-27):** In this quarter the IP scan process will be initiated followed by an IP workshop #2 in M27 for project partners who recognize the pivotal role of IP, and its adequate measures.
- **Q10 (M28-30):** In 2025, the work around the exploration of funding opportunities for plant-based businesses along the value chain will be intensified. Moreover, market analysis will be conducted for 5x business cases prioritised to begin in 2025.
- **Q11 (M31-M33):** The findings from the exploration of funding opportunities will be showcased in a dedicated workshop for stakeholders within the plant-protein value chain. Furthermore, a second update will be made to the Exploitation & IP Catalogue.
- **Q12 (M34-M36):** A series of Business Modelling workshops will be arranged for the prioritised business cases set to commence in 2025, fostering active participation from all stakeholders in co-creating collaborative business models. The validated findings will subsequently be documented in D5.4, due for submission in M48.
- **Q13 (M37-39):** CBMs for the 2025 business cases will be formulated and validated with business cases and other IPS participants. Concurrently, a comprehensive exploration of IP considerations will be undertaken to assist project partners in safeguarding their IP pertaining to VALPRO Path solutions.
- **Q14 (M40-M42):** Individual IP sessions will be in focus while in parallel conducting the work on preparation of individual and joint exploitation plans based on co-created business models for commercial results and exploitation plans for non-commercial results whilst also exploring non-for-profit business models.
- **Q15 (M43-M45):** This quarter will see the update of the Exploitation & IP Catalogue. Drawing from monitoring results, all 10 business models for VALPRO Path business cases will undergo validation and refinement.
- **Q16 (M46-M48)**: During the final quarter of project implementation, attention will be directed towards the preparation of Deliverable 5.2 Dissemination, Exploitation, and Communication Plan II, and Deliverable 5.4 Exploitation, IPR, and Business Models Catalogue II.

VALPRO path.

NEW VALUE LANDSCAPES FOR PLANT PROTEIN PATHWAYS

Value Chain Business Modelling Toolbox

valpropath.eu

Co-funded by the European Union

1. CAPTURE Cycle Tools

The CAPTURE cycle is a comprehensive framework designed to establish the foundation for exploitation and business modelling endeavours within the VALPRO Path project. The CAPTURE cycle encompasses various activities facilitated by tools available in the CAPTURE cycle toolbox. These activities include the development and dissemination of **the Exploitation and IP Catalogue**, along with the utilisation of the **MVP Business Validation General Questionnaire**. This approach aids in identifying and capturing viable business opportunities formulated as hypotheses, which are then validated iteratively. The **MVP Business Validation Survey** is employed to monitor the progress of related business cases and support findings within IPSs.

1.1. Exploitation and IP Catalogue

The Exploitation and IP Catalogue is designed to include both tangible and intangible outcomes (such as knowledge, information, and commercial and non-commercial results) that have the potential for exploitation after the project concludes. It also covers potential applications in scientific, societal, and economic domains, and briefly outlines the partners' future strategies and intentions.

The Exploitation and IP Catalogue contains following information:

- **Name of Result/Exploitable asset.**
- **Description of Result/Exploitable asset.**
- **Individual or Joint result** – partners considered other partners' involvement and specified if the result is developed only by one partner (individual) or is shared with more partners (joint). In doing so, they considered the foreground generated.
- **Partners involved** – partners stated with whom they generated the result.
- **Type of result** –i.e., product, service, advancement in knowledge, methodology, process, model, networks.
- **Marketability** – project results can have the potential to be either commercially exploited, to be exploited on the market to generate income (e.g., concrete products or services) or non-commercially (e.g., to lay the foundation for further research), or both.
- **Type of access to the result** – open/public – private/restricted. A result can be fully or partially open to the public and that open result can in some cases be protected by some IP measures such as copyright in scientific publications or non-registered soft IP if the owner plans to protect its internal exploitation pathways.
- **Intellectual Property (IP) ownership background** – The IP asset that each partner is bringing to the project: invention, databases, know-how, secret knowledge, etc.
- **IP ownership Result (Foreground)** – the outcome generated throughout the project: such as data, knowledge and information, whatever their form or nature, whether they can be protected, which are generated in the action.
- **Expected measures to protect IP** – patent, industrial design, trademark, utility model, copyright, soft IP trade secret, soft IP Confidential information, soft IP Company know-how.
- **Expected TRL advancement per year**.
- **Year of commercialization/availability** – Partners indicated the planned year to start commercialization and/or to make the result available. All non-commercial results will be available before the end of the project, while commercial result can be available on the market sometime after the project ends.
- **Replicability/Upscaling** – indicating the results' replicability potential.
- **Planned use: partners exploitation strategy** - Partners are requested to provide a short qualitative description of how they want to exploit the result after the project's end for their scientific, political, research or economic/commercial purposes (partner's own purposes). All exploitation

possibilities should be considered, including for example launch of products and/or services, but also new university courses, new publications, upscaling, and replicability of results in other areas or regions, leverage for further R&D and research projects, etc. In general, planned use is not how the society and consumers will exploit the result and neither a general description of the result, but it shows how partners plan to use the result in the market for their own purpose. Planned use should be aligned with what was indicated in the marketability question.

- **Target stakeholders/end-users** - Partners provided a list of key target stakeholders/end-users, covering all stakeholders they intend to reach (e.g., citizens, companies, universities, academia, regions).
- **Stakeholders/end-users usage of result** - Partners provided a brief description of how the stakeholders can use the result/solution/innovation/development.
- **Channels** - partners indicated the channels they intend to leverage to exploit the result. If the result has a commercial nature, channels are described as sale channels. For example: manufacturing portfolio, research/scientific, advertising channels, publications, demonstrations, etc.
- **Key messages (value proposition)** - present the pitch of the project result to the potential customers. This only refers to commercial results (e.g. benefits, problems solved, needs satisfied).
- **Exploitation risks** - partners listed all the risks they foresee in exploiting the result. Risks can be both from an internal perspective, so referred to the result itself (e.g., high costs, technical constraints, weak assumptions for a methodology), and from an external perspective, and so referred to the market of reference (e.g., high competition, more innovative products in the market, market not ready for a specific solution).

The primary goal of the Catalogue is to provide a comprehensive overview of available assets that contribute to informed strategic decision-making. It aids in identifying opportunities, protecting developed assets, and aligning partners' objectives with high-value assets. The Catalogue supports the development of the Sustainability Plan by enhancing the analysis of potential markets, customers, or industries where the VALPRO Path KERs and other exploitable assets can be applied. Additionally, the Exploitation and IP Catalogue plays a crucial role in managing IP by supporting the definition of protection measures, ownerships, legal status, and other IP management aspects. Another purpose of the Catalogue is to identify opportunities for collaboration and mutually beneficial partnerships. This facilitates the recognition of potential synergies or complementary capabilities that can be leveraged for developing new licensing agreements, joint ventures, or strategic alliances. Utilising the Catalogue enhances credibility, demonstrating the unique value proposition and competitive advantage of the identified exploitable assets.

1.2. MVP Business Validation General Questionnaire

What does it do?
The MVP Business Validation General Questionnaire identifies business opportunities within each IPS and the plant-protein value chain division and formulates the business opportunity as a hypothesis (If XX, then YY - e.g., If intercropping field peas and faba beans is performed, yield loss due to lodging can be mitigated) to be validated during business case implementation.

How?
The MVP Business Validation General Questionnaire collects data on stakeholders involved in business case development and validation, the crop varieties used, and the pedo-climatic regions addressed (if applicable). Additionally, it provides an overview of the business case, outlining the position of the innovation in the plant-protein value chain, the challenges to be addressed, the objectives, and the Minimum Viable Performance (MVP) aligned with the targeted business opportunity.

Why?
The MVP Business Validation General Questionnaire aids in identifying the end outcomes (e.g., products, services, models, processes) of the business cases and supports the development of collaborative business models and joint or individual exploitation plans for commercial and non-commercial project results.

1.3. MVP Business Validation Survey

What does it do?
The MVP Business Validation Survey maps inputs for the Go-To-Market assessment and tailor-made collaborative business models based on IPS design, business opportunity identification and business case set up, progress and results.

How?
The MVP Business Validation Survey is designed to gather data regarding the advancement of business cases by deploying metrics (indicators) for validating hypotheses established within each IPS as Minimum Viable Performance (MVP). Data collection utilises the reporting template developed in WP3 for quarterly Coordination meetings. Baseline and target values are established as needed for each individual business case.

Why?
The MVP Business Validation Survey ensures performance measurement assessing the effectiveness and impact of efforts while making informed decisions about resource allocation and strategy adjustments. This supports IPS participants in staying focused on goals, remaining responsive to changes and challenges, and ultimately delivering meaningful results.

2. CO-CREATE Cycle Tools

The CO-CREATE cycle represents an extensive framework aimed at advancing the development of business modelling and Go-to-Market assessments within the VALPRO Path project. It encompasses a range of activities facilitated by tools accessible in the CO-CREATE cycle toolbox. These activities encompass market analysis and the implementation of the VALPRO Path business modelling approach, supported by tools such as **the Market Analysis Questionnaire, Value Proposition Statement, Value Chain Innovation Mapping Tool, and Business Model Radar**. This methodological approach is instrumental in crafting sustainable collaborative business models centred around VALPRO Path solutions.

2.1. Market Analysis Questionnaire

What does it do?
The Market Analysis Questionnaire supports the market analysis process and contributes significantly to the preparation of the Collaborative Business Models in line with the identified business opportunities. It captures the market insights of business case participants to support the commercialisation efforts tackled in the business case.

How?
The Market Analysis Questionnaire collects data from stakeholders involved in the business cases on the following aspects: geographical scope, market information (overall market, competition, technology), by-products market information and policy regulations.

Why?
The purpose of the questionnaire is to get feedback from business case participants on market opportunities worth exploring in line with business case objectives.

2.2. Value Chain Innovation Mapping Tool

What does it do?
the Value Chain Innovation Mapping Tool serves as a strategic resource for stakeholders to understand, evaluate, and leverage innovation opportunities within a given value chain, ultimately driving growth and competitiveness in the market.

How?
The Value Chain Innovation Mapping Tool is utilised in co-creation workshops, conducted either online or offline, using a digital workspace platform that facilitates visual collaboration among participants and teams. This platform allows for the presentation of the Value Chain Innovation Mapping template. Alternatively, a printed version of the template with post-its can be used for in-person sessions.

Why?
The Value Chain Innovation Mapping Tool is used to map all business case participants and outline their activities, as well as the information and value they contribute to the co-creation process. This exercise helps to visualise the roles and interactions of each participant, ensuring a comprehensive understanding of how value is created and enhanced for the end-user. By identifying the specific contributions and touchpoints of each participant, the tool facilitates more effective collaboration and coordination, ultimately leading to the creation of a Collaborative Business Model with clearly defined roles for every stakeholder involved.



Figure 1: The Value Chain Innovation Mapping Template

2.3. Value Proposition Statement

What does it do?
A Value Proposition Statement clearly communicates the unique value a product or service provides to end-users. It explains how the offering solves a problem or fulfils a need, what benefits it delivers, and why it is better than competing alternatives. This statement is crucial for market differentiation, customer attraction and retention, and marketing guidance by articulating the core reasons why the target audience should choose the product, service or solution.

How?
The Value Proposition Statement is utilised in co-creation workshops, conducted either online or offline, using a digital workspace platform that facilitates visual collaboration among participants and teams. This platform allows for the presentation of the Value Proposition Statement template. Alternatively, a printed version of the template can be used for in-person sessions or a whiteboard.

Why?
The Value Proposition Statement can help identify the key benefits of a new product, service or solution, communicate those benefits to the target market, and differentiate the offering from competitors.

OUR _____
product or service
HELP(S) _____
customer segment
WHO WANT TO _____
jobs to be done
BY _____ _____
verb (e.g., reducing, avoiding) *and a customer pain*
AND _____ _____
verb (e.g., increasing, enabling) *and a customer gain*
(UNLIKE _____*)*
competing value proposition.

Figure 2: The Value Proposition Statement Template

2.4. Business Model Radar

What does it do?
A Business Model Radar serves as a strategic tool for analysing and assessing various components of a business model. It helps in visualising and understanding the interconnected aspects of a business, such as actors in the CBM, their costs and benefits, their co-production activities, and their value propositions. Overall, a Business Model Radar aids in comprehensively evaluating and refining business strategies to enhance competitiveness and sustainability in collaborations among multiple partners.

How?
The Business Model Radar is utilised in co-creation workshops, conducted either online or offline, using a digital workspace platform that facilitates visual collaboration among participants and teams. This platform allows for the presentation of the Business Model Radar template. Alternatively, a printed version of the template can be used for in-person sessions.

Why?
The Business Model Radar can help enhance strategic decision-making, mitigate risks, foster collaboration, and drive innovation within organisations.

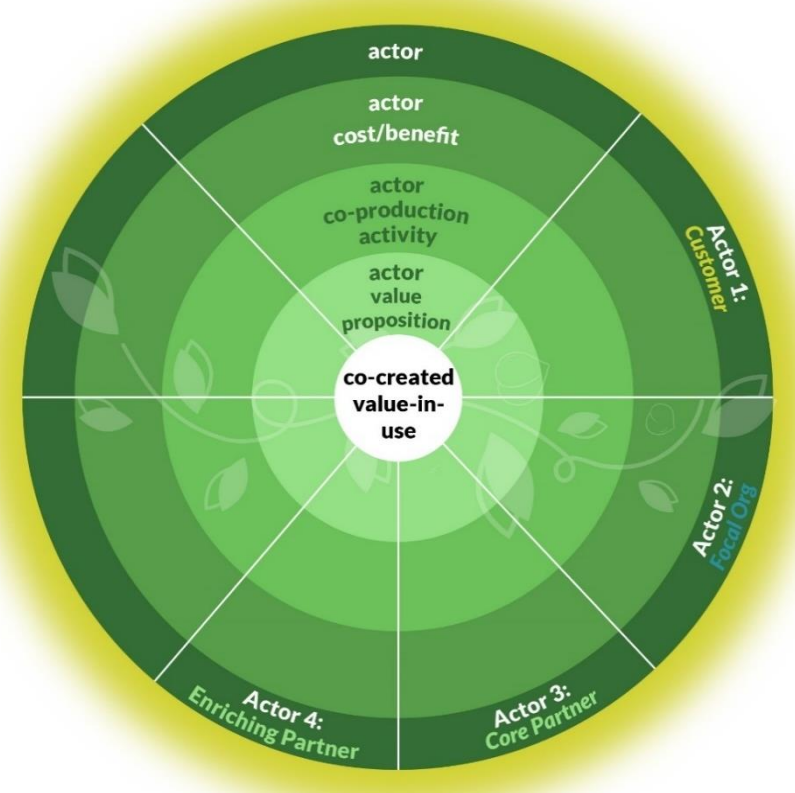


Figure 3: The Business Model Radar Template[3]

3. DELIVER Cycle Tools

The DELIVER cycle serves as a framework designed to propel the development of business modelling and Go-to-Market assessments within the VALPRO Path project. This cycle encompasses activities focused on refining and adjusting business models based on progress and MVP validation throughout the project's lifecycle. The business modelling approach hinges on crafting Collaborative Business Models (CBMs) utilising the **Business Model Canvas** template.

3.1. Business Model Canvas

The Business Model Canvas serves as a strategic management tool, providing a concise visualisation and assessment of a business idea or concept. Comprising nine key boxes representing fundamental elements, it offers a streamlined alternative to traditional lengthy business plans.

VALPRO Path utilises the Business Model Canvas to streamline the mapping and validation of assumptions within identified business cases, presenting information in a structured and concise manner. This tool offers an overview of business model components, such as the value proposition, customer segments, and revenue streams, enhancing clarity and comprehension. The canvas divides into two sides: the right side, emphasising external factors like customers or the market, and the left side, concentrating on internal business aspects. At the centre lie the value propositions, symbolising the reciprocal exchange of value between the business and its customers.

[3] Source: Gilsing, Rick & Turetken, Oktay & Adalı, Onat & Grefen, Paul. (2018). A reference model for the design of Service-Dominant Business Models in the smart mobility domain.

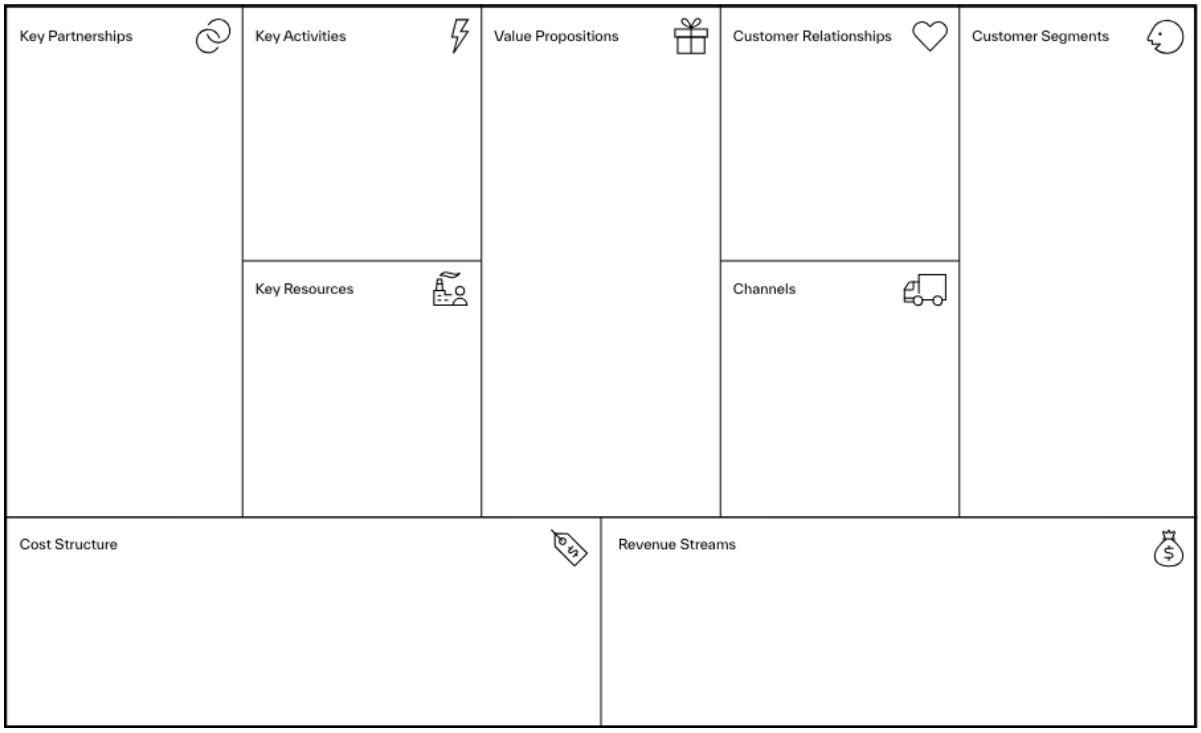


Figure 4: The Business Model Canvas Template[4]

1. **Customer Segment** – Target groups
   - Whose problem does the product, service or solution solve?
   - Who is considered as the most important customer?

2. **Customer Relationships** – The way to interact with customers
   - What type of relationship does each customer segment expect?
   - How can that be integrated into the business in terms of cost and format?
   - How costly is it?

3. **Channels** – Different ways to reach out to customers and vice-versa
   - How will the value proposition reach the customers?
   - Which channels to use?
   - How much does it cost?

4. **Revenue Streams** - The ways a business will earn revenue from the value propositions
   - What value are the customers willing to pay for?
   - Different revenue streams

5. **Key Activities** – Actions that needed to achieve the value proposition for the customers
   - What key activities does the value proposition require?
   - What activities are important in distribution channels, customer relationships, revenue stream, costs?

6. **Key Resources** – Resources needed to achieve the key activities of the business
   - What key resources does the value proposition require?

[4] Source: https://www.strategyzer.com/library/the-business-model-canvas

7. **Key Partners** – Other partners needed to achieve key activities and deliver value to the customer
   - Who are the key partners in the CBM?
   - What are the motivations for the collaboration?

8. **Cost Structure** - All operational costs for taking a business to market
   - How much does it cost to achieve key activities?
   - What is the cost of key resources and key partnerships?

9. **Value Proposition** – A primary reason for a customer to buy a product/ service/ solution
   - What core value is delivered to the customer?
   - Which customer needs are being satisfied?
   - What problem will be solved?
   - Why would someone want to have this problem solved?
   - What is the underlying motivator for this problem?

NEW VALUE LANDSCAPES FOR PLANT PROTEIN PATHWAYS

Annex II – VALPRO Path Market Analysis

valpropath.eu

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1. Market Research Methodology

To successfully conduct market analysis, considering the vast amount of data and information that needs to be investigated, gathered, analysed, and presented, a robust research methodology was planned and executed. A combination of primary and secondary research methods was employed to achieve optimal results.

Primary research involves collecting data directly from sources rather than relying on previously gathered data. This approach focuses specifically on the problem at hand, ensuring that all attention is directed toward a precise subject matter. In this context, primary research methods included the use of questionnaires (such as the Market Analysis Questionnaire) and interviews (online and face-to-face) on various occasions. These methods provided firsthand insights and allowed for a deeper understanding of the specific market dynamics relevant to the study.

Secondary research or desk research is a research method that involves using already existing data that is summarised and collated to increase the overall effectiveness of research. The secondary research primarily relied on utilising existing data that was summarised and compiled to enhance research efficiency. Desk research not only involved data collection but also included reviewing previous research findings to establish a comprehensive understanding of the field.

The basic pillars of the secondary research include a general market overview and a more detailed breakdown of the market by geographic areas and application within the plant-based food market and FaaS. Emphasis is placed on the analysis of the competitive landscape, as well as on connecting the overall market findings to the VALPRO Path business cases. The market analysis findings inform the go-to-market strategy by identifying the product-market fit, understanding the target audience's pain points, assessing competition and market demand, and determining the distribution channels for VALPRO Path products and services.

Conclusions drawn from the market analysis will be of great importance when developing joint and individual exploitation plans within the scope of the project's exploitation activities to be presented in D5.4 in M48.

2. Market Overview - European Plant-based Food Market

Most VALPRO Path products are targeted primarily for commercialization within Europe, in line with the European Commission's goals of reducing the EU's reliance on protein imports and promoting the cultivation of leguminous plants as part of the Common Agricultural Policy (CAP). The project explores applications in both the food and feed sectors for protein crops, while also supporting farmers in these initiatives. However, this Deliverable focuses mainly on the plant-based food market, thus detailed consideration will be given only to the food market potential, excluding feed applications or protein market (protein isolate, protein concentrate or flour) at this stage.

According to reports from Meticulous Research, the global plant-based protein market is anticipated to reach USD 26.45 billion by 2031, growing at a CAGR of 8.4% from 2024 to 2031[5]. Concurrently, the global plant-based food market is forecasted to attain USD 113.1 billion, expanding at a CAGR of 12.3% over the same period[6]. In contrast, the European plant protein market is projected to grow at a CAGR

[5] Plant-based protein market – Global Forecast to 2031, Meticulous Research (2024). Report available here: https://www.meticulousresearch.com/product/plant-based-protein-market-5031
[6] Plant-based food market – Global Forecast to 2031, Meticulous Research (2024). Report available here: https://www.meticulousresearch.com/product/plant-based-food-market-5108

of 6.8% from 2024 to 2032, as outlined by Expert Market Research, indicating a somewhat slower pace compared to global trends.[7]

However, the latest alternative protein investment data reported by the Good Food Institute[8] reveals valuable insights into how Europe's sector is evolving. The figure below illustrates investment trends in the alternative protein sector from 2016 to the first half of 2024, highlighting both investment value and the number of deals. The data is categorised into three main segments: fermentation, represented in yellow, which focuses on protein production through fermentation technologies; cultivated, shown in light green, which pertains to investments in cultivated meat technologies; and plant-based, indicated in dark green, which encompasses investments in plant-based protein products.

The investment trends in the alternative protein sector from 2016 to the first half of 2024 reveal a notable trajectory characterised by rapid expansion of investment flows. In 2016, total investments were modest, all directed towards plant-based proteins, with only 13 deals. However, investment values steadily increased over the years, peaking at €769 million in 2023, which included significant allocations of €553 million for plant-based proteins. The number of deals peaked in 2023 as well, reaching a total of 155. The trend indicates a growing focus on plant-based proteins, which consistently attracted the largest share of investments, although fermentation technologies gained momentum starting in 2020, achieving a peak of €175 million in 2022. In contrast, 2023 experienced a decline in investments in fermentation while plant-based investment came to focus. The first half of 2024 started a downward trend for plant-based investments and a rise in fermentation investment deals with changes anticipated in the second half of 2024. This comprehensive overview underscores the evolving landscape of the alternative protein sector, illustrating the growing interest and financial backing for diverse protein sources as the market continues to expand.

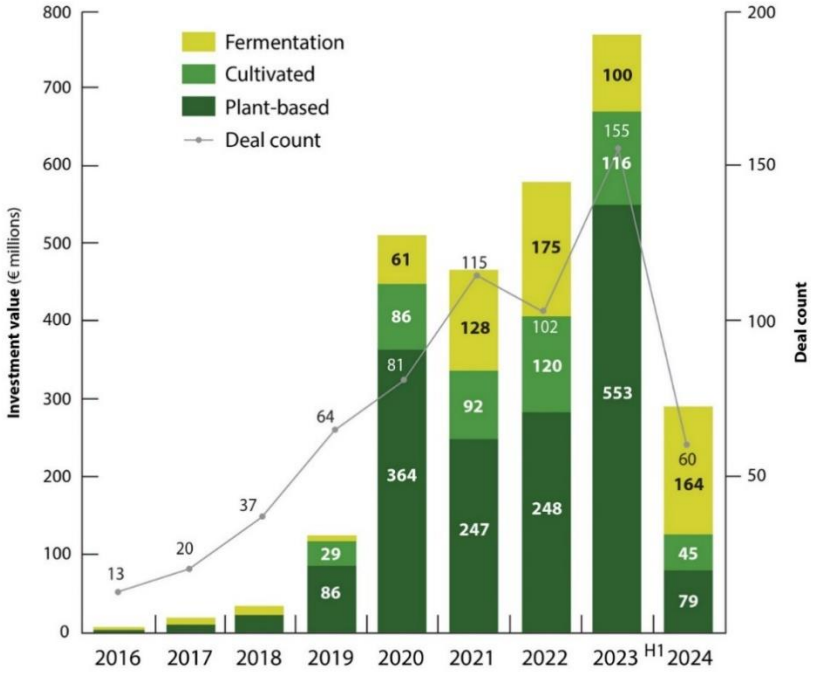


Figure 1: Europe-wide Alternative Protein Investment (2016-H12024)[9]

[7] Europe Plant Protein Market Outlook, Expert Market Research (2023). Report available here: https://www.expertmarketresearch.com/reports/europe-plant-protein-market

[8] https://gfieurope.org/blog/european-investment-figures-point-to-an-evolving-alternative-protein-sector/

[9] Source: Net Zero Insights

The *"Europe: Plant-Based Foods Retail Market Report (2020-2022)"*[10] by the Good Food Institute, using NielsenIQ retail sales data from 13 European countries (Austria, Belgium, Denmark, France, Germany, Italy, Netherlands, Poland, Portugal, Romania, Spain, Sweden, and the UK), reveals that sales of plant-based foods grew by 6% in 2022 and by 21% since 2020, reaching EUR 5.8 billion from EUR 4.8 billion in 2020. Unit sales of plant-based foods increased by 4% between 2021 and 2022, with both sales value and unit sales experiencing a 21% growth from 2020 to 2022[9].

The Good Food Institute also reports that **plant-based milk is the most developed category** in the plant-based market, with sales reaching EUR 2.2 billion in 2022, and it continues to experience steady growth. **Plant-based meat sales also saw a significant increase**, totalling EUR 2.0 billion in 2022 and growing by 19% between 2020 and 2022. Nearly every plant-based category grew in 2022, with the fastest-growing segments being plant-based seafood, meals, and spreads, all demonstrating double-digit growth in sales value. Plant-based seafood, although the least developed category, is the fastest-growing, with sales reaching €43 million in 2022 as evidenced in the figure below[9].

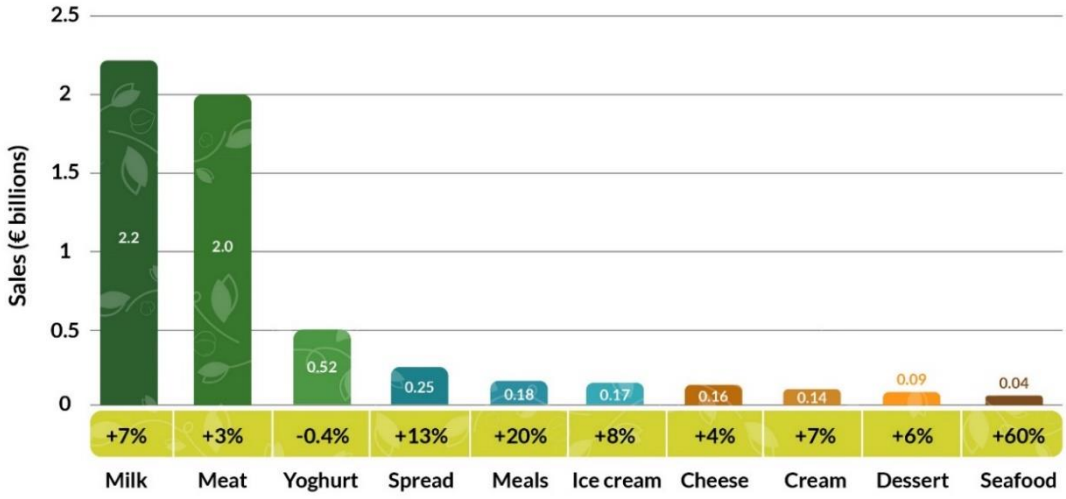


Figure 2: Europe-wide plant-based foods sales by category (in € billions), 2022[11]

Figure 2 represents the plant-based food sales between countries in Europe. The growth rates vary across Europe with some countries showing strong market potential. **Germany leads the market** with €1,911 million in sales, experiencing an 11% growth. Germany's major market share is attributed to an increased preference for plant-based foods as a sustainable alternative, the presence of an aging population, the trend of a healthier lifestyle, increasing food innovations, and increasing investment in the plant-based food sector. Moreover, this country is also projected to register the highest CAGR during the forecast period. The UK follows with €1,077 million but shows a slight decline of 3%. Italy, Spain, and France show growth, with Italy at €681 million (+9%), Spain at €447 million (+4%), and France at €426 million (+3%). The Netherlands remains stable with €411 million in sales. Sweden and Belgium show slight declines and minimal growth, respectively. Notably, Poland, Denmark, Austria, Portugal, and Romania demonstrate significant growth rates, with Romania experiencing the highest percentage increase at 23%, albeit from a smaller base of €33 million[10].

[10] Europe: Plant-Based Foods Retail Market Report (2020-2022), the Good Food Institute (2022). Report available here: https://gfieurope.org/wp-content/uploads/2023/04/2020-2022-Europe-retail-market-insights_updated-1.pdf

[11] Europe: Plant-Based Foods Retail Market Report (2020-2022), the Good Food Institute (2022). Report available here: https://gfieurope.org/wp-content/uploads/2023/04/2020-2022-Europe-retail-market-insights_updated-1.pdf

The growth of the plant-based food market in Europe is driven by several factors, including rising demand for protein-rich diets, heightened consumer awareness of the nutritional benefits of plant-based proteins, and increasing interest from manufacturers in plant-based food and beverages, supported by advancements in ingredient technologies. The rising popularity of vegan diets and ongoing product innovations by plant-based food manufacturers present significant growth opportunities for European vendors of plant-based proteins. However, the entrenched preference for animal-based proteins remains a challenge to the expansion of the plant-based protein market.

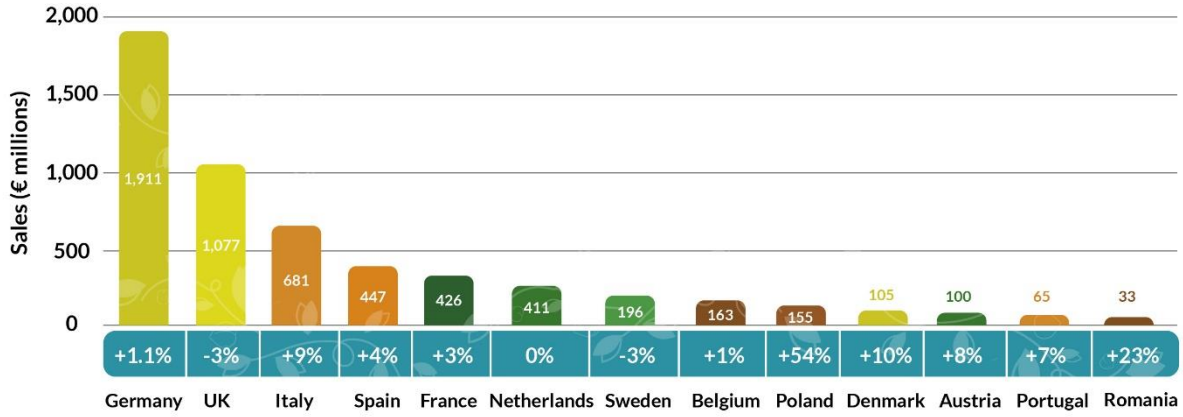


Figure 3: Europe-wide Plant-based Food Sales by Country (in € millions), 2022[12]

Plant-based foods are increasingly recognized as alternatives to conventional animal-derived products, supported by ongoing investments in innovative product development, a focus addressed by the VALPRO Path project as well. The rapidly expanding market for plant-based foods not only presents lucrative opportunities for businesses to meet rising consumer demand but also contributes to fostering a more sustainable and ethical food system. The continuous **introduction of new and innovative plant-based products** highlights the industry's dedication to **offering healthier, environmentally sustainable, and ethically sound food choices**, promising a bright future for the food sector. This aligns with the objectives of the VALPRO Path project, which aims to steer food value chain actors toward sustainable plant protein production.

2.1. Market Breakup by Geographical Area

The VALPRO Path project focuses on innovation in protein crop and plant-based food production, primarily targeting Europe as the key market for raw materials (such as flour, protein concentrate, and protein isolate) and various categories of plant-based food products. While common trends are observed across Europe, the survey findings from the EU-funded Smart Protein project, detailed in the report *"Plant-based foods in Europe: How big is the market?"*[13] and based on Nielsen MarketTrack data for 11 countries (Austria, Belgium, Denmark, France, Germany, Italy, the Netherlands, Poland, Romania, Spain, United Kingdom) from 2018 to 2020, highlight distinct consumer behaviours and preferences in each country.

[12] Europe: Plant-Based Foods Retail Market Report (2020-2022), the Good Food Institute (2022). Report available here: https://gfieurope.org/wp-content/uploads/2023/04/2020-2022-Europe-retail-market-insights_updated-1.pdf

[13] Plant-based foods in Europe: How big is the market? Smart Protein Plant-based Food Sector Report by Smart Protein Project, European Union's Horizon 2020 research and innovation programme (No 862957) (2021). Report available here: https://smartproteinproject.eu/plant-based-food-sector-report.

The analysis in this section draws upon findings from several key reports. These include the previously mentioned *"Plant-based foods in Europe: How big is the market?"* report, as well as data on consumer preferences from the *"European Consumer Survey on Plant-Based Foods: Describing the Product Landscape and Uncovering Priorities for Product Development and Improvement"* by ProVeg International[14]. Additionally, the analysis will incorporate insights from the Smart Protein project's report *"Evolving Appetites: An In-Depth Look at European Attitudes Towards Plant-Based Eating,"*[15] which is based on an online survey of 7,500 participants across 10 European countries. Moreover, the insights from country-level reports delivered by the Good Food Institute for 13 European countries contributed to the findings of the market analysis with geographical break by region including Western, Northern, Southern and Eastern Europe.

Products	All	DE	UK	AT	BE	FR	NL	CH	DK	CZ
Milk	**93%**	93%	97%	92%	94%	91%	90%	96%	95%	92%
Meat	**81%**	79%	89%	63%	85%	66%	89%	66%	86%	64%
Yoghurt	**73%**	72%	72%	74%	82%	80%	75%	76%	56%	77%
Butter/ Margarine	**71%**	71%	80%	67%	73%	61%	72%	65%	80%	56%
Tofu or tempeh	**69%**	52%	57%	83%	79%	87%	69%	85%	55%	97%
Chocolate and baked goods	**62%**	68%	56%	75%	69%	67%	60%	72%	48%	65%
Ice cream	**55%**	48%	57%	64%	56%	41%	60%	70%	61%	56%
Cheese	**55%**	50%	67%	44%	67%	42%	54%	62%	50%	56%
Sauces and dressings	**54%**	34%	53%	44%	63%	36%	72%	52%	51%	54%
Ready meals/ Grab-and-go meals	**37%**	39%	63%	32%	29%	38%	26%	24%	46%	32%
Other dairy	**28%**	32%	21%	29%	22%	39%	25%	36%	17%	40%
Sports nutrition products	**21%**	20%	17%	22%	19%	14%	23%	27%	16%	39%
Seafood	**15%**	11%	26%	14%	26%	8%	19%	18%	3%	4%
Egg alternatives	**12%**	16%	10%	12%	15%	10%	12%	16%	7%	10%

Table 1: Plant-based Product Consumption Rate per Country[13]

Table 1 presents the survey results for 9 European countries detailing purchase and consumption patterns across various plant-based categories in each country.

Plant-based milk has the highest consumption rate across Europe, with over 90% of people in all surveyed countries consuming it. However, other plant-based dairy products show significant variation. Plant-based cheese consumption is highest in the UK and Belgium (67%) and lowest in France (42%), likely due to the strong preference for traditional dairy cheese. Danish and UK consumers lead in purchasing plant-based butter/margarine (80%), while plant-based yoghurt consumption is lowest in Denmark (56%) compared to the average (73%). Meat alternatives are most popular in the Netherlands, Denmark, Belgium, and the UK. Austria and Switzerland have the highest consumption of plant-based chocolates and baked goods (75% and 72% respectively), surpassing the

[14] ProVeg International (2020): European Consumer Survey on Plant-based Foods – Describing the product landscape and uncovering priorities for product development and improvement. Report. Berlin. Report available here: https://corporate.proveg.com/wp-content/uploads/2022/02/PV_Consumer_Survey_Report_2020_030620-1.pdf

[15] European Survey on readiness to adopt a plant-based lifestyle, Smart Protein Project, (2023). Report available here: https://smartproteinproject.eu/european-attitudes-towards-plant-based-eating/

average (62%). Plant-based ice cream is most popular in Switzerland and Austria, and least popular in France and Germany. The UK has the highest penetration of plant-based ready meals (63%), whereas the Netherlands and Switzerland have the lowest (26% and 24%). Food manufacturers should consider these regional variations in consumption for different product categories[16].

The survey results highlight significant growth opportunities for new plant-based products across various food categories as explored in the VALPRO Path project. Expanding plant-based product lines diversifies risk and future-proofs businesses. Offering tasty and healthy plant-based foods allows consumers to make choices that benefit people, animals, and the planet, creating a win-win scenario with advantages extending beyond the food supply chain. The VALPRO Path project builds on European consumer preferences since VALPRO Path products offer tasty and healthy alternatives to animal-based products with the ambition to achieve "0" carbon footprint.

2.1.1. Western Europe

This section analyses the current market state and consumer preferences for plant-based food products in **Austria, Belgium, France, Germany, and the Netherlands** to gain a better and deeper understanding of the trends in each country.

Austria

According to the "Austrian plant-based food retail market insights (2020-2022)" delivered by the Good Food Institute Europe, the Austrian plant-based market as one of the smallest in Europe is valued at €99.6 million. However, consumer demand is growing rapidly, with sales of plant-based foods increasing by 22% between 2020 and 2022. **Plant-based milk is the most developed category**, showing steady growth during this period. **Plant-based meat sales also saw a significant rise**, growing by 27%. Although still a small segment, plant-based seafood is the fastest-growing category, experiencing a remarkable increase in sales[17].

The Smart Protein project reports that the plant-based food market has seen substantial growth, with sales value increasing by 57% (€82 million) and sales volumes rising by 52% (26 million Kg/L) in the period between 2020-2022. Discount stores have performed exceptionally well, with sales value and volume surging by 83% (€15 million) and 82% (6 million Kg/L) respectively, capturing an 18% share of the sales value. Leading the sector are plant-based plain milk (€37 million) and plant-based meat (€25 million), the latter showing the strongest growth in sales value at 58%. Plant-based meat, particularly meals like **stir fry and schnitzel** (€8 million), saw significant sales boosts, especially in discount stores. Plant-based milk also experienced double-digit growth, with oat (€10 million) and almond (€9.5 million) being the most popular, and oat (€1.7 million) and rice (€1.6 million) dominating in discount stores. Additionally, Austria boasts **a diverse range of plant-based yoghurts** (€16 million), including soya (€10 million), coconut (€4.6 million), almond (€1.3 million), and other varieties like lupine, cashew, and oat (€608k)[18].

[16] ProVeg International (2020): European Consumer Survey on Plant-based Foods – Describing the product landscape and uncovering priorities for product development and improvement. Report. Berlin. Report available here: https://corporate.proveg.com/wp-content/uploads/2022/02/PV_Consumer_Survey_Report_2020_030620-1.pdf

[17] Austria plant-based food retail market insights (2020-2022), Good Food Institute Europe (2022). Report available here: https://gfieurope.org/wp-content/uploads/2023/04/2020-2022-Austria-retail-market-insights_updated.pdf

[18] Plant-based foods in Europe: How big is the market? Smart Protein Plant-based Food Sector Report by Smart Protein Project, European Union's Horizon 2020 research and innovation programme (No 862957) (2021). Report available here: https://smartproteinproject.eu/plant-based-food-sector-report.

Based on key findings reported by the ProVeg[19] and the Smart Protein project[20] Austria leads in the acceptance and consumption of fungi-based protein sources and shows significant interest in insect-based proteins, alongside Germany, Denmark, and France. The Austrian population consists of 48% omnivores, 37% flexitarians, 5% vegans, 5% vegetarians, and 5% pescatarians. **Flexitarians are particularly prevalent in Austria**, second only to Germany (40%). Despite Austria's high numbers of flexitarians and vegans, there is a relatively low consumption of plant-based alternatives. **Austria also has the lowest levels of legume consumption** (49%), like Poland and the UK[19]. However, Austrians are notable consumers of plant-based chocolates and baked goods (75%) and plant-based ice cream, both significantly above the market average[18]. Emphasising the nutritional benefits and culinary versatility of legumes could potentially boost their adoption in Austria.

Belgium

The "Belgium plant-based food retail market insights (2020-2022)" report by the Good Food Institute Europe[21] reveals that the market for plant-based foods in Belgium reached €163.5 million by 2022, marking a slight 1% growth from 2020. Despite a 1% decline in sales value and a 6% drop in unit sales of plant-based milk in 2022, it remains the most established category, mirroring trends seen in traditional dairy products. **Plant-based meat sales increased by 4%** to €54.3 million between 2020 and 2022. Notably, plant-based seafood, while still a small category with €670,000 in sales in 2022, demonstrated robust growth of over 37% since 2020, positioning it as the fastest-growing segment within the market[19].

According to the Smart Protein project's findings from 2020-2022, the plant-based food market in Belgium demonstrated notable growth, with a 17% increase in sales value reaching €134 million and an 8% rise in sales volume totalling 42 million Kg/L. Discount stores exhibited even stronger growth, recording a 35% increase in sales value (€8.9 million) and a 19% increase in sales volume (4.1 million Kg/L), securing a 7% share of the total sales value. Plant-based meat (€48 million) and plant-based plain milk (€39 million) lead the sector, with **plant-based meat seeing the highest sales value growth** at 19%. **Plant-based refrigerated meat dominated** with 90% (€44 million), while plant-based frozen meat constituted the remaining 10% (€4.8 million), both segments showing robust double-digit growth. Within the plant-based plain milk sector, soya milk led with €14 million, followed by almond (€11 million) and oat (€5 million), with oat milk showing significant growth at 50%. **Plant-based yoghurt notably surged**, particularly in discount stores, with a remarkable 497% increase (€163k), contributing to an overall growth of 20% (€26 million)[18].

ProVeg[18] reports that Belgium and the UK **lead in plant-based cheese consumption**, with penetration rates reaching 67% in both countries. Additionally, **meat alternatives are notably popular** in Belgium.

France

The plant-based food market in France, valued at €425.7 million according to The Good Food Institute Europe, ranks fifth largest in Europe with a 5% sales growth from 2020 to 2022. **Plant-based milk remains the most established category**, maintaining stable sales during this period and achieving €189.8 million in sales in 2022. **Plant-based meat has shown a notable 17% increase in sales value**, indicating substantial growth. **Plant-based cheese**, while still a small category with €7.4 million in sales

[19] ProVeg International (2020): European Consumer Survey on Plant-based Foods – Describing the product landscape and uncovering priorities for product development and improvement. Report. Berlin. Report available here: https://corporate.proveg.com/wp-content/uploads/2022/02/PV_Consumer_Survey_Report_2020_030620-1.pdf
[20] European Survey on readiness to adopt a plant-based lifestyle, Smart Protein Project, (2023). Report available here: https://smartproteinproject.eu/european-attitudes-towards-plant-based-eating/
[21] Belgium plant-based food retail market insights (2020-2022), Good Food Institute Europe (2022). Report available here: https://gfieurope.org/wp-content/uploads/2023/04/2020-2022-Belgium-retail-market-insights_updated.pdf

in 2022, **has experienced remarkable growth of over 674% since 2020,** marking it as the fastest growing segment in the French plant-based food market.[22]

The Smart Protein Project reports that France's plant-based food market saw a 21% growth in sales value (€355 million) and an 18% increase in sales volume (125 million Kg/L) during the period between 2020 and 2022. **Leading the plant-based food sector are plant-based milk** (€187 million), plant-based yoghurt (€87 million), and plant-based meat (€80 million), all of which have shown significant growth. In plant-based meat, **refrigerated meat (€68 million) is the most dominant segment**, followed by ambient (€7 million) and frozen meat (€5 million), with **frozen meat exhibiting the strongest growth**. The plant-based milk market is led by almond milk (€72 million), followed by soya (€41 million) and oat (€21 million). Within the plant-based yoghurt segment (€87 million), flavoured yoghurt (€55 million) is the most dominant.[23]

In France, there is a notable duality in consumer behaviour regarding plant-based preferences. Despite a relatively high number of respondents in the ProVeg European consumer survey reporting high meat consumption (15% eating beef or pork more than three times per week, 2% above the average), a significant portion (58%, 7% more than the average) express a desire to reduce meat intake. **Flexitarians in France constitute 25% of the population**, smaller compared to other countries like the UK and Germany. When dining out, only 17% of French respondents choose plant-based alternatives, lower than in the UK, Poland, and Romania. Motivations for choosing plant-based foods in France are led by taste, followed by affordability and health. **Trust in plant-based alternatives is relatively low** (36%), indicating **a need for improved consumer confidence through clear labelling** and educational campaigns. France also shows **significant interest in fungi-based and algae-based proteins**, and there is a notable acceptance of insects as a protein source.[24]

In France, the **consumption rate of plant-based cheese is among the lowest in Europe** at 42%, likely due to the strong cultural preference for dairy-based cheese. Similarly, plant-based ice cream has low penetration in France, along with Germany. This indicates a significant challenge for plant-based alternatives to gain acceptance in a market deeply rooted in traditional dairy products.[25]

Germany

The Good Food Institute Europe country-level report values Germany's plant-based food market at €1.91 billion. It is the largest one in Europe, and it grew by 42% between 2020 and 2022. **Plant-based meat is the most developed category**, with sales reaching €642.8 million in 2022 and showing steady growth. Plant-based milk sales also increased significantly, growing by 43% to €552.3 million over the same period. Almost all plant-based categories saw growth in 2022, with the **fastest-growing being plant-based seafood, meals, cream, and dessert**.[26]

In Germany, the plant-based food market surged significantly with a 97% growth in sales value (€817 million) and an 80% increase in sales volume (310 million Kg/L) from 2020 to 2022. **Plant-based milk**

[22] France plant-based food retail market insights (2020-2022), Good Food Institute Europe, (2022). Report available here: https://gfieurope.org/wp-content/uploads/2023/04/2020-2022-France-retail-market-insights_updated.pdf
[23] Plant-based foods in Europe: How big is the market? Smart Protein Plant-based Food Sector Report by Smart Protein Project, European Union's Horizon 2020 research and innovation programme (No 862957) (2021). Report available here: https://smartproteinproject.eu/plant-based-food-sector-report.
[24] European Survey on readiness to adopt a plant-based lifestyle, Smart Protein Project, (2023). Report available here: https://smartproteinproject.eu/european-attitudes-towards-plant-based-eating/
[25] ProVeg International (2020): European Consumer Survey on Plant-based Foods – Describing the product landscape and uncovering priorities for product development and improvement. Report. Berlin. Report available here: https://corporate.proveg.com/wp-content/uploads/2022/02/PV_Consumer_Survey_Report_2020_030620-1.pdf
[26] Germany plant-based food retail market insights (2020-2022), Good Food Institute Europe, (2022). Report available here: https://gfieurope.org/wp-content/uploads/2023/04/2020-2022-Germany-retail-market-insights_updated.pdf

leads the sector with sales of €396 million, followed by plant-based meat at €181 million, both categories showing double-digit growth in sales value, with **plant-based meat and fish experiencing triple-digit growth**. **Plant-based refrigerated meat (e.g., burger patties, nuggets, minced) dominates** the meat segment with €123 million in sales, while oat milk leads the plant-based milk market at €184 million, growing rapidly at 105%. Plant-based fish and cheese segments are emerging with triple-digit growth in sales value, with plant-based fish products appearing in discount stores for the first time in the latest period.[27]

Germany boasts a growing vegan and vegetarian population, with nearly 10% of its citizens adhering to a vegetarian diet—one of the highest rates in Europe[28]. The country has even established legal definitions for vegan and vegetarian food labelling. The **surge in popularity of veganism** and other plant-based diets is largely attributed to the increased availability of high-quality, diverse meat and dairy alternatives on supermarket shelves. The creativity and innovative product launches by major manufacturers and large food corporations have significantly **enhanced the quality and accessibility of plant-based products in Germany**.

Germany leads the plant-based food market in Europe, with 40% of individuals identifying as flexitarian in 2023. The country, along with France, is **at the forefront of reducing meat consumption**. Animal welfare is a significant motivator for this trend. Germany's success in promoting plant-based products stems from a comprehensive approach that includes retail expansion, school programs, cultural events, and addressing consumer demand for affordable options. This strategy has resulted in the highest plant-based retail sales in Europe and a large segment of consumers adopting plant-based lifestyles. Additionally, Germany shows significant **interest in alternative protein sources** such as fungi and insects, further diversifying its plant-based food market.[29]

In Germany, the plant-based ice cream market has the lowest penetration compared to other countries like Switzerland and Austria. Despite this, respondents in Germany have had positive experiences with plant-based products in the sweet category, indicating a strong potential for growth in plant-based cakes and pastries. This sector is currently underdeveloped, especially given the country's cultural emphasis on baked goods. The positive reception of existing plant-based products suggests **a significant opportunity for expanding the range of sweet plant-based offerings** in Germany.[30]

The Netherlands

The Netherlands' plant-based food market, valued at €411.4 million, is the sixth largest in Europe, boasting the **highest per capita consumption rates of plant-based foods**. Sales of plant-based foods in the country grew by 9% from 2020 to 2022, according to the country-level report for the Netherlands by the Good Food Institute. The **most developed category is plant-based meat**, although it saw a 4% decline in sales value and a 5% decline in unit sales in 2022, mirroring trends in the animal-based meat category. Plant-based milk sales, on the other hand, increased by 14%, reaching €106.2

[27] Plant-based foods in Europe: How big is the market? Smart Protein Plant-based Food Sector Report by Smart Protein Project, European Union's Horizon 2020 research and innovation programme (No 862957) (2021). Report available here: https://smartproteinproject.eu/plant-based-food-sector-report.

[28] Europe Plant-based Food and Beverages Market Size & Share Analysis - Growth Trends & Forecasts (2024 - 2029), Mordor Intelligence (2023). Report available here: https://www.mordorintelligence.com/industry-reports/europe-plant-based-food-and-beverage-market

[29] European Survey on readiness to adopt a plant-based lifestyle, Smart Protein Project, (2023). Report available here: https://smartproteinproject.eu/european-attitudes-towards-plant-based-eating/

[30] ProVeg International (2020): European Consumer Survey on Plant-based Foods – Describing the product landscape and uncovering priorities for product development and improvement. Report. Berlin. Report available here: https://corporate.proveg.com/wp-content/uploads/2022/02/PV_Consumer_Survey_Report_2020_030620-1.pdf

million in 2022. Plant-based cheese, while still a smaller category with €8.8 million in sales, is the fastest-growing segment, with a remarkable 60% growth since 2020.[31]

The Netherlands' plant-based food market has shown substantial growth, with sales value increasing by 50% to €291 million and sales volume rising by 35% to 72 million Kg/L from 2020 to 2022. Discount stores experienced even more significant growth, with an 83% increase in sales value (€22 million) and a 58% rise in sales volume (7 million Kg/L). **Plant-based meat dominates the sector**, generating €174 million in sales, followed by plant-based milk at €62 million and plant-based yoghurt at €43 million. **Plant-based cheese exhibited the highest growth in sales value** at 140%, with plant-based yoghurt also showing a strong 35% growth. Within the plant-based meat category, **burger patties lead** with €42 million in sales, followed by stir fry (€33 million) and meatballs (€21 million). In the plant-based milk market, almond milk leads with €20 million in sales. **Sliced cheese is the top-selling product** in the plant-based cheese category with €2.7 million in sales, despite no recorded sales in discount stores yet. New segments like cheese pieces, cheese rolls, and cream cheese have recently entered the market.[32]

In the Netherlands, according to the Smart Protein project, consumer preferences highlight a strong focus on animal welfare as a significant factor in reducing meat consumption, a trend mirrored in Germany. The Netherlands also shows **a notable 35% of consumers identifying as flexitarians**. While Denmark leads in consumption of quinoa and legume-based foods, the Netherlands follows closely behind, reflecting **robust interest in plant-based diets**. Dutch consumers express **higher satisfaction with the availability of plant-based options** compared to other European countries. Moreover, the Netherlands **leads in acceptance of insect-based protein sources**, underscoring a progressive approach to sustainable food choices driven by environmental and animal welfare concerns.[33]

Meat alternatives are highly popular among consumers, reflecting a significant shift towards plant-based diets. However, the adoption of plant-based ready meals and grab-and-go options remains lower compared to the UK. While the UK boasts a 63% penetration rate for plant-based ready meals, the Netherlands only reaches 26%, suggesting a **market that is still developing in terms of convenient plant-based meal options**. This indicates potential growth opportunities for retailers and manufacturers to expand their offerings and cater more effectively to the increasing demand for plant-based convenience foods in the Netherlands.[34]

2.1.2. Northern Europe

This section examines the current market status and consumer preferences for plant-based food products in Northern Europe, focusing on **Denmark and the United Kingdom (UK)** to provide insights into the unique trends shaping each country's market.

[31] Netherlands plant-based food retail market insights (2020-2022), Good Food Institute Europe, (2022). Report available here: https://gfieurope.org/wp-content/uploads/2023/04/2020-2022-Netherlands-retail-market-insights_updated.pdf
[32] Plant-based foods in Europe: How big is the market? Smart Protein Plant-based Food Sector Report by Smart Protein Project, European Union's Horizon 2020 research and innovation programme (No 862957) (2021). Report available here: https://smartproteinproject.eu/plant-based-food-sector-report.
[33] European Survey on readiness to adopt a plant-based lifestyle, Smart Protein Project, (2023). Report available here: https://smartproteinproject.eu/european-attitudes-towards-plant-based-eating/
[34] ProVeg International (2020): European Consumer Survey on Plant-based Foods – Describing the product landscape and uncovering priorities for product development and improvement. Report. Berlin. Report available here: https://corporate.proveg.com/wp-content/uploads/2022/02/PV_Consumer_Survey_Report_2020_030620-1.pdf

Denmark

As reported by the country level report of the Good Food Institute Europe, the Danish plant-based food retail market is valued at 784 million kroner - a relatively small market in Europe but notable for its **high per capita consumption** of these products. Between 2020 and 2022, sales of plant-based foods in Denmark grew by 17%. Plant-based milk is the most developed category, with sales reaching 346.3 million kroner in 2022, and continuing to show steady growth. Plant-based meat sales, recovering from a price-driven dip in 2021, grew to 230.1 million kroner in 2022. Additionally, **plant-based spreads and meals experienced significant growth**, with sales increasing by 34% and 42%, respectively. Overall, plant-based food categories in Denmark are growing faster than their animal-based counterparts.[35]

In **Denmark**, the plant-based food market experienced a 29% increase in sales value (€30 million) and a 46% rise in sales volume (14 million Kg/L) between 2020 and 2022. The sector is led by plant-based milk (€26 million) and plant-based yoghurt (€4.7 million), with both plant-based meat and plant-based yoghurt exhibiting the strongest growth in sales value at 16%. **The plant-based meat sector (€29k) is primarily composed of refrigerated prepared dishes** (€13k) and frozen prepared dishes (€12k), growing 50% in sales value with a 42% discounter share. The plant-based milk market (€26 million) is dominated by oat milk (€14 million), followed by soya (€5.3 million) and almond (€4.5 million), with oat milk showing the highest growth at 26% and a 50% discounter share. The plant-based cheese segment (€1410) is still emerging but has shown triple-digit growth in discount stores in the reference period.[36]

The survey performed within the Smart Protein project shows that Denmark leads Europe in several aspects of plant-based and alternative protein consumption. It has the **highest percentage of pescatarians (6%)** and the **largest proportion of consumers integrating plant-based meats into their diets (32%)**. Denmark also stands out for its high consumption of quinoa (36%) and other legume-based foods (30%). Furthermore, 23% of Danes frequent fully plant-based restaurants, the highest in Europe. Danish consumers exhibit a strong interest in plant-based meat options, alongside Spain and the UK, with 35% desiring more variety. **Price sensitivity is notable**, with 29% of Danes citing it as a concern. **Trust in plant-based alternatives has significantly increased**, with 50% of Danes now more trusting than three years ago. Denmark also ranks **highest in acceptance of cultivated protein sources** and shows considerable interest in fungi-based and insect-based proteins. Environmental concerns (29%) are a key motivation for reducing meat consumption in Denmark, highlighting its progressive stance on sustainable eating.[37]

The United Kingdom

The UK plant-based food market, valued at £963.8 million, is **one of the largest in Europe** and experienced a 9% growth from 2020 to 2022. **Plant-based meat is the most developed category**, though its sales declined by 8% in 2022 following an 11% growth in 2021. Plant-based milk, the second largest category, continued its steady growth, reaching £276.2 million (€308.7 million) in 2022, with a 24% increase over the two years. Plant-based cream, one of the least developed but fastest-growing categories, saw a rapid 49% growth from 2020 to 2022, totalling £3.7 million (€4.1 million) in 2022.

[35] Denmark plant-based food retail market insights (2020-2022), Good Food Institute Europe, (2022). Report available here: https://gfieurope.org/wp-content/uploads/2023/04/2020-2022-Denmark-retail-market-insights_updated.pdf

[36] Plant-based foods in Europe: How big is the market? Smart Protein Plant-based Food Sector Report by Smart Protein Project, European Union's Horizon 2020 research and innovation programme (No 862957) (2021). Report available here: https://smartproteinproject.eu/plant-based-food-sector-report.

[37] European Survey on readiness to adopt a plant-based lifestyle, Smart Protein Project, (2023). Report available here: https://smartproteinproject.eu/european-attitudes-towards-plant-based-eating/

Overall, the **UK market shows robust growth in plant-based foods compared to animal-based alternatives** as reported by the Good Food Institute country level report.[38]

In the **UK**, the plant-based food market experienced substantial growth with a 73% increase in sales value (€750 million) and a 67% rise in sales volume (206 million Kg/L) between 2020 and 2022. **Plant-based meat leads the sector** with €502 million in sales, followed by plant-based milk at €226 million. All categories showed double-digit growth, except for plant-based baked goods, which exhibited a 19% increase in sales value, driven by **strong performance in plant-based confectionery** with a 94% growth in the latest period. Within plant-based meat, refrigerated products (€264 million) outperformed frozen options (€231 million), with **plant-based sausages leading** both segments. Plant-based milk saw a notable 107% growth in sales value, while plant-based cheese showed even higher growth at 165% over the past two periods, highlighting strong consumer demand and market expansion in the UK for plant-based alternatives.[39]

ProVeg International reports that **plant-based cheese and butter/margarine have high penetration rates** in the UK, with 67% of consumers purchasing plant-based cheese and 80% purchasing plant-based butter/margarine, matching Belgium and Denmark, respectively. The UK also shows **significant consumption of meat alternatives** alongside the Netherlands, Denmark, and Belgium. **Plant-based ready meals are particularly popular** in the UK, with a 63% penetration rate, supported by a wide variety of options available in retail stores. However, many UK consumers find plant-based alternatives too expensive for their budgets.[40]

The UK demonstrates **strong support for policy measures promoting plant-based eating** and has the **highest number of vegetarians (7%)**. The UK, along with Poland and Romania, stands out for **high rates of choosing plant-based options in restaurants (24%)**. Despite **lower legume consumption** (48%) and fewer consumers eating plant-based products weekly, the UK has a **significant interest in plant-based meats**, with 35% wanting more options. The UK also has a high preference for purchasing plant-based alternatives in supermarkets (74%) and places great importance on taste (66%), affordability (53%), and freshness (29%). Concern about taste is notably high in the UK (37%). Trust in plant-based alternatives has increased significantly, with 49% of UK consumers now more trusting than three years ago. Additionally, there is significant interest in plant-based proteins, fungi-based proteins, and policy actions to support plant-based eating in the UK.[41]

2.1.3. Southern Europe

This section explores the current market dynamics and consumer preferences for plant-based food products in Southern Europe, specifically highlighting **Italy and Spain**. It aims to uncover distinct trends influencing the markets of each country.

[38] UK plant-based food retail market insights (2020-2022), Good Food Institute Europe, (2022). Report available here: https://gfieurope.org/wp-content/uploads/2023/04/2020-2022-UK-retail-market-insights_updated.pdf

[39] Plant-based foods in Europe: How big is the market? Smart Protein Plant-based Food Sector Report by Smart Protein Project, European Union's Horizon 2020 research and innovation programme (No 862957) (2021). Report available here: https://smartproteinproject.eu/plant-based-food-sector-report.

[40] ProVeg International (2020): European Consumer Survey on Plant-based Foods – Describing the product landscape and uncovering priorities for product development and improvement. Report. Berlin. Report available here: https://corporate.proveg.com/wp-content/uploads/2022/02/PV_Consumer_Survey_Report_2020_030620-1.pdf

[41] European Survey on readiness to adopt a plant-based lifestyle, Smart Protein Project, (2023). Report available here: https://smartproteinproject.eu/european-attitudes-towards-plant-based-eating/

Italy

According to Triton Market Research[42] Italy's plant-based food and beverage market has seen significant growth recently. This expansion is driven by the country's rich culinary tradition and emphasis on local ingredients, encouraging more people to embrace plant-based alternatives. This trend reflects a shift towards healthier and more sustainable dietary habits, which is a key factor propelling the market's growth.

The Good Food Institute Europe's report on Italy's plant-based food retail market insights (2020-2022) highlights significant growth and trends. The Italian plant-based food market, valued at €680.9 million, is the **third largest in Europe** and saw a 21% growth between 2020 and 2022. Plant-based milk, Italy's most developed category, reached €310.4 million in 2022, with steady growth. Plant-based meat also saw significant growth, totalling €168.4 million in 2022, with a 40% increase between 2020 and 2022. Every plant-based category grew in 2022, with **plant-based meals, meat, and ice cream showing double-digit growth**. Overall, plant-based categories in Italy are expanding faster than their animal-based counterparts, with notable increases in sales of plant-based milk, meat, and yoghurt.[43]

As reported by the research conducted within the Smart Protein project, the Italian plant-based food market experienced a slight decline of 1% in sales value (€425 million) during the reference period, despite a 3% increase in sales volume (140 million Kg/L). Plant-based milk leads the sector with €231 million in sales, followed by plant-based meat at €111 million and plant-based yoghurt at €43 million. Plant-based milk showed the strongest growth at 7%, followed by plant-based ice cream at 5% and plant-based meat at 1%. Within the plant-based meat sector, meals like **burger patties and nuggets dominate** with €98 million in sales, while tofu and cold cuts contribute smaller amounts. Soy milk is the leading segment in plant-based milk (€87 million), followed by rice (€46 million) and almond milk (€44 million), with oat milk showing the highest growth in sales value at 23% across both periods. Plant-based ice cream, primarily in multipacks (€22 million), showed double-digit growth in sales value, totalling €33 million.[44]

Italy boasts the highest trust in plant-based products being safe to consume (66%) and leads in the consumption and acceptance of plant-based proteins. The country also has a **strong cultural affinity for legumes**, with 69% of Italians consuming them regularly, presenting a **lucrative opportunity for legume-based products**. Additionally, Italy, alongside Poland, has the highest consumption of plant-based yoghurt (39%). **Taste and health are crucial factors for Italian consumers**, with 39% prioritising taste and 49% driven by health benefits. Despite affordability concerns (27%), Italy, Spain, and the UK exhibit strong support for policies promoting plant-based eating.[45]

Spain

According to the country level report prepared by the Good Food Institute, the Spanish plant-based food market, valued at €447.4 million, is the fourth largest in Europe and grew by 9% between 2020 and 2022. **Plant-based milk is the most developed category**, with sales reaching €352.8 million in 2022 and experiencing steady growth. Although the value of plant-based meat sales declined to €84.7 million in 2022, the category still grew by 25% from 2020 to 2022. One of the least developed but

[42] Europe plant-based food and beverage market 2023-2030, Triton Market Research, Report available here: https://www.tritonmarketresearch.com/reports/europe-plant-based-food-and-beverage-market
[43] Italy plant-based food retail market insights (2020-2022), Good Food Institute Europe, (2022). Report available here: https://gfieurope.org/wp-content/uploads/2023/04/2020-2022-UK-retail-market-insights_updated.pdf
[44] Plant-based foods in Europe: How big is the market? Smart Protein Plant-based Food Sector Report by Smart Protein Project, European Union's Horizon 2020 research and innovation programme (No 862957) (2021). Report available here: https://smartproteinproject.eu/plant-based-food-sector-report.
[45] European Survey on readiness to adopt a plant-based lifestyle, Smart Protein Project, (2023). Report available here: https://smartproteinproject.eu/european-attitudes-towards-plant-based-eating/

fastest-growing categories is plant-based seafood, which saw a remarkable increase of over 6,430%, reaching €1.7 million in sales in 2022.[46]

In **Spain**, the plant-based food market saw significant growth with a 48% increase in sales value (€448 million) and a 20% rise in sales volume (265 million Kg/L) between 2020 and 2022. Plant-based milk leads the sector with €318 million in sales, followed by plant-based meat at €87 million and plant-based yoghurt at €42 million, all categories showing double-digit growth. Plant-based meat, primarily **refrigerated (€80 million), dominates the sector**, with smaller contributions from frozen (€3.4 million) and ambient varieties (€3.1 million). Oat milk is the dominant segment in plant-based milk (€125 million), followed by soya (€91 million) and almond (€57 million), with oat milk showing the strongest growth at 25% overall and 49% in discount stores. Plant-based yoghurt also exhibited strong growth at 55%, with discounters significantly increasing their sales over the past two periods after initially low levels in 2018.[47]

When it comes to consumer preferences investigated within the Smart Protein project, Spain demonstrates significant interest and consumption of plant-based protein sources, alongside Poland and the UK. While Denmark leads in acceptance of cultivated protein sources, Spain ranks high, following Germany. Spaniards also have a notable preference for legumes, with 75% regularly consuming them, reflecting a cultural affinity. In terms of plant-based meats, Spain, the UK, and Denmark all show strong interest, with 35% of consumers in each country expressing a desire for more options. Health emerges as a key motivator in Spain, as it does in Italy, with 49% prioritising health benefits. Spain also stands out for consumer concern about the accuracy of labelling, with 71% agreeing on the importance of clear information.[48]

2.1.4. Eastern Europe

This section explores the current market status and consumer preferences for plant-based food products in Eastern Europe, with a specific focus on **Poland and Romania**, aiming to uncover the distinctive trends influencing regional preferences.

Poland

The Good Food Institute Europe reports that the Polish plant-based food market is valued at 729 million zloty and characterised as **one of the fastest-growing in Europe**, with a 109% increase in sales between 2020 and 2022. **Plant-based milk remains the most developed category**, with sales reaching 387.1 million zloty (€82.5 million) in 2022, continuing its steady growth. All plant-based categories experienced significant growth in 2022, with plant-based milk, cheese, yoghurt, and desserts showing the highest gains, all achieving double-digit sales growth. Notably, the expansion of plant-based options outpaced that of their animal-based counterparts in terms of unit sales growth, highlighting a **strong consumer shift towards plant-based alternatives** in Poland.[49]

In Poland, the market for plant-based milk has shown robust expansion, with a 62% increase in sales value (€43 million) and a 75% rise in sales volume (26 million Kg/L) over the last two periods. Plant-based plain milk, dominated by almond (€9.1 million), oat (€7.5 million), and soya (€6.9 million)

[46] Spain plant-based food retail market insights (2020-2022), Good Food Institute Europe, (2022). Report available here: https://gfieurope.org/wp-content/uploads/2023/04/2020-2022-Spain-retail-market-insights_updated.pdf
[47] Plant-based foods in Europe: How big is the market? Smart Protein Plant-based Food Sector Report by Smart Protein Project, European Union's Horizon 2020 research and innovation programme (No 862957) (2021). Report available here: https://smartproteinproject.eu/plant-based-food-sector-report.
[48] European Survey on readiness to adopt a plant-based lifestyle, Smart Protein Project, (2023). Report available here: https://smartproteinproject.eu/european-attitudes-towards-plant-based-eating/
[49] Poland plant-based food retail market insights (2020-2022), Good Food Institute Europe, (2022). Report available here: https://gfieurope.org/wp-content/uploads/2023/04/2020-2022-Poland-retail-market-insights_updated.pdf

variants, constitutes nearly 90% of total sales, experiencing a 76% growth in sales value and a remarkable 126% growth in discount stores. Similarly, **plant-based flavoured milk**, led by soya (€3.8 million), rice (€653k), and oat (€630k), has also seen triple-digit growth in discount stores, indicating a **growing preference among Polish consumers** for plant-based dairy alternatives.[50]

In Europe, Poland stands out with significant trends in consumer behaviour towards plant-based diets and protein sources. While Poland shows a lower percentage of consumers reducing their annual meat intake compared to other European countries, a substantial 47% of consumers are actively reducing meat consumption. Poland also exhibits a **lower proportion of flexitarians** compared to France and Italy, with 16%, indicating a slower adoption of semi-vegetarian diets. However, Poland **leads in the consumption of plant-based yoghurt**, with 40% of consumers favouring these products, alongside Italy at 39%. **Legume consumption remains comparatively low** in Poland, reflecting a potential area for growth in plant-based diets. Polish consumers also show **a higher preference for shopping at discounters**, with 58% choosing this retail option, aligning with a broader European trend towards affordability and accessibility in plant-based options. Moreover, Poland, along with the UK and Romania, leads in selecting plant-based alternatives when dining out, highlighting a growing **acceptance and availability of plant-based menu items in restaurants**.[51]

Romania

The Romanian plant-based food market has shown significant growth, reaching 163.5 million lei according to the country-level report by the Good Food Institute. Despite being one of the smallest in Europe, sales data indicates rapid consumer demand, with plant-based foods increasing by 67% from 2020 to 2022. **Plant-based milk emerges as the most established category**, achieving sales of 115.4 million lei (€23.6 million) in 2022, continuing its robust double-digit growth trend. **Plant-based meat also saw strong growth**, reaching sales of 48.1 million lei (€9.8 million) in 2022.[52]

The plant-based food market in this country has experienced substantial growth with a 56% increase in sales value (€21 million) and a 51% rise in sales volume (8.6 million Kg/L) in 2020 compared with 2022. Plant-based plain milk leads the sector with €14 million in sales, followed by plant-based meat at €5.0 million and plant-based flavoured milk at €2.7 million, all categories showing double-digit growth in sales value. **Plant-based meat is dominated by sausages** (€1.3 million), meat spreads (€1.2 million), and prepared meats (€1.2 million), with discounters demonstrating triple-digit growth in the 2020-2022 period (154%). Plant-based plain milk also exhibited strong growth, particularly in discount stores with triple-digit growth (316%) over the same period, while **plant-based flavoured milk grew** by 48% in sales value.[53]

In Romania, consumer trends reveal a growing interest in plant-based alternatives despite lower weekly consumption rates compared to other European countries. **Romanian consumers are particularly inclined to shop at discounters**, with 53% preferring these outlets. There is a **strong**

[50] Plant-based foods in Europe: How big is the market? Smart Protein Plant-based Food Sector Report by Smart Protein Project, European Union's Horizon 2020 research and innovation programme (No 862957) (2021). Report available here: https://smartproteinproject.eu/plant-based-food-sector-report.
[51] European Survey on readiness to adopt a plant-based lifestyle, Smart Protein Project, (2023). Report available here: https://smartproteinproject.eu/european-attitudes-towards-plant-based-eating/
[52] Romania plant-based food retail market insights (2020-2022), Good Food Institute Europe, (2022). Report available here: https://gfieurope.org/wp-content/uploads/2023/04/2020-2022-Romania-retail-market-insights_updated.pdf
[53] Plant-based foods in Europe: How big is the market? Smart Protein Plant-based Food Sector Report by Smart Protein Project, European Union's Horizon 2020 research and innovation programme (No 862957) (2021). Report available here: https://smartproteinproject.eu/plant-based-food-sector-report.

preference for plant-based options when dining out, with 27% opting for them in diverse restaurant settings. Romania also **leads in the demand for plant-based sweets and snacks**.[54]

2.2. Market Breakup by Application

In 2023, the food and beverages market segment is projected to hold the largest share of the European plant-based protein market. This market segmentation aligns with the VALPRO Path project, IPSs, and business cases prioritised for 2024. Specifically, IPS1.1 focuses on producing meat analogues, IPS4.1 is developing a plant-based beverage and a plant-based energy bar, and IPS5.1 is dedicated to producing value-added artisan legume-based pasta as an alternative to egg-based pasta. In addition to the food and beverage sector, the nutrition and health supplements segment is expected to experience the highest CAGR during the forecast period in Europe. This growth opens numerous possibilities for the use of protein flours, concentrates, and isolates addressed in the IPSs. Furthermore, business cases such as IPS2, which focuses on developing a varietal selection tool for protein crop cultivation, and IPS3.1, which relates to advisory services for agronomic practices like intercropping, are associated with the Farming-as-a-Service concept and are also analysed within this section.

2.2.1. Plant-based Meat Analogues

Meat analogues have become a significant trend, with recent product innovations closing the gap in taste, texture, and price compared to traditional meat. Europe leads as the largest market for meat substitutes, surpassing North America and Asia, with the European Union (EU-27) market alone valued at nearly 2 billion USD. By 2028, this amount is forecast to be over 3 billion USD. Since 2019, this market has doubled in value, driven by substantial investments in plant-based protein sources. All types of substitutes, including textured vegetable protein and traditional options like tofu and tempeh, are set to see significant growth, alongside increasing consumption rates. Currently, EU consumers consume about 122,000 metric tons of meat analogues, averaging 0.27 kilograms per capita annually. The consumption volume of meat analogues in the EU is forecast to rise in the coming years, reaching a total of 178,800 metric tons in 2028. The market is predominantly driven by younger consumers whose adoption of these products is likely to keep increasing.[55]

According to the *"Europe Meat Substitutes Market Size & Share Analysis - Growth Trends & Forecasts Up To 2029"*[56] the European meat substitute market is set to experience substantial growth from 2017 to 2029. By the end of 2024, the market size is projected to reach USD 3.24 billion, rising significantly to USD 5.42 billion by 2029, driven by a CAGR of 10.86% from 2024 to 2029. **Textured vegetable protein dominates as the largest segment by type**, accounting for a 56.50% value share in 2023, thanks to its meat-like flavour and texture, which resonate with Europe's growing flexitarian population. Tempeh is anticipated to be the fastest-growing segment, with an 11.60% CAGR from 2024 to 2029, particularly in Spain and France, where nearly 70% of production occurs. The United Kingdom is expected to be the fastest-growing country segment, with a projected 11.17% CAGR, driven by rising demand for protein-rich, high-fibre meals, with textured vegetable proteins contributing 57% of total sales.

The VALPRO plant-based burger is expected to enter the European market for textured vegetable meat substitutes which is expected to have a CAGR of 9.38% for the period 2022 to 2028. Annual

[54] European Survey on readiness to adopt a plant-based lifestyle, Smart Protein Project, (2023). Report available here: https://smartproteinproject.eu/european-attitudes-towards-plant-based-eating/
[55] https://www.statista.com/topics/11323/meat-substitutes-market-in-europe/#topicOverview
[56] Europe Meat Substitutes Market Size & Share Analysis - Growth Trends & Forecasts Up To 2029, Mordor Intelligence (2024). Report available here: https://www.mordorintelligence.com/industry-reports/europe-meat-substitute-market

growth rates for soy-based alternatives, such as tofu or tempeh, are forecasted to be even higher as presented in Figure 4.

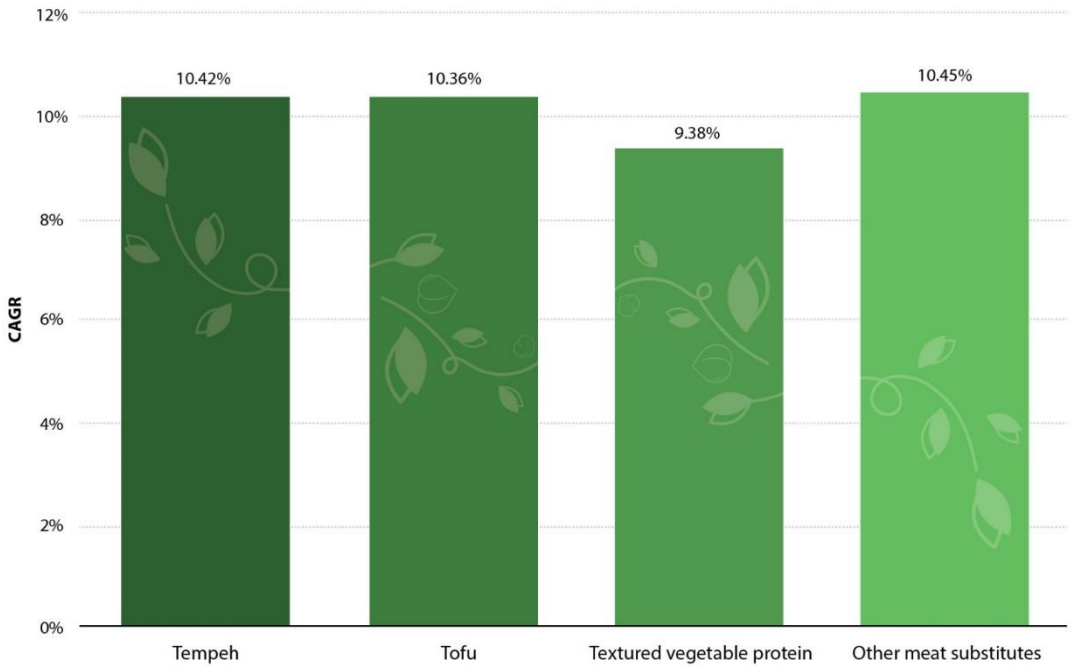


Figure 4: Growth (CAGR) of the European Market for Meat Substitutes from 2022 to 2028[57]

The Good Food Institute Europe[58] reports that between 2020 and 2022, the plant-based meat market experienced significant growth, with sales value increasing by 19% to over €2 billion, with accompanied growth in unit sales of 21% between 2020 and 2022. Unit sales of plant-based meat rose by 21%, while pre-packaged conventional meat saw an 8% decline. Despite inflation and price increases in 2022, plant-based meat prices rose by just 1%, compared to an 11% increase for conventional meat. Plant-based meat secured a 6% market share in 2022 within the total retail pre-packaged meat category. Germany was the country with the highest plant-based meat sales in 2022, worth over €640 million. In terms of sales per capita, The Netherlands led with an average spend of €12.60 per person.

Key drivers. As identified by Grand View Research in the *"Europe Plant-based Meat Market Size, Industry Report, 2030"*[59] the key drivers include a heightened awareness of health concerns related to animal product consumption, such as cardiovascular diseases, obesity, and other chronic conditions. This growing health consciousness is coupled with an increasing prevalence of animal-to-human transmitted diseases, which has prompted consumers to seek safer dietary alternatives. Additionally, there is a growing awareness of animal welfare, leading many consumers to consider the ethical implications of their food choices. The quality and sensory experience provided by plant-based meat substitutes, including taste, texture, and cooking versatility, have also contributed to their popularity. Furthermore, a significant number of consumers are transitioning to meat substitutes, often replacing their regular intake of animal products with these alternatives, driven by a desire for healthier, more

[57] Source: Statista 2024 - https://www.statista.com/statistics/1404599/growth-cagr-of-the-european-market-for-meat-substitutes-by-category/

[58] Europe: Plant-Based Foods Retail Market Insights (2020-2022), Good Food Institute Europe. Report available here: https://gfieurope.org/wp-content/uploads/2023/04/2020-2022-Europe-retail-market-insights_updated-1.pdf

[59] Europe Plant-based Meat Market Size, Industry Report, 2030, Grand View Research (2024). Report available here: https://www.grandviewresearch.com/industry-analysis/europe-plant-based-meat-market-report#:~:text=Europe%20Plant%2Dbased%20Meat%20Market%20Trends,20.4%25%20from%202024%20to%202030

sustainable diets. Collectively, these factors are reshaping consumer preferences and fuelling the expansion of the plant-based meat market across Europe.

Market challenges. A significant challenge in the plant-based products market is the higher price point, which has become a major barrier to consumer adoption. The cost of tempeh, a key plant-based protein, has steadily risen, increasing by 2.61% from 2017 to 2022 in Europe[60]. While stable soybean prices, driven by increased regional production, have helped maintain tempeh prices, the cost of other raw materials, such as chickpeas, remains high, particularly since countries like Germany depend entirely on imports. Many consumers, including those already leaning towards plant-based diets, express dissatisfaction with these high prices, viewing them as a deterrent to broader adoption. Additionally, concerns about the nutritional value of plant-based alternatives have intensified pressure on the industry, which initially thrived on the support of environmentally conscious and health-focused consumers. The sector faced criticism last year for high sodium content in plant-based meats, and a report from the EIT Food Consumer Observatory revealed that two-thirds of nearly 10,000 surveyed individuals believe that ultra-processed foods, including many plant-based alternatives, contribute to obesity, diabetes, and other lifestyle-related health issues. As consumer education continues to evolve, many individuals are becoming increasingly aware of food processing and are shifting their preferences towards natural protein sources like chickpeas and lentils.[61] In addition, the slow adoption of advanced technologies is hindering the capacity of companies in the European plant-based meat market to improve taste profiles. A lack of sufficient technological integration is stifling innovation in plant-based meat production, restricting the industry's ability to enhance textures and flavours. As consumer expectations increase, it is vital for European plant-based meat manufacturers to bridge this technology gap to meet taste standards and remain competitive in the changing market. There is an urgent need for investments and strategic partnerships to drive technological advancements, ensuring the availability of flavourful plant-based meat products in Europe.[62]

Market share. In 2023, Germany accounted for 32.62% of the total revenue in the European plant-based meat market, with projections indicating a robust growth rate of 21.3% CAGR.[63] The Netherlands has the highest average spending on plant-based meat per capita. Italy ranks well with a plant-based meat sales value of €168 million and an average spend of €2.9 per capita. The consumption of meat alternatives is notably high in the Netherlands, Denmark, Belgium, and the UK.[64]

Market segmentation. The European plant-based meat market is segmented into several categories that collectively drive its growth. Protein source segmentation includes soy, pea, wheat, and other protein sources, highlighting the diverse ingredients used in production. Product offerings encompass a variety of items, such as burgers, sausages, patties, nuggets, tenders, cutlets, grounds, and more, catering to the rising demand for meat alternatives. Type segmentation includes chicken, pork, beef, fish, and other plant-based meats, reflecting the broad range of options available to consumers. End-user segmentation differentiates between retail and HORECA (Hotel/Restaurant/Café) channels, emphasising the diverse distribution pathways. Finally, the market is divided by storage options into

[60] Europe Meat Substitutes Market Size & Share Analysis - Growth Trends & Forecasts Up To 2029, Mordor Intelligence (2024). Report available here: https://www.mordorintelligence.com/industry-reports/europe-meat-substitute-market
[61] https://www.kroll.com/en/insights/publications/restructuring-advisory/challenges-for-plant-based-meat-alternatives
[62] Europe Plant-based Meat Market (2019-2029), Blue Weave Consulting (2023). Report available here: https://www.blueweaveconsulting.com/report/europe-plant-based-meat-market
[63] Europe Plant-based Meat Market Size, Industry Report, 2030, Grand View Research (2024). Report available here: https://www.grandviewresearch.com/industry-analysis/europe-plant-based-meat-market-report#:~:text=Europe%20Plant%2Dbased%20Meat%20Market%20Trends,20.4%25%20from%202024%20to%202030
[64] Report available here: https://corporate.proveg.com/wp-content/uploads/2022/02/PV_Consumer_Survey_Report_2020_030620-1.pdf

refrigerated, frozen, and shelf-stable plant-based meats, showcasing the various preservation methods that extend shelf life and maintain product quality from production to consumption.

Key takeaways. In Europe, increasing concerns about environmental sustainability and animal welfare have driven a significant shift in consumer preferences toward plant-based meat alternatives. This trend is supported by favourable EU regulations promoting eco-friendly practices and encouraging reduced meat consumption for health reasons. The rise of vegetarian, vegan, and flexitarian lifestyles has broadened the consumer base, while growing awareness of the health benefits of reducing meat intake fuels demand for plant-based options. The widespread availability of these products in supermarkets, specialty stores, and restaurants enhances accessibility, while strategic collaborations between food tech companies and traditional meat producers create more authentic and diverse offerings. Ongoing R&D focused on optimising texture, flavour, and nutrition aims to bridge the gap between plant-based and animal-based meats. Additionally, the emergence of cultured or lab-grown meat presents new opportunities in the sector. Substantial investments in advertising aim to position plant-based meat as a mainstream choice, further accelerating adoption. Other factors, such as the rise of ethical consumption and continuous product innovations, also support the growth of the plant-based meat market in Europe.[65]

2.2.2. Farming-as-a-Service (FaaS) Market

FaaS embodies a model where technology-driven solutions deliver farming service, ranging from crop management to equipment leasing. This approach blends the familiarity of traditional agriculture with the advantages of modern technology presenting a balanced and practical vision for the future of farming. FaaS integrates advanced technologies with traditional farming methods, offering services aimed at boosting efficiency, sustainability, and profitability in agriculture. As such, FaaS utilises data analytics, IoT devices, and AI to streamline and enhance various farming operations.[66] Based on service type, this market is categorised into: 1) farm management solution, 2) production assistance, and 3) access to markets.

- **Farm management solution**. This segment held the largest market share of about 76.83% in 2023. Farm management solutions include solutions such as providing insights to government, farmers, corporates, and other final advisory firms.[67] Farm management services encompass precision farming, which has experienced significant growth recently due to the increasing adoption of precision techniques to address the global demand for high-quality food products. This includes tools like hyperspectral imaging technology, sensors for monitoring, auto-guidance equipment, and precision irrigation systems to enhance agriculture outcomes. [68]

- **Production assistance**[69]. This segment includes services such as equipment rentals, labour, utility services, and agricultural marketing. Equipment rental services, for instance, are utilised by small and medium-scale farmers, while labour services focus on outsourcing workforce requirements for a field.

- **Access to markets.** This segment aims at addressing the limitations farmers face in accessing profitable, value-added markets. Farmers struggle to rotate/switch between crops without

[65] Europe Plant-Based Meat Market (2024-2032), Imarc Impactful Insights (2024). Report available here: https://www.imarcgroup.com/europe-plant-based-meat-market
[66] https://agtecher.com/faas-farming-as-a-service/
[67] Farming As A Service Market Size And Share Report (2024-2030), Grand View Research (2023). Report available here: https://www.grandviewresearch.com/industry-analysis/farming-as-a-service-market-report
[68] Farming As A Service Market Size And Share Report (2024-2030), Grand View Research (2023). Report available here: https://www.grandviewresearch.com/industry-analysis/farming-as-a-service-market-report
[69] https://agtecher.com/faas-farming-as-a-service/

necessary support service like infrastructure and service provision, relying instead on barter and subsistence trade. The access to markets segment of FaaS directly addresses this issue by linking farmers with suppliers and, subsequently, with end consumers through digital platforms and tools. The access to market segment of FaaS is projected to grow at the fastest CAGR of 15.6% during the forecast period[70].

Key drivers. The adoption of FaaS is experiencing significant growth that is driven by the urgent need for sustainable farming practices and the rising global demand for food. By leveraging advanced technologies, FaaS is set to transform the agricultural landscape, enhancing resilience against challenges like climate change, labour shortages, and rising farming costs.[71] Furthermore, to satisfy the growing demand for high-quality, sustainable products, farmers are increasingly adopting sustainable agriculture practices that enhance soil health, boost biodiversity, and reduce the reliance on harmful chemicals. Methods such as organic farming, agroforestry, precision farming, integrated farming systems, vermicomposting, crop rotation, and intercropping not only foster sustainability, but also offer advantages like improved crop yields and greater profitability for farmers.[72]

Therefore, technological advancements are driving the growth of the Farming-as-a-Service (FaaS) market. An increasing number of companies in the FaaS market are introducing advanced products in response to the rising demand for sustainable agriculture practices. One of the primary drivers of this market is the use of digital platforms that allow farmers to collect and analyse data on soil health, crop yields, and weather conditions, among other factors.[73] Being characterised by a high degree of innovative offerings, FaaS services facilitate addressing the gap in technical expertise and shortage of skilled workers, while enhancing information sharing to enhance technical knowledge[74].

The global farming-as-a-service market size reached USD 4.12 billion in 2023 and is estimated to hit USD 16.75 billion by 2033 with a notable CAGR of 15.06% from 2024 to 2033[75]. This robust growth trajectory highlights the increasing global adoption of technology-driven agricultural solutions. A key driver of this growth is the rising popularity of the Internet of Things (IoT) in agriculture, which provides real-time assistance to farmers, enabling effective responses to environmental changes and optimization of farming processes.[76]

Market Challenges. Traditional farmers often hesitate to adopt new technologies due to a lack of awareness, fear of high costs, and concern about the complexity of the FaaS systems, as well their reliance on strong digital infrastructure. This can be problematic in rural areas where internet connectivity and power reliability may be issues. Furthermore, managing and securing large amounts of data can be challenging due to concerns about privacy, potential misuse, and the need for effective data analysis tools. Market accessibility also remains a challenge, particularly for those in remote or underserved regions. Overcoming these challenges is essential for the successful implementation and growth of FaaS, potentially through educational programs, financial support, the development of user-friendly technology, and ensuring robust infrastructure in rural areas.[77]

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[70] Farming As A Service Market Size And Share Report (2024-2030), Grand View Research (2023). Report available here: https://www.grandviewresearch.com/industry-analysis/farming-as-a-service-market-report
[71] https://agtecher.com/faas-farming-as-a-service/
[72] Farming As A Service Market Size And Share Report (2024-2030), Grand View Research (2023). Report available here: https://www.grandviewresearch.com/industry-analysis/farming-as-a-service-market-report
[73] Farming As a Service Market Size, Share, and Trends 2024 to 2033, Precedence Research (2024). Report available here: https://www.precedenceresearch.com/farming-as-a-service-market
[74] Farming As A Service Market Size And Share Report (2024-2030), Grand View Research (2023). Report available here: https://www.grandviewresearch.com/industry-analysis/farming-as-a-service-market-report
[75] Farming As a Service Market Size, Share, and Trends 2024 to 2033, Precedence Research (2024). Report available here: https://www.precedenceresearch.com/farming-as-a-service-market
[76] Source: Agtecher
[77] https://agtecher.com/faas-farming-as-a-service

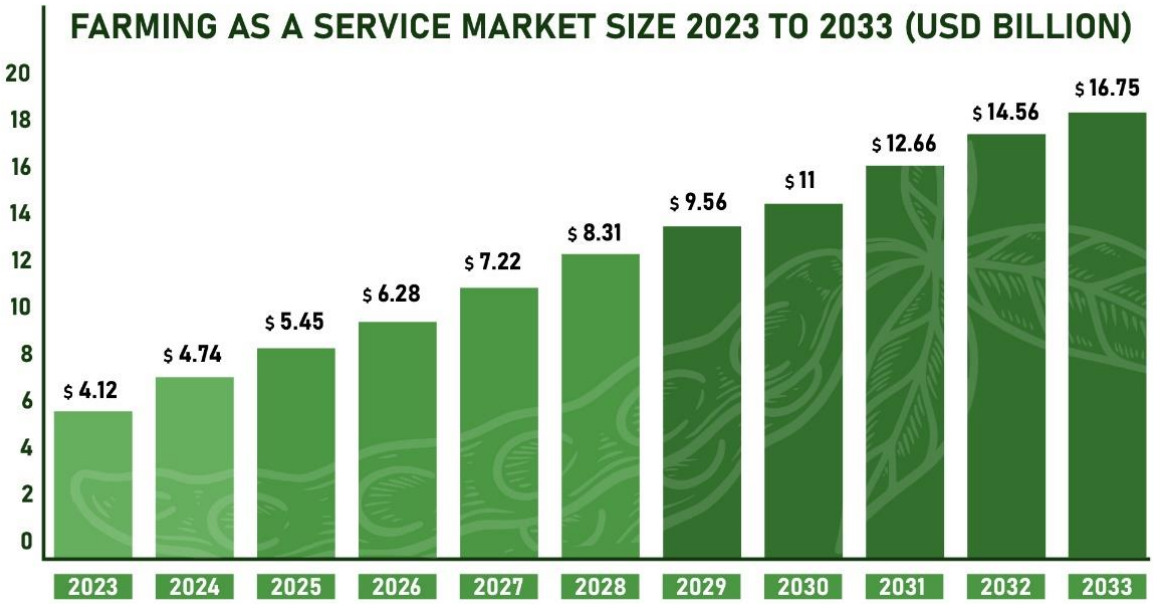


Figure 5: FaaS Market Size 2023-2033[78]

However, the market faces heightened regulatory scrutiny, primarily focused on data privacy and transparency in business agreements. Given the extensive data collection and analysis involved in FaaS, including information on crop yields, weather conditions, and soil health, compliance with strict data privacy and security regulations is crucial. Ensuring the protection of farmers' and stakeholders' information is essential for maintaining trust and adhering to legal requirements. Additionally, transparency in subscription terms, service-level agreements, and legal considerations is critical for sustainable growth and meeting evolving agricultural technology standards.[79]

Market share. Technology has been integrated into agriculture globally, with each region adapting it according to their specific agricultural landscapes and requirements.

Asia Pacific[80], especially in China, India, and Japan, is poised for substantial growth in the FaaS market. The adoption of agricultural technology is swiftly progressing in these countries, facilitated by widespread use of smartphones, IoT devices, and internet-connected tools, which enhance farming techniques. Regional governments are actively promoting agricultural technology to tackle issues like food security, climate change, and rural development, thereby fostering the expansion of FaaS services. Farmers in these nations are increasingly utilising FaaS for sustainable practices such as precision irrigation and soil health monitoring, contributing to efforts in environmental conservation and climate resilience. For example, in India, the growth of Farming as a Service (FaaS) is closely tied to the expanding startup presence in the AgriTech industry. These startups are innovating to address challenges encountered by numerous small-scale farmers. Their offerings include precision farming tools, analytics, and equipment rental platforms, which enhance farming efficiency and improve market access for farmers.

[78] Farming As a Service Market Size, Share, and Trends 2024 to 2033, Precedence Research (2024). Report available here: https://www.precedenceresearch.com/farming-as-a-service-market
[79] Farming As A Service Market Size And Share Report (2024-2030), Grand View Research (2023). Report available here: https://www.grandviewresearch.com/industry-analysis/farming-as-a-service-market-report
[80] Farming As a Service Market Size, Share, and Trends 2024 to 2033, Precedence Research (2024). Report available here: https://www.precedenceresearch.com/farming-as-a-service-market

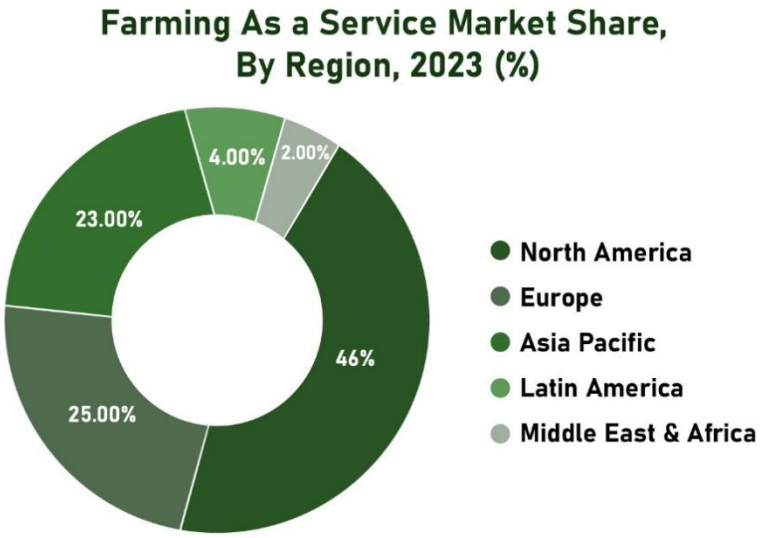


Figure 6: FaaS Market Share by Region[81]

North America dominated with a 46% market share in 2023[82]. Farmers in this region were early adopters of agricultural technology, recognizing its potential to enhance productivity, sustainability, and efficiency. The rise of precision agriculture, supported by technologies such as GPS, drones, sensors and data analytics, has enabled service providers to offer tailored services like yield monitoring, variable rate input application, and precision planting. Due to a shortage of agricultural workers in North America, automation and mechanisation become crucial. Farming-as-a-Service (FaaS) providers can address these challenges by offering robotic harvesting and autonomous machinery operations. Access to real-time data and analytics empowers farmers to better manage crops, allocate resources efficiently, and mitigate risks. Furthermore, in the U.S., there is notable adoption of Farming-as-a-Service (FaaS) fuelled by robust technological infrastructure and a commitment to sustainable agriculture. American farmers are increasingly using IoT, AI, and robotics to streamline farm activities, enhance resource management, and increase crop productivity.

In Europe, there is a strong adoption of Farming-as-a-Service (FaaS), particularly emphasising precision agriculture and sustainable farming practices. The integration of technology in European farming not only enhances productivity, but also plays a crucial role in addressing environmental sustainability and ensuring food security. France, as the largest agricultural economy in Europe, leads the production with approximately 23% of the region's agricultural output, followed by Germany and Italy. Key agricultural products in Europe include cotton, off-season fruits and vegetables, cocoa, tea, spices, soybean products, and coffee, with FaaS technologies widely employed to monitor and optimise the quantity and quality of these products.[83]

Market segmentation. Besides being categorised per service type – farm management solutions, production assistance, and access to markets, delivery model – subscription, pay-per-use, the market of FaaS is also segmented by end-users[84] - farmers, government entities, corporations, financial institutions, and advisory bodies. Farmers constitute the largest segment, accounting for over 30.41% of revenue in 2023, and are projected to experience the fastest growth with a CAGR of 15.4% through

[81] Farming As a Service Market Size, Share, and Trends 2024 to 2033, Precedence Research (2024). Report available here: https://www.precedenceresearch.com/farming-as-a-service-market
[82] Farming As a Service Market Size, Share, and Trends 2024 to 2033, Precedence Research (2024). Report available here: https://www.precedenceresearch.com/farming-as-a-service-market
[83] Farming As A Service Market Size And Share Report (2024-2030), Grand View Research (2023). Report available here: https://www.grandviewresearch.com/industry-analysis/farming-as-a-service-market-report
[84] Farming As A Service Market Size And Share Report (2024-2030), Grand View Research (2023). Report available here: https://www.grandviewresearch.com/industry-analysis/farming-as-a-service-market-report

the forecast period[85]. They utilise a range of services such as farm management solutions for data-driven decision-making, production assistance including equipment rentals and labour services, and access to markets to bypass middlemen, thereby benefiting long-term farmer profitability.

Key takeaways. The potential advantages of FaaS are substantial. By enhancing farming efficiency, sustainability, and reliance on data, FaaS aims to increase crop yields, minimise environmental impacts, and improve economic viability in agriculture. The projected growth of the FaaS market, expected to reach $12.8 billion by 2031, underscores the increasing recognition of these benefits. However, challenges lie ahead. Overcoming resistance from traditional farming communities, addressing infrastructure limitations, effectively managing data, and ensuring technology accessibility and affordability are crucial steps toward fully realising FaaS's potential. Looking ahead, the future of agriculture seems poised for a convergence of technology and tradition, promising a more productive and sustainable sector.[86]

FaaS providers often offer solutions that promote sustainable farming practices, addressing growing concerns about environmental impact in agriculture. FaaS is also attractive across a wide range of farmers, from small family farms to large agribusinesses, due to its scalability. The reason behind this is that these models are flexible, allowing farmers to adjust the level of services based on factors like farm size, seasonal demand patterns, and specific agricultural needs. Finally, government initiatives aimed at rural development, increased farm productivity, and sustainable agriculture are expected to drive expansion in the farming as a service market.[87]

2.2.3. Plant-based Beverages

Plant-based beverages, commonly known as non-dairy or alternative milk, are drinks made from various plant sources that act as substitutes for dairy products. Their popularity has surged in recent years, fuelled by the growing interest in plant-based diets and increasing concerns about lactose intolerance. Popular varieties include rice milk, almond milk, soy milk, oat milk, and coconut milk, among others. These alternatives are praised for their health benefits, as they are typically low in cholesterol and fat and contain no lactose, making them ideal for individuals with lactose sensitivities or those seeking healthier dietary options. Rich in essential vitamins and minerals, plant-based beverages contribute to a balanced diet. They are often fortified with nutrients such as calcium and vitamin D to closely resemble the nutritional profile of traditional cow's milk. Additionally, these beverages are versatile, appealing to a broad range of dietary preferences, including vegans and those aiming to minimise their consumption of animal products. With their wealth of essential nutrients and health-promoting attributes, plant-based beverages provide a nutritious and flavourful alternative to dairy, attracting a growing number of consumers looking for healthier lifestyle choices. As evidence of this, the European plant-based beverages market is expected to witness market growth at a rate of 8.81% in the period between 2021 to 2028.[88]

Key drivers. The growing health consciousness in Europe is a major factor driving the plant-based beverages market. Consumer trends toward replacing dairy milk with plant-based alternatives, along with rising cases of lactose intolerance and milk allergies, accelerate market growth. The nutritional benefits of plant-based beverages and numerous product launches and investments by manufacturers also boost the market. Additionally, rapid urbanisation, lifestyle changes, increased awareness of

[85] Farming As A Service Market Size And Share Report (2024-2030), Grand View Research (2023). Report available here: https://www.grandviewresearch.com/industry-analysis/farming-as-a-service-market-report
[86] https://agtecher.com/faas-farming-as-a-service/
[87] Farming As a Service Market Size, Share, and Trends 2024 to 2033, Precedence Research (2024). Report available here: https://www.precedenceresearch.com/farming-as-a-service-market
[88] Europe Plant-Based Beverages Market – Industry Trends and Forecast to 2028, Data Bridge Market Research (2021). Report available here: https://www.databridgemarketresearch.com/reports/europe-plant-based-beverages-market

product benefits, higher food and beverage spending, and a shift towards veganism positively impact the market. Innovations in flavour and value-added ingredients, along with high demand for plant-based milk in coffee and tea, offer profitable opportunities for market players in the upcoming period. According to the "*Plant-Based Beverages Market Report"* by Imarc Impactful Insights, some of the main market drivers in the market are the following:[89]

- **Growing health and wellness trends:** Consumers are increasingly concerned about their diets' impact on well-being, viewing plant-based beverages as healthier alternatives to dairy milk. Concerns about lactose intolerance and hormones in cow's milk drive the demand for non-dairy options. This aligns with the global trend of prioritising personal health and well-being.

- **Rise in vegan and vegetarian diets:** Ethical concerns about animal welfare, environmental sustainability, and personal health are driving more people to adopt plant-based diets. Veganism, which avoids all animal-derived products, has particularly surged, increasing demand for non-dairy milk alternatives. These beverages also provide plant protein, appealing to those seeking protein-rich options.

- **Increasing cases of lactose intolerance and dairy allergies:** Lactose intolerance and dairy allergies cause digestive discomfort and allergic symptoms. Plant-based beverages, free of lactose and common dairy allergens, offer a safe alternative for those with these conditions. This accessibility has expanded the plant-based beverage market, making them a staple in many households and foodservice establishments.

According to Innova Market Insights[90], plant-based consumer trends in Europe show that non-dairy milk is the most popular among 25 to 34-year-olds. Most consumers report purchasing dairy alternatives primarily at regular supermarkets, making them the largest outlet for these products.

Market challenges. The higher costs of plant-based beverages compared to dairy milk are expected to hinder market growth. Future Market Insights Inc. has identified several threats[91], including strong competition from dairy farmers who are actively marketing their products. Conflicting information about the nutritional benefits of vegan beverages may also lead to consumer confusion and scepticism. Moreover, concerns about potential allergens and cross-contamination during production may deter customers with food sensitivities, limiting market growth. Misleading information or deceptive marketing claims could further erode consumer trust, negatively affecting demand and growth in the plant-based beverage industry.

Market share. North America accounts for 47.80% of the global plant-based protein beverages market, with the United States holding the largest share. Europe represents 14.50% of the market, where the soy protein-based beverage segment is seeing strong demand due to its availability, cost-effectiveness, superior quality, and growing consumer acceptance. Germany leads the European plant-based beverages market, driven by increasing awareness of these products in the region. [92]

Market segmentation. The plant-based beverages market is segmented to capture diverse consumer preferences and product offerings. It is categorised by type into two main groups: milk and other beverages. By source, the market includes almond, soy, coconut, rice, and a broader "others" category

[89] Plant-Based Beverages Market Report, Imarc Impactful Insights (2023). Report available here: https://www.imarcgroup.com/plant-based-beverages-market
[90] https://www.innovamarketinsights.com/trends/plant-based-consumer-trends-in-europe/
[91] Plant Based Beverage Market Outlook (2024-2034), Future Market Insights Inc. (2022). Report available here: https://www.futuremarketinsights.com/reports/plant-based-beverages-market
[92] Plant Based Protein Beverages Market Outlook (2022 to 2032), Future Market Insights Inc. (2022). Report available here: https://www.futuremarketinsights.com/reports/plant-based-protein-beverages-market

encompassing cashew, oats, pea, hemp, and hazelnut. Functionally, it is divided based on health benefits, such as cardiovascular health, cancer prevention, bone health, and lactose-free alternatives. Product offerings include both plain and flavoured varieties. Additionally, distribution channels are segmented into supermarkets and hypermarkets, convenience stores, specialty stores, and online platforms.

Key takeaways. Plant-based beverages are quickly becoming popular as healthier alternatives to dairy milk, fuelled by greater availability and increased consumer interest in nutrition. This trend has attracted significant investment from both venture capital firms and traditional food and beverage companies, resulting in heightened demand for these products. Additionally, consumer education and advocacy efforts have emphasised the ethical, environmental, and health benefits of plant-based diets. Consequently, the market for plant-based beverages is expanding, reflecting a shift towards more sustainable and health-conscious choices. On the production side, major players are exploring innovative plant-based sources for sugar substitutes in protein beverages[93]. As a result, the demand for plant-based nutritive sweeteners in vegan protein drinks is expected to rise significantly.

2.2.4. Plant-based Protein Bars

Plant-based protein bars are nutritious snacks made primarily from plant-derived ingredients that provide a rich source of protein. They typically include nuts, seeds, legumes, whole grains, and plant-based protein sources like pea, brown rice, or hemp protein. Designed for convenience, these bars cater to various dietary preferences, including vegan, vegetarian, gluten-free, and dairy-free diets. They can serve as a quick energy boost, a post-workout snack, or a meal replacement, offering a blend of protein, healthy fats, and carbohydrates. Many also contain added flavours, sweeteners, and nutrients to enhance taste and nutritional value.

The market for protein bars has grown tremendously over the years. While they were once primarily consumed by athletes, the ongoing health and wellness trends have expanded their appeal, leading to increased sales and a surge in production. Changing lifestyles and preferences have also contributed to their popularity among a broader audience. Looking ahead, the market is poised for further growth, driven by a growing focus on sustainable practices and technological advancements, which are expected to generate even more revenue. The European protein bar market was valued at USD 1.12 billion in 2023 and is projected to reach a market size of USD 1.58 billion by the end of 2030 with a projected growth at a CAGR of 5.01%.[94]

Key drivers. As food allergies rise, consumers are increasingly turning to plant-based alternatives for dairy and animal products, leading to a projected increase in demand for vegan protein bars as health and wellness take centre stage. These bars are often free of common allergens such as dairy, eggs, and gluten, making them appealing to individuals with dietary restrictions and expanding the customer base for businesses. Their popularity extends beyond the vegan community to include fitness enthusiasts and active individuals who seek convenient snacks that meet protein needs, support muscle recovery, and promote overall fitness. Consequently, the market for vegan protein bars is experiencing significant growth. According to the *"Europe Protein Bar Market Research Report"* by Virtue Market Research, some of the main market drivers identified are the following:[95]

[93] Plant Based Protein Beverages Market Outlook (2022-2032), Future Market Insights Inc. (2022). Report available here: https://www.futuremarketinsights.com/reports/plant-based-protein-beverages-market

[94] Europe Protein Bar Market Research Report (2023-2030), Virtue Market Research (2023). Report available here: https://virtuemarketresearch.com/report/europe-protein-bar-market

[95] Europe Protein Bar Market Research Report (2023-2030), Virtue Market Research (2023). Report available here: https://virtuemarketresearch.com/report/europe-protein-bar-market

- **The nutritional benefits of protein bars:** Protein bars can provide essential amino acids and support muscle growth. They also help regulate blood sugar levels when paired with carbohydrate-rich meals and snacks. Compared to candy bars or processed snacks, protein bars are often much healthier, typically containing more nutrients, fewer calories, and less sugar. They serve as an excellent alternative to high-calorie, nutrient-poor processed snacks or sweets. Many protein bars are fortified with vitamins and minerals, contributing to overall well-being. Additionally, they are beneficial for weight loss, as protein positively influences metabolism, aids in calorie burning, and helps curb hunger. Consuming protein can naturally lead to reduced food intake by lowering levels of the hunger hormone.

- **Innovation and product diversity:** The food sector is exploring new product types with significant advancements in taste, texture, quality, and formulation. The food and beverage industry supports various fitness goals by developing healthier alternatives, including sugar-free options, plant-based products, and low-calorie bars. Additionally, many snacks are being customised to cater to specific consumer needs, leading to an expanded customer base.

- **A changing lifestyle:** Alongside the importance of physical fitness, the rising prevalence of chronic illnesses such as diabetes, hypertension, and heart disease has further highlighted the need for a healthy lifestyle. As a result, gym attendance has become a priority for many, with trainers often creating customised meal plans that include protein bars as a popular pre- or post-workout option.

Market challenges. The plant-based protein bars market faces several significant challenges affecting its growth and consumer perception, underscoring the need for innovation, transparency, and responsibility. Competition is strong, with established brands dominating the sector, making it difficult for emerging companies to gain market share and stifling innovation. Environmental concerns are also prevalent, as many manufacturers use plastic and non-recyclable packaging, raising sustainability issues among eco-conscious consumers. Additionally, regulatory compliance and transparency remain challenges, particularly regarding clean labelling; unclear ingredient lists can pose allergy risks and lead to negative perceptions. Finally, manufacturers struggle to maintain the sensory attributes of texture and flavour in plant-centric products, prompting leading companies to seek solutions that neutralise undesirable flavours and enhance consumer appeal.

Market share. The global plant-based bars market was valued at USD 7.55 billion in 2022 and is expected to expand from USD 8.05 billion in 2023 to USD 14.31 billion by 2030, reflecting a CAGR of 8.57% in the respective period. In 2022, North America led the market, holding a 48.74% share[96] while Europe accounted for over 35% of the global market, reflecting a growing trend among consumers in the region to reduce animal product consumption in favour of plant-based alternatives.[97] The availability of these bars has significantly increased across Europe, with many supermarkets and health food stores now offering a wide variety. This increased availability has driven greater consumer awareness and interest in plant-based bars. In Europe, the UK leads the market with approximately a 33% share, driven by factors such as population size, large-scale production, strong demand, innovation, and flavour advancements, while Germany, the fastest-growing market with a 25% share, is fuelled by the rise of fast-food franchises, population growth, new businesses, international operations, increasing veganism, investments, and culinary innovations.[98]

[96] Plant-based Bars Market (2023-2030), Fortune Business Insights (2024). Report available here: https://www.fortunebusinessinsights.com/plant-based-bars-market-104369
[97] Plant-based Bars Market Size, Share & Growth Report (2023-2030), Grand View Research (2023). Report available here: https://www.grandviewresearch.com/industry-analysis/plant-based-bars-market-report
[98] Europe Protein Bar Market Research Report (2023-2030), Virtue Market Research (2023). Report available here: https://virtuemarketresearch.com/report/europe-protein-bar-market

Market segmentation. The market for various types of bars, including protein bars, granola/cereal bars, energy bars, and fruit and nut bars, is segmented by both product type and distribution channel, with further differentiation by the nature of the products. The product categories range from high-protein bars favoured by athletes to granola and cereal bars popular for breakfast, energy bars designed for quick energy boosts, and fruit and nut bars that offer natural sources of nutrients. These products are available in both organic and conventional forms, catering to consumers with different priorities, such as a preference for natural, environmentally friendly ingredients versus more widely available and often lower-cost options. Distribution channels for these bars include hypermarkets and supermarkets, which serve as primary retail points due to their convenience and accessibility, as well as convenience stores for quick, on-the-go purchases, specialty stores that cater to niche markets with specific dietary needs, and online platforms that offer a wide selection and convenience of purchase. Additional channels like vending machines, gyms, and direct sales also play a role in the market.
Key takeaways. Barry Callebaut, a leading Swiss manufacturer of high-quality chocolate and cocoa products, has outlined three key strategies for nutritional bar producers to meet the growing demand for plant-based products[99]:

- **Plant-Based proteins:** To address consumer preferences for plant-based over animal-based proteins, especially due to ethical and environmental concerns, protein bars should focus on using plant-based proteins such as soy and pea. These options are favoured for their neutral flavour and appealing texture.

- **Clean label:** Consumers increasingly demand nutrition bars with a "clean label," which involves using fewer, recognizable ingredients with positive connotations and avoiding those that do not align with a health-conscious lifestyle.

- **Adding greens:** In addition to highlighting dairy-free and vegan claims, producers are enhancing their product lines by incorporating green or earthy flavours like beetroot, hemp, or matcha to appeal to health-focused consumers.

The growth of the plant-based bars market is significantly boosted by the increasing use of emerging e-commerce platforms, which provide manufacturers with opportunities to sell directly to consumers through channels like Amazon and specialised platforms. Prominent market players are actively working to neutralise the inherent flavours of plant proteins and enhance the textural characteristics of their products by combining various plant proteins and binding syrups. Additionally, manufacturers are focusing on expanding their customer base through collaborations and joint ventures, while also prioritising the introduction of innovative, sustainable products rich in vital nutrients, which collectively contribute to the market's progress.

Legume Pasta

Plant-based pasta is an emerging food trend that is transforming the traditional pasta scene with its innovative ingredients. Unlike the typical white pasta made from durum flour and eggs, plant-based pasta incorporates a variety of ingredients such as lentils, chickpeas, whole wheat, brown rice, black beans, and more. This diversity offers numerous health benefits, making it a popular choice among health-conscious individuals. According to Introspective Market Research, the plant-based pasta market size is expected to grow from USD 182.17 million in 2022 to USD 310.67 million by 2030, at a CAGR of 6.9% between 2022 and 2030.[100] The VALPRO Path business case explored in IPS5 focuses on a sub-category of plant-based pasta made from legumes. Consequently, the market research in this

[99] https://www.barry-callebaut.com/en/manufacturers/trends-insights/protein-bars-plant-based-growth-trajectory
[100] Global Plant-Based Pasta Market and Region Global Market Analysis and Forecast (2022-2030), Introspective Market Research (2024). Report available here: https://introspectivemarketresearch.com/press-release/plant-based-pasta-market/

section examines the legume pasta market, with a particular focus on Europe as the key market segment for analysis.

Legume pasta, made from ingredients like lentils, chickpeas, and various beans, resembles traditional pasta in form but offers more protein and fibre compared to grain-based pasta, such as those made from semolina or whole wheat flour. Its health benefits and gluten-free nature make it appealing to health-conscious consumers and those with gluten intolerance. As a result, legume pasta is expected to dominate the plant-based pasta market. The increasing demand for healthier food options is driving significant growth in the consumption of legume pasta, which is rich in protein, fibre, calcium, iron, and vitamin B6. The global legume pasta market is poised to register a CAGR of 11.33% between 2024 and 2032.[101]

Key drivers. The legume pasta market is experiencing significant growth driven by several key factors according to Market Research Intellect.[102] Technological advancements in materials, manufacturing processes, and digital technologies are enhancing the efficiency and effectiveness of legume pasta products and services. Increasing demand, fuelled by population growth, urbanisation, and changing consumer preferences, is further propelling market expansion. Favourable government policies, regulations, and incentives are supporting this growth, while rising environmental awareness and the need to reduce carbon emissions are encouraging the adoption of eco-friendly and renewable legume pasta solutions. Additionally, decreasing production costs, driven by economies of scale, technological innovations, and heightened competition, are making legume pasta more affordable and accessible.

Trends in the food and beverage sector are also reshaping the legume pasta market. The rapid adoption of online platforms for legume pasta purchases is transforming distribution channels and customer engagement. Additionally, sustainable packaging solutions are becoming increasingly important as the industry addresses environmental concerns. This shift includes a focus on both the size of packaging (small and bulk packs) and the use of environmentally friendly materials. Companies are implementing blockchain and IoT technologies to manage the procurement, processing, and distribution of legume pasta products effectively. Mergers and acquisitions are key for acquiring new technologies, strengthening portfolios, and leveraging capabilities in the legume pasta industry.

Market challenges. The legume pasta market faces several challenges that may impact the revenue mix of companies in the coming years. Competition from traditional pasta manufacturers remains a constant challenge, as they have established brand loyalty and market presence. MarketReseacrh.com[103] has identified supply chain disruptions, along with the need to comply with stringent regulations on food safety and labelling, as significant risks. Growing competition and the challenge of sustaining inflation in key markets further strain companies. Additionally, fluctuating raw material prices lead to surging input costs, impacting profit margins. These factors collectively act as market restraints, requiring strategic management to maintain market position and drive growth in the legume pasta sector.

Market share. North America is the largest market accounting for over 35% of the global market share in 2023[104]. Europe is the second largest market followed by Asia-Pacific, South America and Middle

[101] Legume Pasta Market Size Outlook (2024-2032), Market Research (2024). Report available here: https://www.marketresearch.com/VPA-Research-v4245/Legume-Pasta-Size-Outlook-Type-37034137/
[102] Global Legume Pastas Market Size, Scope And Forecast Report (2021-2031), Market Research Intellect (2024). Report available here: https://www.marketresearchintellect.com/product/global-legume-pastas-market?utm_source=PulseW&utm_medium=041/
[103] Legume Pasta Market Size Outlook (2024-2032), Market Research (2024). Report available here: https://www.marketresearch.com/VPA-Research-v4245/Legume-Pasta-Size-Outlook-Type-37034137/
[104] Global Legume Pastas Market Research Report (2024-2032), Wise Guy Reports (2024). Report available here: https://www.wiseguyreports.com/reports/legume-pastas-market

East and Africa. Based on the *"Europe Legume Pasta Market Outlook"*[105] for the study period from 2018 to 2032, the European legume pasta market is expected to experience steady growth in the medium to long-term future, particularly driven by increasing demand in Western European countries.

Market segmentation. The legume pasta market is segmented by product type based on the main ingredients, including chickpea, red lentil, pea, and black bean pasta. It is also divided by application into residential and commercial uses, such as retail and foodservice. The market can further be categorised by consumer types, including vegans, vegetarians, gluten-intolerant individuals, health-conscious consumers, and fitness enthusiasts. Key distribution channels include supermarkets and hypermarkets, online retailers, health food stores, restaurants, and foodservice outlets. According to the *"Global Legume Pastas Market by Wise Guy Reports"*[106] supermarkets dominate the market due to their extensive distribution networks and diverse product offerings.

Key takeaways. The increasing popularity of plant-based diets and rising health consciousness among consumers are driving the demand for legume pasta. Market leaders are concentrating on product innovation and expanding distribution channels to meet the growing consumer base. Recent developments include the introduction of new legume pasta products with enhanced nutritional value and improved flavour profiles, along with collaborations with foodservice providers to boost product availability.

3. Competitive Landscape Analysis

The global shift towards plant-based diets has ignited a revolution in the food industry, prompting major manufacturers and retailers to embrace this trend. With growing consumer engagement and interest in plant-based proteins worldwide, these companies are responding by introducing innovative products, forming strategic partnerships, and investing in new production facilities. According to Mordor Intelligence[107] key players in the global plant-based food market include Danone SA, Blue Diamond Growers, Campbell Soup Company, Hain Celestial Group, Conagra Brands Inc., Pfeifer & Langen (AMIDORI Food Company GmbH & Co. KG), Beyond Meat Inc., Upfield, Vieve, and Nestlé SA. However, the whole alternative protein market ecosystem includes a variety of actors as presented in Figure 7 with startups, ingredient producers, companies active in the plant-based foods market as well as regulatory and advisory bodies like the WHO (World Health Organisation), EFSA (The European Food Safety Authority) and FDA (U.S. Food and Drug Administration).

The competitive landscape analysis presents the VALPRO Path business cases by their application in the plant-based market, analysing the plant-based meat market for IPS1.1 Production of a plant-based burger, plant-based bars and beverages market for IPS4.1 Production of plant-based beverage and energy bar and legume pasta market for IPS5.1 Value added production of artisan legume-based pasta. Business cases tackled in IPS2 and IPS3.1, namely Varietal selection for different pedo-climatic regions and Intercropping field peas and faba beans, are analysed within the framework of the Farming-as-a-Service (FaaS) market in comparison to commercial solutions available currently.

[105] Legume Pasta Market Size Outlook (2024-2032), Market Research (2024). Report available here: https://www.marketresearch.com/VPA-Research-v4245/Legume-Pasta-Size-Outlook-Type-37034137/
[106] Global Legume Pastas Market Research Report (2024-2032), Wise Guy Reports (2024). Report available here: https://www.wiseguyreports.com/reports/legume-pastas-market
[107] Europe Plant-based Food and Beverages Market Size & Share Analysis - Growth Trends & Forecasts (2024 - 2029), Mordor Intelligence (2024). Report available here: https://www.mordorintelligence.com/industry-reports/europe-plant-based-food-and-beverage-market



Figure 7: Protein Alternatives Market Ecosystem[108]

3.1.1. Competitive Landscape in the Plant-based Meat Market

The European market for plant-based meat alternatives is experiencing remarkable growth, driven by shifting consumer preferences, increased awareness of environmental and health concerns, and significant advancements in food technology. As consumers become more conscious of the impact of their dietary choices, the demand for sustainable and ethical food options has surged. Wonnda, the European platform designed to connect brands with manufacturers with the aim to facilitate the creation and production of private label products, has identified the following major manufacturers in the plant-based meat category in Europe that are shaping the industry:[109]

- **Veganz** (DE): A plant-based food company headquartered in Berlin committed to making vegan nutrition both accessible and enjoyable. Since its founding in 2011, the company has emerged as a leading brand in the European market, renowned for its extensive array of over 160 innovative plant-based products. Their diverse offerings include dairy alternatives, meat substitutes, snacks, and sweets, all designed to support a sustainable and compassionate lifestyle.

- **Unilever** (UK): A global leader in consumer goods driving sustainability and innovation through its plant-based initiatives in the UK and Ireland. With a strong commitment to minimising the environmental impact of food production, the company has launched a variety of plant-based meat products under its well-known brands, including ***The Vegetarian Butcher***.

[108] Source: Protein Alternatives Market Overview (2024-2029), Markets and Markets
[109] https://wonnda.com/magazine/plant-based-meat-manufacturers-in-europe/

- **Nestlé S.A.** (CH): A global leader in nutrition, health, and wellness, spearheading the plant-based food revolution. Demonstrating a strong commitment to sustainability and innovation, the company offers a wide variety of plant-based meat products that meet the rising consumer demand for environmentally friendly and nutritious alternatives to traditional meat. Nestlé's plant-based portfolio includes brands like ***Garden Gourmet*** and ***Sweet Earth***, which feature a range of delicious and high-quality meat substitutes.

- **Meatless Farm** (UK): A food company focused on creating tasty, plant-based meat alternatives. Founded with the mission to help people reduce their meat consumption for the benefit of the planet and personal health, the company provides a range of high-quality products designed to taste and cook just like traditional meat.

- **Heura Foods** (ES): An innovative company dedicated to transforming the food industry with its lineup of plant-based meat alternatives. Founded in Barcelona, Heura Foods strives to provide delicious, nutritious, and sustainable options that can seamlessly replace traditional meat products without compromising on taste or texture. Their diverse portfolio includes plant-based chicken, beef, and pork alternatives.

Vegconomist[110] has also identified some of the meat producers in Europe recently starting plant-based projects in a series of articles. In the European market, characterised by high food quality standards and forward-thinking consumer tastes, some of the traditional meat businesses that are expanding their products to include plant-based options are the following:

- **PHW Group** (DE) - Vegan brand called ***Green Legend*** launched in 2018.
- **ABP Food Group** (IE) - Chilled plant-based meat-free brand, ***Equals***, launched in 2019 for distribution in the UK, a retail plant-based brand named ***Dopsu*** for the frozen aisle in the UK launched in 2021.
- **Hanegal A/S** (DK) - More than 16 vegan ready meals offered by the company.
- **Richmond/Kerry Group** (UK & IE) - A vegan meat brand, ***Naked Glory***, launched in 2020 and rebranded to ***Taste & Glory*** in 2023.
- **Vion** (NL) - Alternative meat line called ***ME-AT*** introduced in 2020.
- **Campofrío Food Group** (ES) – Expansion to plant-based category with ***Vegalia*** in 2017.
- **Ponnath Group** (DE) – Launch of ***Veggie Gourmet Ponnath***, a vegetarian and vegan range, in 2015.
- **Jan Zandbergen Group** (NL) - ***PLNT Crab Cakes*** and ***Veggie Lovers***, a vegetarian range of meat alternatives made with organic ingredients, launched in 2019.
- **M-Food Group** (DE) - Vegan gourmet salads, and a vegan pulled pork products.
- **Rügenwalder Mühle** (DE) – Introduction of ***Vegane Linie*** in 2018.
- **Tönnies Group – Gutfried** (DE) - Ohne Fleisch line of plant-based sausages introduced in 2019.
- **InFamily Foods Holding** (DE) - ***The Plantly Butchers*** subsidiary established in 2020.
- **Danish Crown** (DK) - ***Den Grønne Slagter*** (The Green Butcher) brand launched in 2022.

The scanning of the competitive landscape in the plant-based meat production, with a special focus on plant-based burgers in the Italian market, presented in Table 2 provides Business case IPS1.1 participants with the edge to understand business strategies in the industry, current and potential future direct competitors for the VALPRO Path plant-based burger, and their main strengths. Such

[110] https://vegconomist.com/food-and-beverage/meat-and-fish-alternatives/meat-giants-driving-plant-based-market-growth-europe-part-1/#:~:text=and%20Fish%20Alternatives-,EU%20Meat%20Producers%20Driving%20Plant%2DBased,Growth%20in%20Europe%2C%20Part%201&text=Europe%20experienced%20some%20of%20the,hype%2C%20post%2DBeyond%20IPO.

insights serve to enhance business strategies and provide input for FSDC as the focal organisation in CBM related to Business case IPS 1.1.

Direct competitors for Business case IPS1.1: Production of plant-based burgers				
No.	**Direct competitors**	**Product categories**	**Operating regions**	**Main strength**
1	**Amica Natura** Brescia (IT)	Plant-based "Vegeintable" line: burgers, meatballs, nuggets and cutlets available in the versions with or without soy. Chickpea burger available with authentic flavour, light, rich in fibre and protein.	Italy, Europe	- 100% plant-based recipe, without gluten, soy and GMO. - Diversity of plant-based products. - Customised frozen food products for the private label of renowned distribution chains and food companies.
2	**Biolab**, Gorizia (IT)	Tofu, seitan, tempeh, vegan cold cuts, plant-based ready meals. Veggie burgers made from spinach, aubergine, dried tomatoes, broccoli, pea, zucchini and soy. Chickpea is used only in falafel.	Europe, Australia, South America	- Compliance with BRC[111] and IFS[112] standards. - Local sourcing from Italian farmers.
3	**CGM Natural Frozen Food**, Macerata (IT)	Product line for oven VegeTiAmo! With 3 types of veggie burgers: chickpea & cheese, lentil & potato, spinach & potato burger.	Europe, UK, USA & Japan	- Compliance with BRC and IFS standards. - Special product line for vegetarians and vegans.
4.	**Kioene**, Padua (IT)	Fresh products: mini burgers, burgers, bites, falafel and cutlets from spinach, carrot, pumpkin, broccoli, kale, aubergine, artichoke, sundried tomato, mushrooms, soy. Chickpea is used only in falafel. Veggie burger with chickpeas available only as frozen product with gluten.	Italy, Spain, Croatia	- Availability of fresh and frozen products in individual shops and supermarkets. - "Made in Italy" know-how. - "Elected Product of the Year" award for innovation and perceived consumer satisfaction in 2023.
5.	**Orogel**, Forli-Cesena (IT)	Product lines on herbs and seasoning, vegetables, soups, fish and crustaceans, side-dishes, ready meals and jams. Maxi burgers with quinoa and linseeds available in the ready meal category.	Europe, global	- More than 85% of the raw materials comes from Orogel cooperative members. - GMO use is prohibited.
6.	**Fioravanti**, Teramo (IT)	A wide range of products available including a line of veggie products with a breaded oven-ready lentil burger available with carrots, semi-dry tomatoes and veggie nuggets from vegetables and legumes, chickpea mini burgers as falafels.	Europe	- Online shop available. - A wide choice for retail, HORECA[113] channels and private labels. - Range of products from ethnic specialties to street food with exclusive finger food experience offer.

[111] BRC - Global Standard for Food Safety
[112] IFS - International Food Standard
[113] HORECA - Hotels, Restaurants, and Cafés

7.	**Golfera** Ravenna (IT)	Product lines including organic, deli meats, ready meals and specialities. Separate product line for plant-based foods – pre-sliced deli meats. No plant-based burgers in the product categories.	Europe	- Compliance with BRC and IFS standards. - Certified organic products with eco-friendly packaging.
8.	**Muscolo di Grano,** Catanzaro (IT)	Organic *Cappelli* wheat flour mixed with legume flour available as meat delis, sausages, whole cuts. One veggie burger product from wheat protein, durum wheat flour, lentil flour, aromatic herbs and vegetables. Contains gluten.	Italy	- Family-owned business based on a personal story. - Meat food names for products. - Online shop available.
9.	**Mediterranea bioveg,** Vicenza (IT)	The main products are tofu and tempeh made from 100% Italian soy and seitan. Big burgers available made with organic lentils and medburgers, burgers inspired by Mediterranean cuisine, made with vegetables.	Italy	- A widespread network of local businesses offering Mediterranean bioveg products across all Italian regions. - Organic plant-based protein foods.
10.	**Valsoia S.P.A.,** Bologna (IT)	High protein plant-based dishes with soy as main ingredient: classic burger, pea protein burger, spinach and quinoa burger, pea, carrot and corn burger, protein burgers using peppers, zucchini, and aubergine. Soy-based burgers with barbecue and chicken flavours.	Europe, USA	- Variety of products in frozen and refrigerated options. - "We are what we eat" Valsoia Food Project for introducing different plant-based products relying on other protein sources in addition to soy. - Online shop through Amazon.it. - Distribution partnership for the USA market.

Table 2: Competitive landscape for Business case IPS1.1

Indirect competition. The competition in the market for meat alternatives is intensifying as various options vie for consumer attention. Plant-based meat alternatives have gained significant traction due to their appeal to vegetarians, vegans, and flexitarians seeking environmentally friendly and health-conscious options. However, they face stiff competition from **cultivated meat**, which is grown from animal cells and offers a closer approximation to traditional meat in terms of taste and texture. This nascent industry promises to meet the demand for meat without the ethical and environmental drawbacks of animal farming. Meanwhile, **mycoprotein meat**, derived from fungi, presents another innovative option, boasting a unique nutritional profile and sustainable production process.

Figure 8 presents a landscape of start-ups and companies worldwide active in plant-based, fungi-based and cell-based meat production portraying the diversity of flavours (beef, poultry, pork) as well as the emerging plant-based seafood market actors.



Figure 8: Mapping of Meat Alternatives[114]

Despite these advancements, **animal-derived meat** continues to dominate the market, benefiting from established supply chains, consumer familiarity, and deeply ingrained dietary habits. The interplay between these alternatives will shape the future of the food industry, with each competing to balance taste, cost, environmental impact, and health benefits to capture a share of the evolving market.

3.1.2. Competitive Landscape in the Farming-as-a-Service (FaaS) Market

The European Farming-as-a-Service (FaaS) market is driven by the increasing adoption of sustainable farming practices and the integration of advanced agricultural technologies. Sustainable farming focuses on minimising synthetic inputs, reducing greenhouse gas emissions, conserving water, and promoting soil health. FaaS providers support these practices by offering access to advanced technologies, agronomic expertise, and data-driven insights. Digital farming platforms are also gaining popularity, offering comprehensive tools for farm management, decision support, and data analytics by integrating data from sensors, satellites, and weather stations. Some of the major players operating in this market based on the research results of Research Nester[115] include the following:

- **ITC Limited** (IN)**:** The company is a diversified conglomerate with a significant presence in the agricultural sector. Their Agri Business Division focuses on providing farm inputs, technology, and extension services to enhance farm productivity and profitability.

- **Trimble Inc.** (US): Trimble provides advanced positioning solutions for various industries, including agriculture. Their technology integrates GPS, data analytics, and automation to improve farm management and precision agriculture.

[114] Sources: Alexandre Romet et Manon Gazzotti available here: https://medium.com/xangevc/the-global-mapping-to-meat-alternatives-412c35fe63c

[115] Global market size, forecast, and trend highlights over 2024-2036, Research Nester (2024). Report available here: https://www.researchnester.com/reports/farming-as-a-service-market/6199

- **EM3 Agriservices** (IN): The company offers pay-per-use farm services, enabling small and marginal farmers to access advanced farming equipment and services without high capital investment. Their solutions cover various aspects of farming, from land preparation to post-harvest operations.

- **Taranis** (IL): Taranis provides precision agriculture solutions through high-resolution aerial imaging and advanced AI analytics. Their technology helps farmers monitor crop health, detect issues early, and optimise field management.

- **Apollo Agriculture** (KE): Apollo Agriculture uses satellite data, mobile technology, and machine learning to provide small-scale farmers with financing, inputs, and advice. Their integrated platform aims to increase farmers' productivity and income.

These players concentrate on strategic partnerships, new product launches, and commercialization to expand their market presence. Additionally, they invest heavily in research to develop innovative products and maximise revenue. Analysing the competitive landscape in the FaaS market, especially in advisory services, offers IPS2 and IPS3.1 participants valuable insights into business strategies and competitors among private companies in the efforts to commercialise VALPRO Path solutions, namely the varietal selection tool and intercropping agronomic practices. Table 3 provides detailed information on direct competitors in the European market as potential future competitors for VALPRO Path solutions.

Direct competitors for Business case IPS2 & IPS3.1: IPS2 Varietal selection for different pedo-climatic regions & IPS3.1 Intercropping field peas and faba beans				
No.	**Direct competitors**	**Product categories**	**Operating regions**	**Main strength**
1.	**Agroapps**, Thessaloniki (GR)	Agricultural ICT solutions (advisory services, helping farmers plan optimal agricultural cycles, climate and weather forecasting).	Europe	- Provision of tools like mylocalfarm and Turn2bio to connect farmers and facilitate online sales of produce.
2.	**Ekylibre**, Saint-Porchaire (FR)	Farm management with a platform that combines various farming solutions integrating operational information to maximise productivity.	Europe	- Offering features like inventory management, accounting, sales, purchases, and farm mapping.
3.	**Farmlyplace**, Berlin-Charlottenburg (DE)	Focus on urban farming using up-cycled logistics containers for local produce growth, employing hydroponics for year-round operation.	Europe	- The model is beneficial for city-based businesses and consumers, offering fresh produce with minimal transportation.
4.	**Føn Energy Services**, Oslo (NO)	Sustainable energy solutions for various sectors, including agriculture.	Europe	- Services that help reduce the environmental impact of farming operations.
5.	**Accenture plc**, Dublin (IE)	Consulting and technology services in agriculture.	Global	- Digital transformation solutions to enhance agricultural productivity and sustainability.

Table 3: Competitive landscape for Business case IPS2 and IPS3.1

Potential direct competitors to Aarhus University and Teagasc identified as focal organisations to engage with customers and end users within the CBM, include scientific education and research institutions active in agriculture, particularly across Europe. These institutions offer similar services,

providing agricultural research, education, and advisory support to improve farming practices and sustainability. Key competitors in agriculture advisory services include **Wageningen University and Research (NL), Rothamsted Research (UK), French National Institute for Agriculture, Food, and Environment - INRAE (FR), the Agricultural and Food Development Authority (UK), the University of Hohenheim (DE), and The James Hutton Institute (UK).** These organisations are leaders in agricultural research and advisory services, focusing on sustainable farming practices, crop science, and environmental conservation, offering comparable support to farmers and agribusinesses.

3.1.3. Competitive Landscape in the Plant-based Beverages and Bars Market

The demand for natural products is growing due to rising health consciousness among consumers, even though these products are often more expensive and less readily available. These consumers are increasingly choosing high-quality, healthy, and sustainable private-label goods, making the plant-based bars and beverages market a crucial segment for many food and beverage businesses. Having this in mind, the VALPRO Path business case addresses the growing need for sustainable and innovative food products that consider both nutritional composition and environmental impact. By leveraging advanced digital tools and spectroscopy technologies, the goal is to develop high-value, near zero-carbon labelled products, exemplified by a plant-based beverage and an energy bar as proof of concept. These prototypes will feature ingredient labels that display both nutritional composition and carbon use efficiencies, providing consumers with transparent information about the environmental impact of their food choices. This approach sets a new standard for eco-friendly food labelling, offering significant value to consumers who prioritise sustainability and informed purchasing decisions. Leading global players Kerry and PepsiCo are involved in the development of this business case, with direct competitors outlined in Table 4 for the plant-based protein bar (snack) market and Table 5 for the plant-based beverage market.

Plant-based Beverage Market

Major players have significantly expanded their product portfolios to include a diverse range of plant-based beverages beyond traditional options like almond and soy milk. These innovative offerings now encompass oat, pea, and hemp milk, as well as plant-based creamers, yoghurts, and dairy alternatives such as cheese and ice cream. To appeal to health-conscious consumers, companies have fortified their plant-based beverages with essential nutrients like calcium, vitamin D, and protein. These enhancements aim to match or surpass the nutritional content of cow's milk, addressing one of the primary concerns consumers have with non-dairy alternatives. Additionally, many key players are committed to sustainably sourcing ingredients, emphasising responsible farming practices and reducing the environmental impact of their supply chains. This sustainability focus aligns with the growing consumer concern about the ecological footprint of their food choices. Furthermore, leading companies have invested in marketing campaigns that highlight the benefits of plant-based beverages, including health advantages, sustainability, and suitability for various dietary preferences. Some of the major players on this market according to the Imarc group are the following international US-based companies:[116]

- **Blue Diamond Growers Inc.** (US): Blue Diamond Growers is renowned for its ***Almond Breeze*** product line, which offers a variety of almond milk beverages. These include original, vanilla, and chocolate flavours, as well as unsweetened and refrigerated options. Almond Breeze products are often fortified with vitamins and minerals, including calcium and vitamin D, to provide nutritional benefits like those found in dairy milk.

[116] Plant-Based Beverages Market Report 2024-2032, Imarc Impactful Insights (2023). Report available here: https://www.imarcgroup.com/plant-based-beverages-market

- **Califia Farms LLC** (US): Califia Farms produces a wide range of plant-based beverages, primarily focusing on almond and oat milks. Their product line includes ***Barista Blend*** almond and oat milks designed for frothing and steaming in coffee, as well as ready-to-drink cold brews mixed with almond or oat milk. Califia also offers creamers, protein drinks, and seasonal flavours like Pumpkin Spice and Holiday Nog.

- **Drink Koia Online** (US): Koia specialises in plant-based protein drinks made from a blend of almond milk and a proprietary mix of plant proteins, including pea, brown rice, and chickpea proteins. Their product offerings cater to different needs, including ***Koia Protein, Koia Keto, and Koia Coffee***, all of which are low in sugar and free from dairy, soy, and gluten.

- **Pacific Foods of Oregon LLC** (US): Pacific Foods offers a diverse range of plant-based beverages, including soy, almond, oat, hemp, cashew, and hazelnut milks. Their products emphasise organic ingredients and sustainability. Pacific Foods' plant-based beverages are available in various flavours and formulations, including original, vanilla, and chocolate, as well as fortified options for enhanced nutrition.

- **SunOpta** (US): SunOpta Inc is a leading producer of plant-based beverages, offering a diverse range of products including soy, almond, oat, coconut, rice, and hemp milks, as well as custom blends. Their beverages come in various flavours and formulations, such as original, vanilla, chocolate, and unsweetened options. SunOpta emphasises the use of organic and non-GMO ingredients, sustainable farming practices, and environmental responsibility. They supply ingredients to major brands and retailers, as well as producing their own branded products, making them a key player in the plant-based beverage market.

Analysing the competitive landscape of plant-based beverages in the European market provides participants in Business Case IPS4.1 with a strategic advantage in understanding industry business strategies, current competitors, and potential future direct competitors for the VALPRO Path plant-based beverage. These insights will be instrumental in refining business strategies for PepsiCo, the focal organisation in CBM. Table 4 presents the global competitors based in Europe, as it serves as the primary target market for the VALPRO Path business case.

Direct competitors for Business case IPS4.1: Production of plant-based beverage				
No.	**Direct competitors**	**Product categories**	**Operating regions**	**Main strength**
1.	**Danone S.A.** Paris (FR)	Essential dairy and plants-based products, waters and specialised nutrition. Danone plant-based brands include ***Silk, Alpro, Activia, Actimel, So Delicious, Follow Your Heart,*** and ***Oikos***.	Global	- Plant-based 2.0 technology announced in 2021 for Silk, Alpro, and So Delicious brands. - A great variety of products across different product categories - non-dairy milks, cheeses, and yoghurts. - Products available in 120+ countries around the world. - 91% of volumes of products sold are in healthy categories, 84% of packaging is reusable, recyclable, or compostable.

2.	**Hain Celestial**, New York (USA), strong presence in Europe via UK	Products in the following categories: baby/ kids, beverages, meal prep, personal care, snacks. Hain plant-based beverage brands include ***Joya*** (Austria), ***Lima***, and ***Natumi*** (Germany). Over 60 plant-based products such as drinks, tofu, desserts, and vegan alternatives to yoghurt under Joya brand. Milk alternatives produced under the Lima brand. Organic plant-based drinks and cooking creams in Germany produced under Natumi brand.	Global	- Marketed and sold in 75+ countries. - Impact strategy around 3 areas: Healthier Planet, Healthier Products, & Healthier People. - Support of transition toward recyclable and renewable packaging materials with standardised recycling labelling. - UK products include the On Pack Recycling Label (OPRL). - ESG metrics include GHG emissions, renewable electricity, waste and water usage data.
3.	**Borges International Group, S.L.** Tàrrega (ES)	A wide range of key Mediterranean cuisine products like olive oil, seed and composition oil, nuts, vinegar, milk alternatives, pasta, sauces, balsamic creams, olives. ***Borges*** brand for Natura milk alternatives.	Global	- Reduction of sodium, sugar and fat levels in products, in line with the recommendation of the Spanish Ministry of Health. - Supplier Code of Conduct for suppliers' selection. - ECOSENSE certification for single-dose containers. - Since 2020, 94% of all power used by Borges production centres has been from renewable sources. - BRC, IFS, ISO, organic and other certifications. - B2B marketing.
4.	**Coca-Cola HBC,** Zug (CH)	Coca-Cola HBC bottles and sells Coca-Cola products exclusively in 28 markets, mainly in Europe, offering brands across sparkling, juice, water, sport, energy, plant-based, ready-to-drink tea, coffee, adult sparkling, snacks, and premium spirits categories. Through its acquisition of ***AdeZ***, Coca-Cola includes a variety of plant-based drinks, such as almond, coconut, and soy-based options.	Global	- Net zero emission by 2040 mission. - External assessment to evaluate suppliers on farm level for accreditation. - 100% of primary packaging is recyclable while 56% of bottles and cans were collected for reuse or recycling.

5.	**Nestle**, Vevey (CH)	Product categories include baby foods, cereals, chocolate & confectionery, coffee, culinary, chilled and frozen food, dairy, drinks, food service, healthcare nutrition, ice cream, pet care, water. a plant-based portfolio comprising different products. beverages include vegan coffee creamers with zero lactose and zero cholesterol under ***Natural bliss*** brand.	Global	- Sustainability report on Nestle contribution to UN SDGs[117]. - Global network of 300 food experts and chefs working on the company's plant-based portfolio. - Nestlé Responsible Sourcing Core Requirements outlining requirements for direct suppliers and origin. - Participation in the Business Coalition for a Global Plastics Treaty. - Net Zero Roadmap by 2050. - Growing plant-based brands and adding plant-based options to existing brands (e.g. Vegan KitKat).

Table 4: Competitive landscape for Business case IPS4.1 – Plant-based beverage

Europe is home to several prominent plant-based beverage producers that cater to the growing demand for dairy alternatives. **Oatly**, based in Sweden, is renowned for its oat-based beverages and a range of dairy alternatives, including creamers and ice creams. **Provamel**, located in Belgium, focuses on organic plant-based drinks such as soy, almond, and rice milk, emphasising sustainability in its production processes. The UK is represented by **Rude Health**, which produces a diverse array of plant-based beverages, including almond, oat, and coconut milk, and **Nutty Bruce**, specialising in organic options like almond and cashew milk. From Italy, **Isola Bio** offers a wide range of organic plant-based beverages, including rice, oat, and soy milk, while **The Bridge** produces similar organic drinks, emphasising quality and sustainability. Lastly, **Vegan Milker** by Chufamix in Spain has gained popularity for its innovative kitchen appliance that enables consumers to create fresh plant-based milk at home from various nuts, seeds, and grains, empowering individuals to enjoy customised dairy alternatives. Together, these companies reflect the vibrant and diverse landscape of the plant-based beverage market in Europe, catering to a wide range of consumer preferences for health, sustainability, and flavour.

While cereal-based beverages like oat and rice milk are prevalent in the market, the legume-based segment is largely dominated by soy milk. However, there is significant potential to diversify this segment with other legumes that may offer superior functionality and nutrition. Despite this potential, there remains limited knowledge about the processability, functionality, health benefits, and associated risks of various legume-based milk substitutes. The global and European plant-based beverage markets are dominated by soy and oat products, but innovations like the VALPRO Path protein beverage, which introduces a lupin-based drink, are emerging as new entrants. Legume-based milk, made from soybeans, peas, chickpeas, or lupin beans, generally offers higher protein and fibre content, with a nuttier and thicker texture compared to cereal-based milk. Cereal-based milks, such as those made from oats, rice, or quinoa, are milder, sweeter, smoother, and lower in protein but higher in carbohydrates. Both legume and cereal-based milks are more environmentally friendly compared to animal-derived dairy, making them attractive options for eco-conscious consumers.

Plant-based Bar Market

Some prominent players in the global plant-based bars market are actively expanding their customer base through collaborations and joint ventures with other major businesses, aiming to boost their

[117] United Nations 2030 Agenda for Sustainable Development with Sustainable Development Goals (SDGs)

profitability. Additionally, their strong focus on introducing innovative and sustainable products rich in essential nutrients further drives the growth of the vegan bars market. Key players in this market include:[118]

- **Kellanova** (US): Known for its extensive range of snacks and frozen food brands, Kellanova has ventured into the plant-based sector with its **RXBAR** brand, offering a variety of plant-based protein bars that cater to health-conscious consumers.

- **Green's Gone Wild, LLC** (US): This company specialises in producing plant-based snack bars that are crafted from natural, whole-food ingredients, focusing on delivering nutritious and tasty options for the plant-based market.

- **General Mills Inc.** (US): A major player in the food industry, offers plant-based bars through its **LÄRABAR** brand, which emphasises minimal, natural ingredients and a variety of flavours that cater to vegan and gluten-free diets.

- **88 Acres** (US): This company produces seed-based snack bars that are free from common allergens. Their plant-based bars are designed to provide wholesome, nutrient-dense snacks suitable for a wide range of dietary needs.

- **Rise Bar** (US): Rise Bar specialises in protein bars that use simple, plant-based ingredients. Their bars are designed to deliver high protein content with clean, natural ingredients, appealing to health-conscious consumers.

Analysing the competitive landscape of plant-based bars in the European market offers participants in Business Case IPS4.1 a strategic advantage by enhancing their understanding of industry business strategies, current competitors, and potential future rivals for the VALPRO Path plant-based bar. These insights will be crucial for refining business strategies for PepsiCo, the primary organisation in CBM. Table 5 presents the competitors based in Europe, which is the main target market for this business case.

Direct competitors for Business case IPS4.1: Production of plant-based energy bar				
No.	**Direct competitors**	**Product categories**	**Operating regions**	**Main strength**
1.	**LoveRaw,** Manchester (UK)	Products include cream wafer bars, peanut butter cups and vegan milk chocolate bars. Flavours include milk, nutty, caramel, caramelised biscuit, salted caramel.	UK	- Distribution via retailers operating in the grocery and health food sectors. - Purchase via online shop – loyalty club, gift boxes available. - The Best Dairy Product Alternative at the World Plant Based Awards.
2.	**Raw Bite,** Copenhagen (DK)	3 main ingredients for bars include dates, almonds and cashew nuts in an organic quality. Mainly fruit and nut bars. In protein bars, rice protein powder is used.	Denmark, Sweden, Germany, Austria	- All the bars are organic, sugar free, lactose-free,

[118] Plant-based Bars Market 2023-2030, Fortune Business Insights (2022). Report available here: https://www.fortunebusinessinsights.com/plant-based-bars-market-104369

				vegan, gluten-free and high in fibres. - Web shop available. - Boxes with 12 bars, mixed boxes, office boxes and single bars available.
3.	**Grenade** (Mondelēz International's), Solihull (UK)	Product lines include sports drinks, sports nutrition, bundles, protein bars and snacks. Protein bars available in 15 flavours with high protein and low sugar content.	UK	- Loyalty points through online shopping. - Protein bars are Informed Sport certified for consumption by professional athletes and military personnel.
4.	**Fulfil Nutrition**, Dublin (IE)	Vitamin and protein bars available in 10 flavours. Protein source – milk and soy.	Ireland, UK, EU member states, USA	- High protein, low sugar, 9 vitamins (C, B2, B6, E, B3, B9, B1, B5, B12) - Online shopping possibility.
5.	**Myprotein**, Manchester (UK)	Vegan and plant-based product category with a range of protein powders, blends, superfoods and snacks. Protein bars available as wafers, squares and cookies in 3 flavours. Legumes used in protein powders.	Europe	- Products support health and fitness goals. - Compatibility with other product lines including activewear and vitamins. - Key benefits include high protein content, low in sugar, and vegan-friendly.

Table 5: Competitive landscape for Business case IPS4.1 – Plant-based bar

Energy and protein bars commonly feature oats as a primary base for texture and fibre, complemented by nuts such as almonds and peanuts for healthy fats and protein. Seeds like chia and flaxseed contribute additional protein and fibre, while various protein powders, including whey, soy, or pea protein, provide an extra boost. Nut butters, such as almond or peanut butter, help bind the ingredients while delivering protein and healthy fats. Natural sweeteners like honey, maple syrup, and dried fruits such as dates or raisins add sweetness and chewiness. Flavourings, including dark chocolate, cocoa powder, spices, and extracts, enhance the overall taste, and some bars may incorporate fibre sources like inulin and psyllium husk. While some brands may use preservatives for shelf stability, many emphasise natural ingredients. Like trends in the plant-based beverage market, plant-based protein from legumes is not the primary choice among vegan bar producers, making the VALPRO Path energy bar an innovative entry into the plant-based bar market.

Indirect competition. Plant-based protein bars face strong competition from **granola, nut, and fruit bars**, which, while not always high in protein, offer convenience, energy, and nutritional benefits that appeal to similar consumers. Additionally, **ready-to-drink protein shakes, and protein powders** provide a quick, nutrient-dense alternative for on-the-go nutrition. Other **plant-based snacks**, such as roasted chickpeas, lentil chips, and veggie crisps, also compete with protein bars by offering healthy, protein-rich options for health-conscious individuals.



Figure 9: Plant-based Milk Chocolate Alternatives in Europe[119]

Furthermore, the plant-based chocolate market is increasingly competitive, with numerous innovative brands using dairy-free ingredients to create milk chocolate alternatives. A study by Vegconomist identified around 100 brands across Europe offering plant-based chocolate alternatives, highlighting a diverse and evolving market landscape, as shown in Figure 9. The figure illustrates a landscape of brands categorised into specialised vegan brands, artisanal chocolate makers, global chocolate brands, and supermarket own brands. According to the same research, consumers often struggle to spontaneously name plant-based chocolate brands but expect popular brands to offer plant-based milk chocolate options. This indicates that established brands could quickly gain market share by introducing plant-based chocolate products (e.g., Vegan KitKat).

3.1.4. Competitive Landscape in the Legume Pasta Market

Leading market players are investing in research and development to expand their product lines and drive growth in the legume pasta market. These participants are also pursuing various strategic initiatives to broaden their reach. Key activities include new product launches, contractual agreements, mergers and acquisitions, increased investments, and collaborations with other organisations. To succeed in an increasingly competitive and expanding market, the legumes industry must offer cost-effective products. A primary strategy employed by manufacturers is local production, which helps reduce operational costs, benefiting clients and enhancing the market sector. Key players in the global legume pasta market include:

- **Barilla G. e R. Fratelli Spa** (IT): Barilla, a leading global food company based in Parma, Italy, is renowned for its pasta, sauces, and bakery products. Established in 1877, Barilla has cemented its presence in the pasta market through a commitment to sustainability and quality. The company offers a diverse range of pasta products across various categories, including legume and gluten-free options. Notably, Barilla's legume pasta product line features pasta made from green pea and

[119] Source: Future Grocery Shopping

red lentil flour. With a large distribution network, Barilla continues to meet the demands of consumers seeking both traditional pasta and innovative, health-conscious alternatives.

- **Ebro Foods SA** (ES): A multinational food group specialising in rice, pasta, and sauces with headquarters in Madrid, Spain. It operates in over 80 countries and focuses on innovation and sustainability to meet global food demands.

- **F.lli De Cecco di Filippo SpA** (IT): De Cecco is an Italian food company with a rich heritage dating back to 1886 based in Italy. It is renowned for its premium pasta products made using traditional methods and high-quality durum wheat. Legume pasta is produced within the gluten-free category from pea and red lentil flour.

- **Newland Food SpA** (IT): Newland Food is an Italian company specialising in the production and distribution of high-quality pasta products. It emphasises traditional Italian culinary values and innovative production techniques. Legume pasta is available under the category of gluten-free products specifically formulated for people with gluten intolerance under the ***Delverde*** brand.

- **Seggiano** (UK): A company offering a versatile range of products, including condiments, savoury items, sweets, and gifts. In the pasta category, they feature certified gluten-free legume pasta made from red lentils and green peas, available in fusilli and tagliatelle shapes. Seggiano operates in the UK, France, Norway, the US, Israel, and Saudi Arabia. Their online shop provides a "Shop by diet" option, allowing customers to select from vegan, vegetarian, organic, wheat-free, gluten-free, and palm oil-free products.

Analysing the competitive landscape of legume pasta production in the Italian market gives Business Case IPS5.1 participants a strategic advantage in understanding industry business strategies, current competitors, and potential future direct competitors for VALPRO Path legume pasta. These insights will help refine business strategies for ATP as the focal organisation in CBM related to the value-added production of artisan legume-based pasta. Table 6 depicts the competitors in Italy as the primary target market for VALPRO Path artisan legume-based pasta.

Direct competitors for Business case IPS5.1: Value added production of artisan legume-based pasta				
No.	**Direct competitors**	**Product categories**	**Operating regions**	**Main strength**
1.	**Antico Pastificio Morelli** Pisa (IT)	A variety of pasta products in the following categories: pasta with the wheat germ, durum wheat semolina, regional specialties, egg pasta with the wheat germ, wholewheat pasta organic, cereal organic, pasta 100% legumes, gluten-free pasta, special flavoured pasta, multicolour pasta. In legume pasta 100% chickpea of lentil flour is used.	Italy, Europe	- Online shop available. – Pasta with high protein content, processed using artisan methods. - Italian raw materials used. - Suited for hyper protein diets, for diabetics, very digestible. - Fairly short preparation time.

2.	**Azienda Agricola monte Monaco**, Amandola (IT)	Pasta 100% legumes from chickpeas, faba beans, lentils and peas in the following forms: penne, rigatoni, laccetti, hooks.	Europe, USA	- Certified supply chain from seed to packaging traced by blockchain technology. - Compostable and biodegradable internal bags. - Eco-responsible cardboard box certified FSC - Gluten-free, no GMO with a moderate glycaemic index, without thickeners or preservatives and low in saturated grass and salt. - Certifications by IFS and FDA[120]. - Private label availability.
3.	**Legu**, Varese (IT)	Different products in the following categories: soups, pasta, ragu, savoury snacks, condiments, flour mixture. Legume pasta is made from a combination of 2-4 legume flours including white bean flour, steamed chickpea flour, steamed hulled yellow lentil flour, and steamed yellow pea flour.	Italy	- 100% Italian legumes and cereals. - Gluten-free pasta suitable for celiacs and intolerants. - Quick and simple to prepare. - Online shop available and through HORECA distribution network. - Certified as gluten-free and organic products in line with UNI EN ISO 22000 standards.
4.	**Tomitaly**, Piacenza (IT)	Versatile product lines including the following: tomato line, vegetables and legumes, Italian wine, 100% Italian wheat pasta, ready-to-use sauces, Italian oil, balsamic vinegars, rice, special pasta and spreadable creams. Legume pasta made from red lentils, peas, chickpeas and beans.	Italy	- Certified supply chain with the richness of regional Italian flavours. - Private label options. - Online shop available. - Gluten-free, suitable for celiac consumers. - Private label available.
5.	**Tiberino** Bari (IT)	A variety of product lines: risotto, pasta, soups, legumes, beans, cereals, premium spices, fine herbs, extra virgin Italian olive oil and white truffle oil. In the pasta category mainly Italian durum wheat semolina premium pasta is made in various shapes from non-GMO vegetables grown in Europe. In Tiberino's pantry product line, premium legume pasta is made from red lentil, pea and chickpea flour.	Europe	- Online shop available. - SPACE FOOD: Italian gourmet meals for astronauts & OUTFOOD, plant-based meals for outdoor gourmeters. - Distribution through specialty stores, gourmet supermarkets and HORECA. - One-pot pasta – premium legume-based Italian pasta. - Biodegradable packaging with a zero-waste philosophy.

[120] FDA – The United States Food and Drug Administration

6.	**Bioitalia** Sarno (IT)	A diverse range of pasta products that cater to various dietary preferences, including bronze-drawn pasta, whole wheat pasta, legume pasta, gluten-free pasta, and vegetable pasta. Legume pasta made from 100% chickpeas, 100% lentils, and 100% green peas, available in penne and fusilli forms.	Europe, USA	- Certified organic cultivation. - 100% recyclable packaging. - Sustainable supply chain. - Organic gift idea boxes.

Table 6: Competitive landscape for Business case IPS5.1

Indirect competition. Indirect competition for legume-based pasta primarily includes traditional wheat pasta, gluten-free pasta, vegetable-based pasta, and whole grain pasta. **Traditional durum wheat pasta** remains a staple in many diets due to its widespread availability and affordability. **Gluten-free pasta**, made from alternative flours like rice, corn, or quinoa, caters to those with gluten sensitivities or dietary restrictions. **Vegetable-based pastas**, such as zucchini noodles and butternut squash pasta, appeal to health-conscious consumers seeking low-calorie, nutrient-rich alternatives. **Whole grain pasta**, crafted from whole wheat, spelt, or barley, offers a higher fibre content and a more robust nutritional profile, attracting those aiming to incorporate more whole grains into their diet. These indirect competitors provide various options that fulfil similar consumer needs, thereby challenging the market share of legume-based pasta.

4. Barriers to Market Entry

The plant-based protein industry is experiencing rapid growth driven by increasing consumer awareness of health, environmental sustainability, and ethical considerations. However, amidst this growth, the sector faces various challenges that demand strategic mitigation measures. This chapter explores key challenges faced by the plant-based protein industry and outlines effective mitigation strategies to overcome them presented in the table below:

Barrier	Barrier description	Mitigation measures
Allergen issues	Although the consumption of plant-based protein sources can be highly beneficial for health, some types of protein ingredients have been identified as allergens.	Clear and accurate labelling on potential allergens on food packaging
High Production Costs	Producing plant-based protein products can be expensive, especially if specialised ingredients or processes are used. High production costs can erode profit margins, making it difficult for companies to sustain their operations.	Achieve economies of scale by increasing production volume, procure raw materials in bulk and streamline operations.
Supply Chain Disruptions	Issues with the supply chain, such as disruptions in the availability of raw materials or distribution challenges, can impact production and increase costs. Smaller companies in the plant-protein industry may not have the resources to quickly adapt to such disruptions.	Diversifying suppliers by ensuring multiple suppliers, their geographical diversification and performing regular supplier audits.
Regulatory Compliance	The food industry, including plant protein products, is subject to strict regulations and standards related to safety, labelling, and quality. Non-compliance can lead to fines, recalls, and damage to the brand reputation.	Implement robust compliance management systems to effectively manage regulatory requirements, reduce the risk of non-compliance, and maintain brand reputation.

Consumer Trends and Preferences	Rapid changes in consumer preferences and dietary trends can affect the demand for plant protein products. Companies that fail to adapt to these changes may see declining sales, putting their financial stability at risk.	Engage in market research and innovation to stay ahead of consumer trends and ensure product offerings remain relevant and appealing.
Lack of Diversification	Overreliance on a single product or a limited range of products can be risky. If the market for that product stagnates or declines, some companies may face financial difficulties.	Product line diversification spreading risk across multiple products and market segments, reduces the impact of any single product's decline on company performance.
Environmental and Sustainability Concerns	Events like the global pandemics can disrupt supply chains, reduce consumer demand, and lead to financial instability for actors at the end of the value chain.	Develop sustainable and resilient supply chains to better manage environmental concerns and reduce the impact of disruptions on operations.

Table 7: Barriers associated with the plant-based protein and food market entry

In conclusion, to navigate challenges in the plant-based protein industry, clear labelling addresses allergens, while economies of scale mitigate high production costs. Diversifying suppliers' counters, supply chain disruptions, and robust compliance systems ensure adherence to regulations. Market research and product innovation keep pace with consumer trends, while product line diversification spreads risk. Sustainable supply chains mitigate environmental concerns and disruptions. These measures collectively foster stability and resilience in the face of industry challenges.