D1.3
Food system maps for 13 countries

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List of abbreviations

APF – Alternative protein foods
AL - Aleksandra Luszczynska (co-author)
CBSD - Community-based system dynamics approach
CLD – Causal loop diagram
EK - Ewa Kulis (co-author)
EU – European Union
FAO – Food and Agriculture Organization, the United Nations
FDA – Food and Drug Administration, USA
GMB – Group model building
HZ – Hanna Zaleskiewicz (co-author)
LSD – Least significant difference test
MSD – Mean standardized difference
MS – Maria Siwa (co-author)
ZS – Zofia Szczuka (co-author)
WP – Work package

Executive summary

Background:

The complex food system includes interrelated factors and processes, which jointly explain consumers' food choices. Among others, these factors may include governance mechanisms (e.g., policy instruments), actions and beliefs of food system stakeholders (e.g. food producers and processors, retailers, policy makers, consumers), major events (e.g., the COVID-19 pandemic), and other micro, meso, and macro-level determinants (e.g., economic factors such as family income, production costs, and the economic situation in a country), which operate in the complex food system and, in consequence, contribute to the consumption of food in Europe.

D.1.3 provides a review of evidence and presents findings of the system mapping study, analyzing the food system factors and associations between these factors, which jointly explain consumers' choices of alternative protein food (APF) in 13 European countries. In particular, the study aimed at eliciting so-called leverage points in the food systems, that is the determinants best connected with other well-connected determinants.

Methods:

Food system stakeholders (n = 166), including food producers, food processors, consumer representatives, from 13 European countries (Austria, Czech Republic, Denmark, France, Germany, Greece, Italy, Norway, Poland, Portugal, Slovenia, Spain, and Türkiye), developed 17 systems maps (5 maps for Poland, 1 map per remaining 12 countries). The maps were developed during systems mapping workshops, using STICKE software and a standardized workshop protocol. Eigenvector centrality indices were calculated to identify the leverage points. Post-workshop survey data were collected to identify the micro-, meso- and macro-level factors that are perceived as the most important determinants of APF intake by consumers.

Results:

The analyses of the leverage points showed that several leverage points were consistently included across 6-8 maps. They are:

- Formal and experiential knowledge about APF and efforts to educate consumers;
- Social encouragement of APF intake and social norms indicating approval and popularity of APF among people important to a consumer (e.g., a family member);
- Advertising, promotion, and influencers' actions (other than education; delivered by organizations, and institutions).

Additionally, 3-4 maps included leverage points, referring to: (1) regulations and perception of APF as a healthy, balanced, and safe product; (2) fear of novelty or curiosity; (3) food culture in the respective country; (4) perceiving APF as ultra-processed food; (5) environmental and sustainability issues, and (6) animal welfare or ethics.

Post-workshop survey results additionally highlighted the importance of economic factors, such as cost of living and disposable income, as well as prices of APF as determinants rated most important for consumers' choices of APF. In the context of a broader uptake of APF, the stakeholders participating to the workshops agreed that the consumers may be the most important stakeholders in the food system.

Conclusions:

This study offers new insights into the complex systems of the determinants of APF choices. Seventeen systems maps highlight the role of individual-level consumers' characteristics, social and economic factors, as well as APF education and advertising policies and actions. A change in these determinants may trigger a reverberating effect occurring throughout the system. Therefore, identified leverage points are potentially the best targets of interventions promoting APF.

1. Introduction

The term "food system" has been gaining popularity in the last two decades and has been applied to describe a broad environment and processes encompassing food production retail, and consumer choices, as well as the causes and consequences of such choices at a local and global scale (Diaz-Mendez, Lozano-Cabedo, 2020). Although a broadly acknowledged definition of the food system is lacking, the existing approaches share an understanding of the crucial characteristics of the food system (c.f. Gregory et al., 2005; Ericksen, 2008; Ingram, 2011; Rotz & Fraser, 2015; Tendall et al., 2015). In particular, the literature is consistent in acknowledging the assumptions that as a system, food should be studied holistically, that is, by capturing multiple determinants associated with activities such as food production, processing, packaging, distribution, sales, consumption, etc. (c.f. Gregory et al. 2005; Ericksen, 2008; Ingram, 2011; Rotz & Fraser, 2015; Tendall et al. 2015). The determinants are chained together to form complex processes, which in turn have multilevel dimensions, including individual, organizational, or institutional, and higher societal/ national levels (Tendall et al., 2015). The determinants also describe the physical, social, economic, and political environments that regulate how food system activities (e.g., food consumption) are performed (Tendall et al., 2015).

1.1 Food system stakeholders and the interlinks between their actions

The **food system stakeholders**, including food production and processing industry, retailers, policy makers, consumers, researchers, etc., contribute to the current status of the food system. Based on existing evidence it is impossible to specify which of the food system stakeholders may be the most important in shaping the system, maintaining its status quo, or shifting it towards/away from alternative protein. According to the complex system approach models applied to food systems (c.f. Gregory et al. 2005; Ericksen, 2008; Ingram, 2011; Rotz & Fraser, 2015; Tendall et al. 2015), a change initiated by one system actor may cause changes reverberating throughout the system, mobilizing a response of all other system actors.

The existing literature provides several examples of activities of food system actors that have contributed to major shifts in the food system, resulting in an increase of the availability and purchase of alternative protein products. The examples of the actions of food producers and processors, retail representatives, researchers, non-governmental organizations, mass media representatives, policy makers, etc., are summarized in Table 1.

Table 1. Examples of actions of major food system stakeholders which affected the production, availability and intake of alternative proteins (based on Mylan et al., 2023).

Years	Type of food system stakeholders and their actions affecting the complex food system in terms of alternative protein production, availability, intake
1990	**Food processing companies and biotechnology researchers** set off biotechnological advancements, related to the production of the enzyme 'chymosin' via precision fermentation, subsequently approved by the **governmental stakeholder,** the US Food and Drug Administration (**FDA**)
1999	Interest in the **corporate sector** is boosted by the decision of the **FDA** to authorize health-related claims for soy products. A wave of alternative protein company acquisitions by **multinational food corporations** such as Kraft and Kellogg's
2000-2006	Accelerating **mass-media** and **scientific debates** on alternative proteins as a "solution" to climate change, with a turning point in public discourse around animal agriculture represented by Food and Agriculture Organization's (**FAO)** report *Livestock's Long Shadow* (2006), framing livestock as a major contributor to climate change, raising controversies and debates around the role of animal protein products in climate change

2009-2011	A new generation of **researchers and entrepreneurs** enters alternative protein niche and funded new, currently high-profile firms such as Beyond Meat in 2009, The Vegetarian Butcher in 2010 and Impossible Foods in 2011
2000-2013	**Social movement actors** promote development of the technology. For example, animal rights organization People for the Ethical Treatment of Animals offers 1mil USD award to alternative protein producers and processors able to develop a commercially viable production process
2010-2021	An intensification of public discussion involving **policy makers, civil society representatives, social movement activism, social media and mass media** discourse, causes changes in public perception of meat industry. Consensus between scientific groups, major NGOs, consumer groups, mainstream media in developed countries, highlights the links between meat production, climate change issues and a lack of sustainable food systems. This is counteracted by support of policy makers to animal agriculture: the policy makers' support continues under pressure of arguments about stabilizing employment and economy in rural areas. This is supported by a promotion of animal-based proteins as health and luxury products, which counteracts consumers' motivation to eat less animal-based proteins.
2000-2021	Partial destabilization of animal protein-based food **producers** and their tentative restoration (by expanding to developing food markets and diversification of protein production). The global meat consumption is stagnated in the majority of developed countries while it remains to increase in developing countries. The three **largest meat processors in the world** (JBS, Tyson, Cargill) establish companies producing alternative proteins (years 2017 and on)
2013-2022	An acceleration of the diffusion of the plant-based meat-replacement protein products with **major retailers** offering their own "plant-based" alternative protein food ranges (e.g., Walmart, Carrefour, and Tesco). **Major fast food companies** (Yum! - the owner of KFC and Pizza Hut; Restaurant International - owners of Burger King and Tim Hortons) are establishing commercial relationships with plant-based firms and launching plant-based products (e.g., McDonald is launching McPlant burger and Burger King is opening a plant-only outlet in London in 2022)

The changes in the complex food system may be discussed by highlighting the contribution of specific food system stakeholders, including food producers, representatives of food processing industry, retailers, policy makers, consumers, researchers, etc. Actions of each stakeholder may constitute turning points, triggering a change in the whole system. However, in-depth analysis accounting for actions of all food system stakeholders requires multiple studies, conducted from the perspective of each of them.

Specific actions of each of food system stakeholders may be also treated as the main outcomes of the food system analysis. According to the food system studies there are four types of key actions in the food system: production, processing and packaging, distribution and retail, and consumptions (Ericksen, 2008; Hospes & Brons, 2016). D.1.3. focuses on food system characteristics and processes which are explaining the fourth action, that is (alternative protein) food consumption. This approach does not mean that the consumers' actions and perspectives are more important than actions of other food system stakeholders. The choice of consumption as the key food system action is an arbitrarily selected "entry point", guiding our analysis of various factors operating within the complex food system, and interrelations between these factors.

1.2 Consumption as a key activity in the food system

Several food system approaches suggest that consumption is one of the four key activities in the food system, together with: (1) production, (2) processing and packaging, and (3) distribution and retail (Ericksen, 2008; Hospes & Brons, 2016). Due to its innate complexity, research on food systems may either focus on certain types of activities (e.g., agricultural food production only; c.f. Blake et al., 2019), or certain meta-characteristics of the system such as resilience (Tendall et al., 2015) or sustainability (Bene et al., 2019).

Research addressing food producers (as the food system stakeholders) and their respective activities (production, processing, retail) has dominated food system studies (Boer & Aiking 2022; James et al., 2018; Mendez, Lozano-Cabedo, 2020). This dominance has occurred as a consequence of the traditional objectives of food systems research, such as food security, food safety, and food risks. With new objectives emerging in the last two decades, such as environmental, social, and ethical issues, the importance of other system stakeholders, such as consumers, is growing (Diaz-Mendez, Lozano-Cabedo, 2020). The emergence of "more aware consumers" resulted in responses by policymakers and governments. These responses include providing new public policies, further increasing consumer education, and accessibility of healthy and sustainable food (Diaz-Mendez, Lozano-Cabedo, 2020). Changes in consumer demands resulted in changing actions of producers, food processors, and retail, such as developing new types of foods and food certificates, ascertaining sustainability, transparency, and traceability (Diaz-Mendez, Lozano-Cabedo, 2020).

Consumers' actions, such as trends in changing food demands are now considered essential to achieving a transformation of the food system into a more sustainable and resilient structure (James et al., 2018; Willet et al., 2019). Collective changes in consumer behaviors, such as choices of more sustainable foods (e.g., made of proteins that are alternative to meat and dairy from animal sources) shape actions of other system stakeholders and thus open pathways towards sustainable food systems (HLPE, 2017). In sum, recent research on food systems observes a power shift towards the ways consumers and their actions influence other system stakeholders and their actions, as well as an increased interest in determinants of consumers' actions (Boer & Aiking 2022).

This study aims to investigate the determinants of consumers' food choices, as the key actions of the key stakeholders of the food system. We focus on alternative protein food (APF) choices.

1.3 The role of consumers in sustainable food systems: Review of evidence

Previous research on key stakeholders who play a role in transforming European food systems into more sustainable ones indicates that food producers (farmers, fishers) and food manufacturers are considered the most important stakeholders, as indicated by 61-74% of respondents, participating in a survey enrolling N = 27,237 Europeans (Boer & Aiking, 2022). The importance was determined as the percentage of grading respective stakeholders as significant players in the food system. Consumers were indicated as important less frequently and located respectively in either the third place (by 58% of respondents in North and West of Europe) or the fifth place (34% in South and East of Europe) of most significant food system stakeholders. In South and East of Europe, consumers were less frequently indicated than retailers (36%) and national governments (43%). In Western Europe, the national government was evaluated as the fourth most important actor (52%) while the EU institutions were indicated as the fifth most influential stakeholders, as pointed out by 46% of respondents (Boer & Aiking, 2022).

The majority of research addressing the role of consumers' actions in the food system focused on determinants of decision-making by consumers. For example, Hoek et al. (2021) conducted a systematic review in which the determinants were classified into broader categories, such as individual-level factors, immediate environment, indirect environment, and macro-level environment. The findings suggest that the individual-level determinants affecting sustainable food choices include psychosocial characteristics such as "knowledge", "beliefs," and "attitudes", socioeconomic characteristics, but also taste, convenience, and familiarity (Hoek et al., 2021). Immediate environmental factors include determinants such as availability in the local shops, social norms shared by family and friends, and family preferences. Indirect environmental factors, in turn, include geographical characteristics (such as urbanization), community, and information in the environment (including advertising). Finally, macro-environmental factors may include national dietary guidelines and various public policies which may influence consumers' decisions (Hoek et al., 2021). Unfortunately, Hoek et al. (2021) did not provide insights regarding the content of broader classes of

determinants, such as beliefs (i.e., it is unclear what the beliefs refer to). More importantly, it remains unclear how the determinants may be related or interact together in hindering/prompting consumers' choices of sustainable food (Hoek et al., 2021).

High food security and a reduced risk of limited accessibility to food by consumers is a key characteristic of a sustainable and resilient food system. Major events, such as crises of food systems may appear when food supply to consumers is impeded by either natural disasters (e.g., extreme weather conditions, a pandemic such as COVID-19 outbreak) or human-generated hazards (e.g., political unrests, wars). Research considering which proteins could replace meat in case of a crisis causing limited food supply indicated that insect-based proteins were more viable than algae-based, mycoprotein-based, or pulses-based alternative proteins (Boccardo et al., 2023). This conclusion was drawn after analyzing land, water, and energy requirements for different types of protein sources. Insect-based proteins are also characterized by an effective and short supply chain and relatively high feasibility of conversion (low knowledge and technology required for the production) (Boccardo et al., 2023). At the same time, consumers' disgust and neophobia may be strong emotional determinants hindering consumers' willingness to eat insect-based proteins (Kroger et al., 2022) and thus result in an unbalanced diet in case of food crises where the availability of traditional proteins is reduced.

The interactions between public policies/laws and consumers' choices of alternative proteins constitute yet another type of complex processes taking place in the complex food systems. Policymakers may respond to changes in consumer food demands and challenges related to climate change by adjusting public policies, for example by incorporating revision of national nutrition guidelines to favor more sustainable food choices (Aschemann-Witzel et al. 2021). Linking the food policy to climate targets and greater national investments in sustainable food production (using e.g., fiscal instruments, changing public procurement standards, etc.) may change food supply and in turn, consumer demands (Aschemann-Witzel et al. 2021).

Concluding, existing research on the role of consumers' actions in the food system provides evidence for psychosocial and environmental determinants of consumers' choices, link consumers' actions with actions of other key system stakeholders (e.g., producers), indicate potential vulnerabilities of the system in case of major events, and provide preliminary insights into the interactions between actions of policymakers and consumers' choices.

Importantly, an in-depth investigation of the complex connections between the determinants of consumers' choices in the food system is missing. Going beyond merely listing the determinants and assuming they operate "together" is essential. In particular, we need an approach allowing to identify the ways the complex food system operates and to elicit the determinants in the system which (when altered) may trigger changes reverberating throughout the system.

1.4 Systems mapping as an approach to explore the consumers' choices of alternative proteins

Systems thinking can be understood as a shift from conventional, linear approach. Systems thinking facilitates understanding of the complexity of the whole, rather than focusing on its component parts, and considers interdependent relationships and views a problem as a dynamic, interdependent, and ongoing process (Meadows, 2008; Hovmand, 2013). The complex adaptive system approach assumes that the system elements (determinants) are connected, and a change in one element will affect other parts of the system. Furthermore, the connections form feedback loops, that is a non-linear association, that can lead to growth or decline of a respective action (i.e., reinforcing loops) or can have a stabilizing effect and result in the system maintaining its status quo (Medows, 2008; Hovmand, 2013).

An advancement of the prior research of food systems would include the production of systems maps (Littlejohns et al., 2021), which represent an innovative participatory action research process to advance

theory development and set the targets for public health interventions. A system mapping approach to consumers' choices would connect determinants in terms of representing how they intersect within a system, accounting for their interdependence and relative strengths.

Systems mapping have had utility in actively engaging stakeholders to explain availability, affordability, accessibility and acceptability of various types of foods among the consumers with a low socioeconomic position (Sawyer et al., 2021), as well as systems of factors underlying production of specific types of food (e.g., cocoa), or the livestock sector development (Dentoni et al., 2023). In general, systems mapping uses a participatory approach which involves a group of stakeholders to explore how a system "works" by using a structured, step-by-step format to create a map of proposed causal-loop diagrams of a complex system. Subsequently, these systems maps help inform responses to the investigated issue through a further participatory research (Király & Miskolczi, 2019).

Systems maps allow to identify four categories of determinants which are most likely to trigger the change in the whole system (Meadows, 1999; Murphy & Johnes, 2020). In particular, the "leverage points" may be identified using network analysis. Leverage points, when altered, have positive ripple effects throughout the system and therefore can evoke substantial changes in the system (Meadows, 1999). These leverage points may be the main target of interventions, promoting higher uptake of APF by consumers.

1.5 Study aims

The study aimed at mapping the system of the determinants of consumers' choices of alternative protein foods and exploring the associations between these determinants. In particular, we mapped the determinants and the relationships between these determinants across 13 European countries (Austria, Czech Republic, Denmark, France, Germany, Greece, Italy, Norway, Poland, Portugal, Slovenia, Spain, and Türkiye), and developed 17 systems maps (5 maps for Poland, 1 map per country for the remaining 12 countries).

The analysis focused on uncovering the leverage points that could shift the system towards a change in alternative protein choices by consumers. Furthermore, we also investigated the differences and similarities between countries in terms of the uncovered leverage points.

2. Method

2.1 Procedures

The research procedures were prepared using the principles of the Group Model Building (GMB), community-based system dynamics approach (CBSD), and elements of systems mapping procedures developed in the CO-CREATE Horizon2020 project (Savona et al., 2021; Savona et al 2023). Seventeen systems maps were developed in 17 systems mapping workshops, conducted in Austria, Czech Republic, Denmark, France, Germany, Greece, Italy, Norway, Portugal, Slovenia, Spain, Türkiye (1 map per 12 countries) and Poland (5 maps).

2.2 General models guiding the systems mapping workshops

Community-based system dynamics (CBSD; Hovmand, 2014) was applied as an overarching model, guiding the study design and procedures. This approach actively engages stakeholders in the challenge being addressed, positioning them as "experts" in how the system works, before identifying potential actions that could be taken to improve it (Hovmand, 2014). Group Model Building (GMB) is a structured format used in

CBSD that employs systems mapping to create causal loop diagrams (CLDs), which provide a graphic representation of the complexity of a problem's drivers (or determinants), from the food system stakeholders' perspective (Savona et al., 2021; Savona et al., 2023). GMB guides stakeholders to collectively map their perceived drivers of a complex issue (Hovmand, 2014; Karli & Miskolczi, 2019) and it encompasses a group representing their collective ideas in a CLD (a systems map). If developed using the CBSD model, systems maps are part of an iterative process of examining a dynamic hypothesis, to identify and revise postulated causal links and feedback, achieved during the consensus process involving all participating stakeholders engaged in the mapping (Savona et al., 2021; Savona et al., 2023). The CLDs can subsequently help participants identify potential intervention points to move the system toward achieving a more desirable state, for example, to increase consumers' preferences for alternative proteins.

2.3 Workshop preparation

In **Step 1**, the core research team (AL, AB, ZS, EK, HZ, AK, JM, all representing SWPS) developed the set of preparatory materials for the potential workshop participants (food system stakeholders) and the workshop facilitators from 13 European countries. The overall aim of developing and sending out the materials was to assure a similar level of evidence-based knowledge on determinants of consumers' choices among the stakeholders participating across the countries as well as among the workshop facilitators.

The preparatory materials for workshop participants (see Annex 1) included 5 sections: (1) the introduction to the LIKE-A-PRO project; (2) the definitions of alternative proteins to be discussed during the workshop, (3) a definition of systems mapping, (4) an example of a definition of a food system, (5) a list of the groups of determinants influencing alternative protein choices (e.g., marketing, economic factors, individual factors, etc.).

The preparatory materials for workshop facilitators (Annex 2) included: results of the review of literature conducted by the SWPS team, dealing with determinants such as nutritional considerations, health concerns, taste, economic factors, policies and other governmental instruments, major events that may cause disruptions in food system, etc. The materials also included references and full-texts of publications that present the state of the art in research on food systems mapping, modelling consumer nutrition behaviors and determinants of alternative protein choices. The facilitators were also familiar with the preparatory materials for workshop participants.

In **Step 2**, the research team adjusted the participant information sheet and the informed consent sheet developed in the LIKE-A-PRO project to the aims of the systems mapping workshops. The forms and invitations were sent in English or translated to country languages, depending on the decision of the local LIKE-A-PRO teams facilitating the workshops.

In **Step 3** the representatives of the SWPS team (ZS, EK, AL) developed a workshop manual (see Annex 3), providing a set of step-by-step instructions on how to conduct the systems mapping workshops. The manual explained the roles of facilitators, provided general rules of engagement, following the principles of participatory research, specified the overall research questions for the workshop, clarified the order and the timeline of the workshop preparations, and provided step-by-step instruction on how to conduct the workshop. The workshop manual was complemented by a set of PowerPoint slides (to be presented by the facilitators during the workshops).

STICKE (System Thinking In Community Knowledge Exchange) software was applied to visualize system maps and calculate network analysis. STICKE is an accessible tool developed to build casual diagrams (Hayward et al., 2020), offering the largest number of options for data analysis and data visualization, compared to other system mapping tools available. The tool has been successfully used in stakeholder research in the context of nutrition, obesity, and other public health issues (e.g. see Savona et al., 2021, 2023). The step-by-step instruction on how to use the STICKE software during the workshop to draw the connection

circle, add the determinants and connections, and how to transform the circle into a map was developed by EK from SWPS team (see Annex 4).

In **Step 4**, the core research team (HZ, AK, ZS, EK, JM, AB, MS, AL) developed a post-workshop survey (Annex 5) to collect the basic sociodemographic information (age, gender), information on stakeholder sector and years of work experience.

The sociodemographic and sector-related information was followed by the question to rate the importance of the groups of factors determining an increase of alternative protein choices in the respective stakeholder's country. The list included 28 determinants based on the review of literature presented in the preparatory materials for the workshop facilitators, developed in Step 1 (see Annex 6). The determinants included individual-level factors (beliefs), organization-level factors, and critical risk factors. The determinants also included items referring to food policies, following the Food-EPI taxonomy (e.g., referring to fiscal actions or education interventions) (Pineda et al., 2022). The responses to the 28 questions were provided on a 7-point scale ranging from "–3" (not important at all) to "+3" (extremely important). The survey, developed in English, was translated to national languages (Polish, German, Spanish, Greek, Norwegian, Slovenian, Turkish, Danish, and Italian) whereas Portuguese, French and Czech teams chose to use the English-language version.

In **Step 5**, the LIKE-A-PRO partners assigned 2 persons per each country to facilitate the workshops and started the internal process of identification of the potential workshop participants.

In **Step 6**, the SWPS team submitted the study protocol for evaluation of the Ethics Committee at SWPS University, Wroclaw, Poland. The study was approved (decision no. 01/E/03/2023), assuming the workshops will be overseen and supported by the SWPS LIKE-A-PRO team. MOREFORSKING team also sought the approval of their respective ethics committee, in line with the institutional guidelines (decision no. 301103, SIKT).

In **Step 7**, an online training workshop was conducted, with the SWPS team (ZS, EK) playing the role of the moderators and the involved LIKE-A-PRO partners acting as workshop participants. Besides the mapping procedures, the workshop included information on ways of using the STICKE software. The online training was recorded and made available for the facilitators to rehearse prior to the actual workshops.

In **Step 8** the LIKE-A-PRO teams recruited the stakeholders of the food system (representatives of food producers, food processors, policy makers, consumers, health care and education professionals working in the context of healthy diet promotion, representatives of NGOs operating in the food system, etc.).

In particular, each of the teams in 13 countries invited food system stakeholders that the teams have either knew of or collaborated with previously. The convenience sampling method was combined with a snowballing method of the recruitment. Those who were invited were asked if they can recommend another relevant stakeholder representative to participate in the workshop. The recruitment procedures assumed that each team should aim at recruiting at least 2 types of the key food system stakeholders to participate in the workshop(s) conducted in the country. Another guiding rule was to secure a balanced participation to avoid a dominance of one type of stakeholders over other type (i.e., avoiding one representative of NGO facing ten representatives of food producers).

The invitation was sent by an email or delivered in person, together with a standardized information about the LIKE-A-PRO project, information about the workshop content, procedures, dates/time and location, and informed consent forms (see Step 2). Those who agreed to participate received workshop preparatory materials (see Step 1), and a link/address to the workshop location.

2.4 Workshop procedures

Across 13 locations, the same workshop procedures were followed. The facilitators used a step-by-step manual (see: Step 3 in section 2.3; and Annex 3). All workshops were followed by post-workshop anonymous online survey (see: step 5 in section 2.3; Annex 5). The link to the survey was provided at the end of the workshop, using videoconference chat systems or by an email sent at the end of the workshop (as agreed with the workshop participants). In cases when less than 60% of stakeholders responded to the survey within a week after the respective workshop, the link was resent to all participants.

The workshops took place in person (Italy, Portugal, 2 workshops in Poland), or online using a teleconferencing software available to a respective partner e.g., TEAMS, MEET, ZOOM (Austria, Czech Republic, Denmark, France, Germany, Greece, Norway, 3 workshops in Poland, Portugal, Slovenia, Spain, and Türkiye). In France, the workshop had a mixed delivery format (some people online, some in person

The details of the facilitating teams and workshop dates are provided in Table 2.

Table 2. Systems mapping workshops' timeline, facilitators and the number of enrolled stakeholders.

Country	The name of organization/ Institution of the facilitating team	Names of Facilitator	Workshop dates	No. of participants	No. of participants present	No. of post-workshop surveys
Austria	LVA – Food Research Institute	Katharina Stollewerk	10 Oct 2023	11	11	11
Czech Republic	FFDI	Sarka Stejanarova	05 Dec 2023	16	12	7
Denmark	Food & Bio Cluster Denmark	Britt Sandvad	23 Nov 2023	54	13	6
France	ANIA	Ariane Voyatzakis	07 Dec 2023	16	16	16
Germany	Collaborating Centre on Sustainable Consumption and Production (CSCP)	Rosa Strube, Lisa Mai	09 Nov 2023	39	11	6
Greece	SEVT	Natassa Kapetanakou	21 Nov 2023	10	10	10
Italy	FEDERALIMENTARE – Federazione Italiana dell'Industria Alimentare e delle Bevande	Giorgia Sabbatini	27 Nov 2023	18	13	13
Norway	Møreforsking AS	Per Solibakke, Lisa Kolden Midtbø	21 Nov 2023	15	9	9
Poland (workshops 1-5)	SWPS	Hanna Zaleskiewicz, Ewa Kulis	11 Dec 2023 11 Dec 2023 12 Dec 2023 14 Dec 2023 19 Dec 2023	11 12 10 10 8	6 9 9 8 6	6 8 9 8 6
Portugal	FIPA	Isabel Cardoso	21 Nov 2023	11	11	10
Slovenia	CCIS-CAFE	Maja Oblak	28 Nov 2023	35	7	7
Spain	FIAB	Concha Ávila	30 Nov 2023	13	10	10
Türkiye	Türkiye Süt, Et, Gıda Sanayicileri ve Üreticileri Birliği Derneği (SETBİR)	Feyza Başak Coşkun	29 Nov 2023	30	8	8
Total				319	166	150

The workshops were initiated with participants being reminded about the workshop plan and its aims, followed by an individual exercise, including a brief re-reading of the preparatory materials and writing down 5 top determinants (selected individually by each stakeholder, during the preworkshop preparation). The group drew upon their pre-workshop homework and contributed an additional determinant per person, in consecutive order around the room. This first stage was where the participants built the dynamic factors that they believed drive consumers to choose alternative protein food. The facilitators used the STICKE software

to populate a shared screen with the potential determinants. By sharing their determinants, the participants were able to further prioritize the determinants which they had prepared, while adjusting to what has already been addressed on the screen until there was data saturation. The group worked to define each determinant as it was added to the screen for clarity. The resulting determinants formed a “connection circle” on the screen.

In the next phase, participants worked as a group to identify causal relationships between the determinants on the circle, with the facilitators eliciting the direction (positive or negative) of the relationship between the two determinants and discussed the direction with the workshop participants until reaching a consensus. The group also worked together to achieve a consensus regarding the robustness of the proposed relationships. After reaching the saturation point at which no further connections were proposed, the workshop facilitators used STICKE to transform the “connection circle” into an initial version of a systems map, representing the consensus views of the group resulting from the discussion. After a break, the continuing of the session involved revising the map through review and verification of the content of the map in terms of the determinants and proposed connections. The facilitators then guided a process to identify points in the map where interventions may help promote consumer choices of alternative protein foods and where feedback loops may contain particularly strong leverage points for action (Murphy & Jones, 2020a; Smith et al., 2022).

2.5 Participants

Of the 166 stakeholders who took part in the workshops, 150 provided their data (see Table 3). The remaining 16 stakeholders chose not to provide their responses to the post-workshop survey which was voluntary and anonymous.

Among those who provided their responses 39 men (26%) and 111 women (74%). Most participants were either 25-35 years old (31.3%) or 36-45 years old (27.3%); 26% were 46-65 years old. The remaining participants were 18-25 years old (12.7%) or older than 65 years old (2.7%).

The participants represented various food system stakeholder and sectors, with the majority working in food production, including: food processor industry (22.7%), food ingredients industry (6.7%), industrial agriculture and aquaculture (6.0%), or food industry companies combining food production with technology development and food research (12.0%). Other participants represented: education and scientific research sector (16.0%), young consumers (aged 18-19 years old; 8.7%), health care sector, in particular clinical nutrition (12.7%), retail and catering (5.3%), NGOs supporting consumer rights (3.3%), governmental agencies, including food industry regulators, commerce chambers, consumer rights protection chambers (3.3%), marketing (2.0%). The remaining 1.5% indicated other sectors. Across the countries, the workshops involved representatives of at least 3 sectors, except for Italy where all participants represented food production, and Poland, where 3 workshops were conducted with heath care (clinical nutrition) sector representatives being the majority (19 out of 24 participants) and 2 workshops conducted among young consumers (13 participants).

The stakeholders (other than young consumers) indicated that their work experience in their food system-related jobs was up to 5 years (31.5%), 30.6% reported 6-15 years of experience, and 29.1% indicated 16 or more years of experience (9.5% did not provide their data).

The overview of the characteristics of stakeholders is presented in Table 3.

Table 3. Characteristics of workshops' participants across 13 countries.

Country	No. of participants	No. of participants who responded to the survey	Gender	Age range	Years of work
Austria	11	11	5 M; 6 F	26-35 – 27% 36-45 – 36% 46-55 – 36%	1 – 5 – 9% 6 -10 – 9% 11-15 – 27% 16-20 – 45% >20 – 9%
Czech Republic	12	7	1 M; 6 F	18–25 – 14% 26-35 – 28% 36-45 – 28% 46-55 – 14% 56-65 – 14%	<1 – 42% 1-5 – 14% 11-15 – 14% 16-20 – 14% >20 – 14%
Denmark	13	6	3 M; 3 F	26-35 – 16% 36-45 – 33% 56-65 – 16% >65 – 33%	1-5 – 33% 6-10 – 33% 11-15 – 16% >20 – 16%
France	16	16	16 F	18-25 – 6% 26-35 – 12% 36-45 – 50% 46-55 – 6% 56-65 – 25%	1-5 – 25% 6-10 – 12% 11-15 – 6% 16-20 – 25% >20 – 31%
Germany	8	6	2 M; 4 F	18-25 – 16% 26-35 – 50% 36-45 – 33%	1-5 – 66% 6-10 – 16% 16-20 – 16%
Greece	10	10	4 M; 6F	26-35 – 40% 36-45 – 20% 46-55 – 10% 56-65 – 30%	1-5 – 40% 6-10 – 10% 16-20 – 20% >20 – 30%
Italy	13	13	5 M; 8F	26-35 – 30% 36-45 – 38% 46-55 – 15% 56-65 – 7% >65 – 7%	-
Norway	9	9	3 M; 6F	26-35 – 44% 36-45 – 22% 46-55 – 22% >65 – 11%	<1 – 11% 1-5 – 22% 6-10 – 33% >20 – 33%
Poland	38	37	5 M; 32 F	18-25 – 43% 26-35 – 32% 36-45 – 13% 46-55 – 10%	<1 – 21% 1-5 – 29% 6-10 – 21% 11-15 – 24% >20 – 2%
Portugal	11	10	2 M; 8 F	36-45 – 20% 46-55 – 50% 56-65 – 30%	1-5 – 10% 11-15 – 10% 16-20 – 20% >20 – 60%
Slovenia	7	7	2 M; 5 F	26-35 – 28% 36-45 – 57% 46-55 – 14%	1-5 – 42% 11-15 – 28% >20 – 28%
Spain	10	10	5 M; 5 F	26-35 – 60% 36-45 – 10% 46-55 – 20% 56-65 – 10%	1-5 -60% 6-10 – 10% 11-15 – 10% >20 – 20%
Türkiye	8	8	2 M; 6 F	26-35 – 50% 36-45 – 25% 46-55 – 25%	1-5 – 25% 6-10 – 37% 11-15 – 37%

Note: 17 workshops, including 5 in Poland and 12 in each of the 12 remaining countries; F = female gender, M = male gender.

2.6 Data analysis strategy

The structure of the systems maps may be analyzed using network analysis methods to identify 4 indicators of centrality: (1) eigenvector, with high values representing the leverage points in the system; (2) degree, with high-degree elements indicating the system elements that are sensitive to change; (3) closeness, with high values representing resilient elements; and (4) betweenness, with high values representing bottlenecks/gateways into the system (Murphy & Jones, 2020). As there are no absolute cut-off scores for centrality measures, we followed common practice with other systems maps reporting and highlighted the determinants with the largest centrality scores as critical centrality points (Murphy & Jones, 2020). The primary analysis focuses on 3-4 determinants of the highest centrality values. Four determinants were reported if the third and fourth determinants of the highest values were of close values (e.g., 0.33 and 0.32) with the fifth (and the following) determinants having lower values (e.g., 0.18). In case the fourth determinant was already of a lower value than the third (e.g. 0.40 for the 3rd determinant, 0.22 for the fourth), only 3 determinants were reported and analyzed further.

Due to recent criticism of the centrality measures other than eigenvector (Crielaard et al, 2023), the primary analysis focuses on determinants that had the highest values of the eigenvector coefficient, that is the leverage points. The eigenvector index accounts for the direct and indirect connections between a respective determinant and other determinants in the system (Murphy & Jones, 2020). However, a determinant that is well-connected by any metric may seem to have high centrality, but it may be well-connected to weakly-connected elements. The eigenvector centrality indicator recognizes that not all neighboring determinants are equivalent in terms of their centrality and assesses whether the given determinant is well-connected to other well-connected elements (Murphy & Jones, 2020). Eigenvector centrality is found by summing the relative eigenvector centrality scores of all the neighboring determinants. Thus, eigenvector centrality indicates how well-connected a given determinant is to other well-connected determinants (Murphy & Jones, 2020).

Values of the other types of centrality measures, that is degree, closeness, and betweenness, are also reported in Supplementary Table 2. Network analysis was conducted with STICKE 3.0 software.

After conducting the network analyses, the consumers' choices indicators which were included in the maps, namely "acceptability of AP", "willingness to consume AP" and "preference for APF", all of which were defined as "intention/willingness to consume APF" were removed from the final list of the leverage points. "APF product purchase" was also omitted from analyses. This decision was made because all workshop moderators were instructed not to include the consumer choice indicators (willingness/intention to eat/buy APF, or the actual intake of APF). Excluding the key outcome (here, the indicator of APF choices by consumers) from the system maps is in line with the approach used in earlier complex system mapping research, using network analysis to identify the leverage points (Hayward et al., 2020, McGlashan et al., 2016; Savona et al., 2021, 2023). he maps were assumed to represent the determinants only, not the consumers' choice indicators themselves, such as acceptance/willingness to eat.

Regarding post-workshop survey analysis, descriptive statistics and between-group comparisons for dependent samples (t-test) were conducted with IBM SPSS Software v.29.

3. Results

3.1 Results form systems mapping

The maps developed during the 17 workshops included between 10 and 34 determinants. In sum, there were 336 identified determinants (M=19,76) (Austria=12; Czech Republic=10; Denmark=23; France=23; Germany=19; Greece=17; Italy=14; Norway=34; Poland 1st workshop=23; Poland 2nd workshop=17; Poland

3rd workshop=26; Poland 4th workshop=20; Poland 5th workshop=17; Portugal=21; Slovenia=23; Spain=23; Türkiye=14). Supplementary Table 1 reports the full list of the determinants included in each map in each workshop and the definitions of the respective determinants, provided by the stakeholders.

The 17 maps are presented in Supplementary Table 2. A high heterogeneity of the maps shows differences between the countries, between European regions (North, East, South, and West) as well as differences within a country (for the 5 maps obtained in systems mapping workshops in Poland).

The analysis presented in this deliverable (D.1.3) focuses on the leverage points, representing the determinants that are most likely to trigger the change in the whole system (Meadows, 1999; Murphy & Johnes, 2020). Leverage points, when altered, have positive ripple effects throughout the system (Meadows, 1999). Therefore, leverage points may be the main target of an intervention: if altered, the leverage point could promote the target behavior (Meadows, 1999; Murphy & Johnes, 2020), that is a higher APF intake. Below we discuss the determinants that were identified as the leverage points in at least 3 out of 17 systems maps (see Table 3).

3.2 Formal and Experiential Knowledge about APF and educating consumers about APF

Knowledge about alternative proteins is the type of a leverage point found most frequently across the systems maps. Limited knowledge or low "APF literacy" was identified as a leverage point in eight maps (Denmark, France, Germany, Greece, 3x Poland, Portugal; see Table 3). The definitions of the determinants indicate that the workshop participants referred to limited alternative protein food-literacy, low knowledge about how to prepare/cook a meal with alternative proteins, and low dissemination of knowledge about the alternative proteins. The findings indicate relevance of conceptual knowledge of APF, that is, understanding of ideas, attributes, and procedures, related to APF (Borkman, 1976; Gorzelsky, 2013).

Familiarity with the product, which encompasses personal experience of attributes of the specific food, was also indicated in the systems maps. This type of knowledge is known as experiential knowledge. (Borkman, 1976; Gorzelsky, 2013). Familiarity with APF was identified as the leverage point in maps developed in Germany and Greece. Importantly, knowledge about ways to cook/prepare APF (e.g., indicated in the Danish map) may be a determinant which encompasses both formal and experiential knowledge about APF.

Finally, actions aiming at the dissemination of knowledge by means of education policies or interventions, delivered by institutions or organizations were identified as the leverage points in two systems mapping workshops in Poland.

3.3 Social encouragement and social norms

The next type of leverage points referred to social approval and social norms. In particular, approval of APF by important others (e.g., family, friends, admired models) and beliefs that APF choices are something that important others do, and what is popular and "trendy" among important others, were found most frequently (see Table 3). Beliefs about family habits and family suitability were indicated in France and Denmark, social norms in Germany, trends defined as popularity of trying APF by important others were identified in the map developed in Portugal. Social encouragement to choose APF or perceiving eating APF as a social norm (a behavior popular among important others) were indicated in 3 maps developed in Poland. In sum, seven maps included factors referring to social encouragement and social norms.

3.4 Advertising, promotion, and actions of influencers

Four maps included marketing advertising and/or promotion of APF as the key leverage points (Czech Republic, Italy, Spain, Türkiye; see Table 3). Promotion was defined as campaigns encouraging APF consumption (other than education campaigns), delivered by organizations, institutions or governments/local authorities. Furthermore, the promotion of APF by influencers was identified as a leverage point in three additional maps, one developed in Slovenia and two developed during workshops conducted in Poland. Overall, six maps included leverage points referring to advertising and formal promotion/marketing efforts, delivered by institutions, organizations, or influencers.

3.5 APF as an example of healthy, balanced diet and a safe product

Four maps include leverage points related to the content of APF which can be perceived as an example of choosing a healthier, and balanced diet. These maps were developed in, Austria, Italy, Portugal, and Türkiye. A lack of harm (healthiness and safety) related to the product may be also a key component of trust in producers of APF, indicated as the leverage point in Portugal and regulations around APF indicated in Norway. In sum, various health and safety issues (including consumers' beliefs about healthiness, the actual nutrition content, and the regulations regarding the content of APF) may be considered leverage points in six maps (see Table 3).

3.6 To approach or to avoid? Curiosity versus and fear of novelty

Neophobia (fear of novel, unknown food) and being curious about unknown food were indicated as the leverage points in four maps, including the Czech Republic, Germany, Italy, and Poland. For details see Table 4.

3.7 Food culture-related factors

Maps in three countries indicated that national culture and a presence/a lack of APF in the national culture/cuisine is a crucial determinant of consumers' choices of APF. Culture-related factors were leverage points in Greece, France, and Denmark. For details see Table 4.

3.8 APF as ultra-processed food

The potential barrier may refer to the perception of APF as ultra-processed food. Recognition of APF products as ultra-processed food was identified as the leverage point in three maps, developed in Austria, Norway, and Spain (cf. Table 4).

3.9 Environmental and sustainability issues

Leverage points referring to the environmental benefits of including APF in the diet were identified in three maps (Italy, Norway, Türkiye; cf. Table 4).

3.9.1. Animal welfare/ethics of refraining of eating traditional meat

Respective leverage points were identified in three maps. One was developed in Türkiye and two in Poland (cf. Table 4).

Table 4. Results of network analysis: the leverage points of consumers' choices of APF.

Country	Determinants with the highest values of the centrality measure (Eigenvector)
Austria	Ingredient overload in APF products = 0.49; Health effects of APF products = 0.49; Nutritional factor of plant proteins (PER) = 0.41; Ultra-processed foods = 0.41
Czech Republic	Fear of the unknown = 0.58; Price = 0.49; Promotion and advertisement of AP= 0.45
Denmark	Family suitability = 0.49; Danish food culture = 0.38; Knowledge of preparation = 0.38
France	Use & habits (cultural familiarity and tradition, family habits) = 0.51; Education (about how to cook) = 0.45; Visual representation /presentation/ perception of the APF product= 0.35
Germany	Familiarity (opposite to fear of new products) = 0.32; Availability = 0.36; Social norms = 0.36
Greece	Familiarization with APF (culture-related factor) = 0.47; Educational level (low cognitive ability and rigidness in food choices) = 0.37; Age = 0.26
Italy	Advertising = 0.43; Curiosity = 0.38; Environmental impact = 0.32; APF intake perceived as good and balanced diet = 0.32
Norway	Regulations for products with APF= 0.28; Climate, nature and environment effects of APF= 0.28; Degree of processing of APF= 0.26
Poland (1st workshop)	Nutritional diversity (dietary habits rich in various types of proteins) = 0.35; Popularity of APF(social encouragement, social norm) = 0.35; Positive attitude towards (e.g. ethics of not eating meat) APF= 0.35
Poland (2nd workshop)	Educating consumers about APF= 0.44; Norms of APF in terms of USP*= 0.37; Social approval = 0.37
Poland (3rd workshop)	Popularity of products with APF(social encouragement, social norm) = 0.47; Trend for the consumption (due to influencers) = 0.32; Knowledge about APF= 0.30
Poland (4th workshop)	Readiness for culinary variety = 0.37; Disgust = 0.33; Product availability = 0.32
Poland (5th workshop)	Dissemination of knowledge about APF= 0.33; Normalization of the APF topic in mass media/social media = 0.32; concern for welfare of livestock = .26
Portugal	Trust (of consumers in APF) = 0.44, Social trends (popularity of trying APD) = 0.40; Literacy about APF = 0.36, Nutritional profile of APF = 0.35
Slovenia	Taste = 0.39; Influence of influencers = 0.3. advertising = 0.32
Spain	Promotion of consumption = 0.50; Lack of knowledge = 0.37; Perception of ultra-processed = 0.28
Türkiye	Preference of APF due to health, environment and ethics = 0.49; Marketing influencing consumer perception = 0.35; Taste = 0.30

*Note. *USP is a uniqueness of a product (unique selling proposition; the essence of what makes your product better than competitors).*

3.10 Results from the post-workshop survey: the perceived importance of food system policies, relevance of food system stakeholders, and importance of multi-level determinants

Data from the post-workshop survey complemented the results of systems mapping. Small sample sizes obtained across 13 countries do not allow for conducting a reasonably powered between-country comparisons, assuming effects of medium sizes. Therefore, we conducted the analysis for the whole sample of workshop participants. Paired t-tests for dependent samples were conducted to compare pairs of determinants and establish if the differences were significant. The analyses focus on findings obtained for:

- 10 types of food system policies;
- beliefs, knowledge and actions of four types of food system stakeholders (consumers, policy makers, producers, retail representatives);
- the roles of micro-, meso- and macro-level determinants referring to the individual level (e.g., disposable income in families), organizational level (e.g., costs of introducing new types of food by producers), national level (e.g., political elections, major events such as the pandemic), referring to social, economic, political, climate, infrastructure, major crises, etc.

3.11 Comparisons within the three groups of determinants: which policy is the most important, who is the most important actor, which micro-, meso-, and macro-level determinants are most important?

Across the food system policies included in the survey (see Figure 1), respondents rated importance of all policies as significantly higher than 0 (0 was representing the response "neutral for the uptake of alternative proteins in my county"), all *p*s <.050. Mean values for the rating of importance of respective policies (response ranging from -3 [not important at all], to +3 [extremely important]) and their 95% confidence intervals (represented by whiskers for each bar) are displayed in Figure 1.

Two types of policies (advertising policies, food composition policies) were rated as significantly more important for the uptake of alternative proteins than taxation policies, other fiscal policies, food retail regulation policies, and public procurement policies (e.g., referring to providing products at schools, etc.), all *p*s < .05. Taxation policies were also rated as less important than food marketing and food education policies, all *p*s < .05).

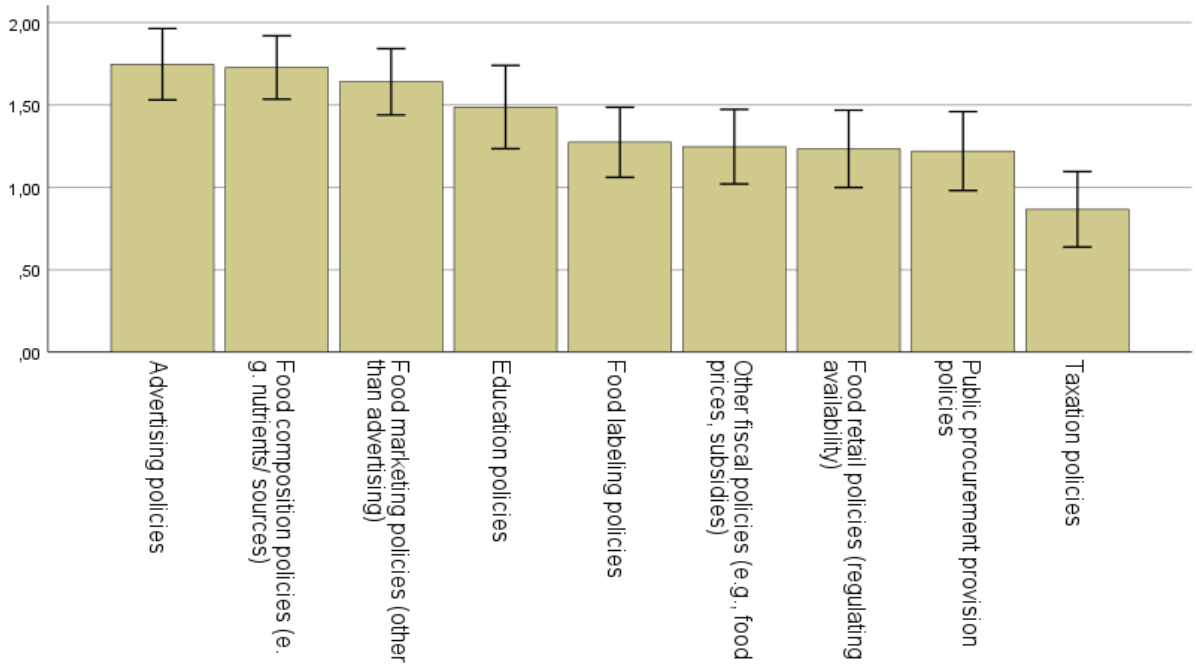


Figure 1. The importance of food system policies rated by participants of 17 workshops.

Regarding the importance of actions, beliefs, and knowledge of 4 groups of food system stakeholders (policymakers, consumers, food industry, retail), the respondents enrolled in 17 workshops indicated that the consumers are the most important drivers of the uptake of alternative protein food in their country (see Figure 2). In particular, the importance of the consumers' knowledge, beliefs, and actions was significantly higher, than those of policymakers, producers, and retail representatives, all *p*s < .05.

It should be noted that input from all 4 types of food system stakeholders was evaluated as "important". Considering the rating of the importance of the 4 types of stakeholders, the mean values for the importance of their roles were significantly different from 0 (indicating a neutral influence), all *p*s < .05). The mean values and 95% CI for standard errors (represented by whiskers) for the importance of beliefs, knowledge, and actions of the four groups of stakeholders are displayed in Figure 2.

Furthermore, the mean value of the importance of consumers' beliefs, knowledge, and actions was higher than the mean value of any food system policies (Figure 1) accounted for in the survey (all *p*s <.05), and significantly higher than the importance of the highest-valued multi-level determinant, disposable income, $p < .05$ (see Figure 3).

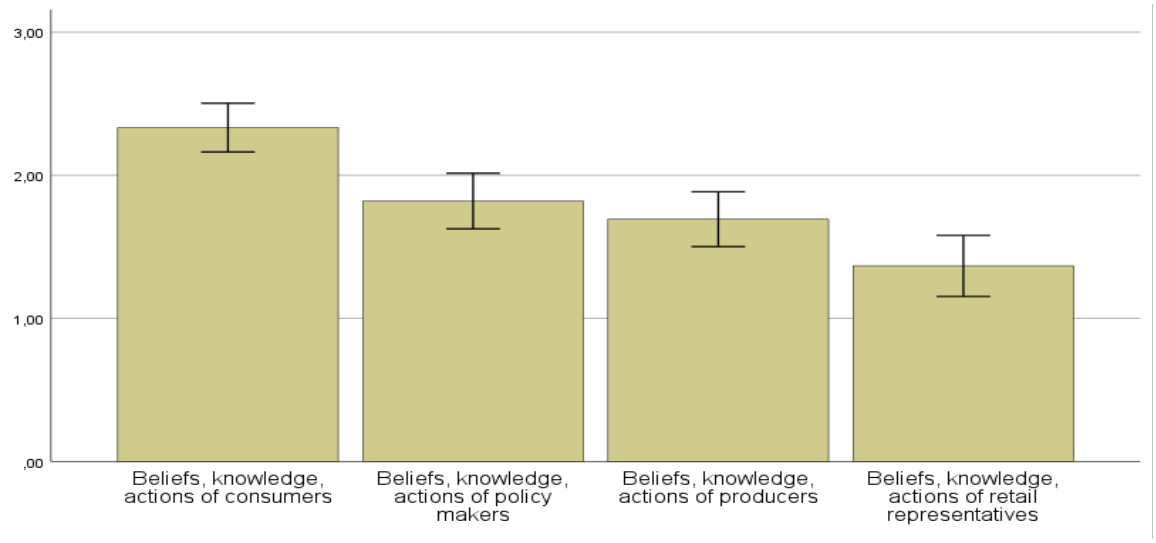


Figure 2. The importance of beliefs, knowledge and actions of food system stakeholders rated by participants of 17 workshops.

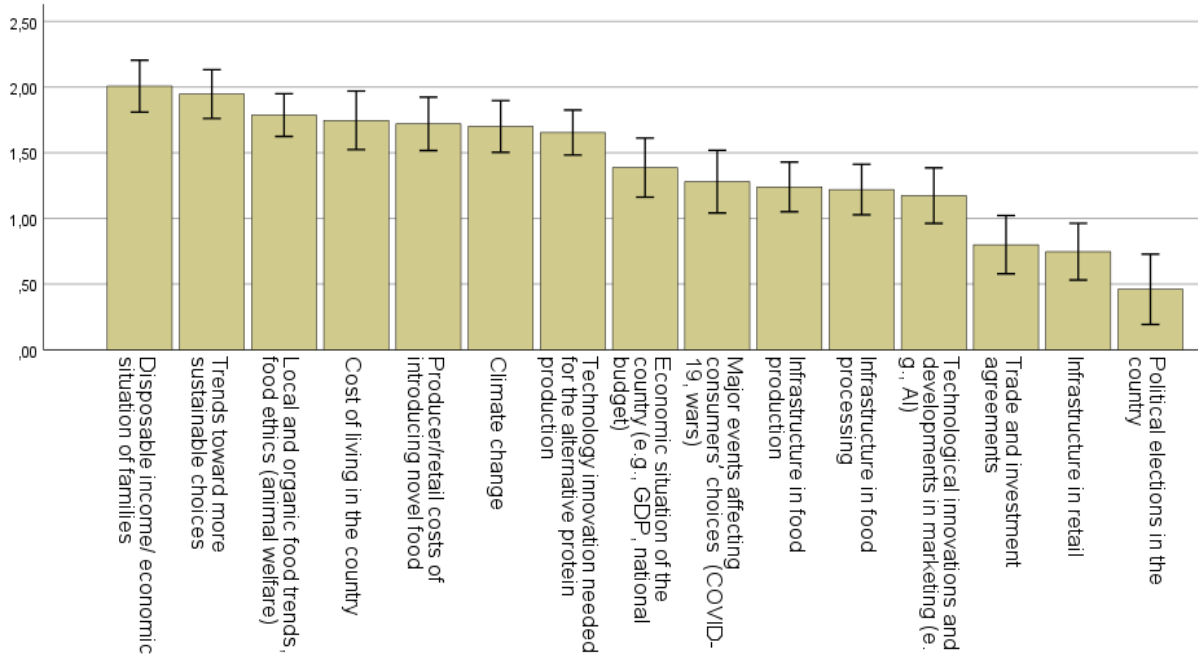


Figure 3. The importance of macro-, meso- and micro-level determinants representing economic, sociocultural, political, organizational, climate and major crises-related determinants, rated by participants of 17 workshops.

Finally, workshops' participants rated the importance of 15 multi-level determinants referring to the individual level (e.g., disposable income in families), organizational level (e.g., costs of introducing new types of food by producers), national level (e.g., political elections), referring to social, economic, political, climate,

infrastructure, major crises, etc. Figure 3 presents means and 95% CI for standard errors, calculated for the determinants included in the analyses.

Micro-level economic factors, such as disposable income in families and costs of living in the country were among the determinants that were rated the highest, with organizational level economic factor, producer/retailer costs of introducing novel food also included in the group of the top 6 factors that had the highest importance scores (see Figure 3). The list of top determinants also includes macro-level sociocultural determinants, such as "food trends", including local/ and organic food trends, trends highlighting food ethics, trends towards sustainable choices and, finally, a macro-level factor, the climate change.

The importance of the top 6 factors was rated significantly higher (all *p*s < .05) than the importance of 6 factors that received the lowest importance scores. In particular, the lowest importance scores were obtained for three meso-level infrastructure- and technology-related determinants, namely infrastructure in retail, food processing and food production, as well as novel technological developments (such as AI). Relatively limited importance was also reported for macro- and meso-level policy determinants, such as trade and investment agreements, and political elections (see Figure 3).

It should be noted that all determinants were evaluated as of significant importance by the workshop participants. Across the 15 determinants, the mean values for the importance of their roles were significantly different from 0 (indicating a neutral influence), all *p*s < .05.

3.12 Do stakeholders from different sectors perceive distinct determinants as important?

The final set of analyses compared the importance of all analyzed determinants (k = 27) across three groups: stakeholders representing the food production industry (n = 71), young consumers (n = 13), and healthcare sector representatives – clinical nutrition specialists (n = 19). These three groups were the largest and homogeneous in variance of respective determinants.

The analyses (conducted with the LSD test) indicated a consistent pattern, in which the healthcare sector representatives scored higher than either food producers or consumers, assigning a higher importance to respective determinants. Overall, 81 comparisons were conducted and only 7 yielded significant effects.
In particular healthcare sector representatives (clinical nutritionists) indicated:

- higher importance of policymakers, (MSD = 1.37, p = .007), when nutrition specialists were compared with young consumers;
- higher importance of food composition policies (*MSD* = 0.90, *p* = .020), when nutrition specialists were compared with the food production industry
- higher importance of advertising policies (*MSD* = 1.37, *p* = .019), when nutrition specialists were compared with young consumers;
- higher importance of marketing policies, when nutrition specialists were compared with young consumers representatives (*MSD* = 1.43, *p* = .002) and food industry representatives (*MSD* = 1.24, *p* < .001);
- higher importance of taxation policies when nutrition specialists were compared with food producers (*MSD* = 0.95, *p* = .046) and young consumers (*MSD* = 1.77, *p* = .002);
- higher importance of education policies (*MSD* = 1.14, *p* = .005) when nutrition specialists were compared with food producers;
- higher importance of political elections (*MSD* = 1.24, p = .027); when nutrition specialists were compared with food producers.

4. Discussion

This study provides novel insights into the determinants of alternative protein food choices among consumers. The insights were obtained by conducting systems mapping workshops among the food system stakeholders from 13 European countries. The systems maps and post-workshop surveys allow us to draw conclusions regarding the key leverage points in the system of determinants of APF choices and the determinants that are rated as most important for the changes in APF uptake.

The maps developed across countries (and within the country where 5 workshops were conducted) are characterized by high heterogeneity of the determinants included, differences in connections between determinants, and a variety of feedback loops that may either balance the system or push the respective systems towards a change in APF uptake. The systems maps may be considered as case studies, providing information about the interplay of determinants, that may be specific for the country. On the other hand, the analysis of the leverage points that were most frequently found in systems maps does not indicate specific geographic patterns. We did not observe an emergence of distinct leverage points in one European region, compared to another European region (e.g., south vs. north). In particular, the two most frequently indicated leverage points (knowledge and social norms/social encouragement) were identified in maps developed in Northern, Eastern, Southern, and Western European countries (for the regions' definition see United Nations, 2009).

The detailed discussion of the specificity of each of the 17 maps (the types of determinants, connections, and feedback loops) is beyond the scope of this report. Instead, we focus on similarities in leverage points, which may be found across the systems maps.

4.1 The leverage points, most frequently found in systems maps

One of the ways to synthesize the findings for the patterns of the associations within maps refers to identifying the so-called leverage points. Leverage points (as indicated by the highest eigenvector index values) represent the determinants that are well-connected to other well-connected determinants in the respective system (Murphy & Jones, 2020). It may be assumed that if the determinants constituting the leverage points are altered, such alterations have ripple effects throughout the system (Meadows, 1999). Thus, the leverage points may be the main target of interventions promoting higher uptake of APF by consumers.

Knowledge-related determinants were the most frequently identified leverage. As defined by the workshops' participants, knowledge is a broad concept and refers to recognizing, differentiating, and defining alternative proteins, and knowledge of APF (nutritional) characteristics. Research on health-related or information-related knowledge coined the terms "health literacy", and "digital literacy". In line with this approach, the type of formal knowledge identified in the systems maps could be called "alternative protein food literacy".

Second, the findings indicate that the procedural aspects of APF knowledge, that is knowing how to cook/prepare a meal with APF, also emerged as a relevant leverage point. These findings are in line with research suggesting that cooking/preparation skills were identified as a viable individual-level determinant of consumer choices of APF (cf. Deliverable 1.1; Zaleskiewicz et al., 2023a- submitted).

The third aspect of knowledge which emerged as a relevant leverage point refers to familiarity with APF products. Familiarity is usually developed during multiple exposures to the product which results in developing a personal representation of attributes of the specific product (Borkman, 1976; Gorzelsky, 2013). In contrast to formal knowledge, familiarity has an affective component (e.g., liking), which may increase the motivational impact of this type of knowledge on the adoption of APF.

Finally, the knowledge-related leverage points referred to organizational/institutional-level efforts to increase understanding what APF is. This determinant may include education policies or actions undertaken

by organizations/institutions active in a respective community (i.e., macro-level actions or meso-level actions). Food education policies and interventions are among the popular policy solutions (Pineda et al., 2022). However, improving physical food environments (e.g., food presentation in retail setting) has been found more effective in changing behaviors among vulnerable populations or people with low socioeconomic position. Policies highlighting individual's responsibility (such as nutrition education campaigns), are more feasible and effective in changing behaviors of people who have high socioeconomic resources (cf. Pineda et al., 2022). Thus, education policies, focusing on formal knowledge and on individuals' responsibility for food choice, should not be implemented as the sole solution, but accompanied by other policies, for example focusing on environmental and structural changes, which prompt consumers' choices without investing a self-regulatory effort. Using education policies focusing on formal knowledge alone (i.e., APF literacy) may increase social inequalities in dietary habits.

The findings referring to knowledge aspects, as the leverage points, may have practical implications. APF literacy campaigns and education programs on what APF is (promoting "APF literacy") should include actions facilitating procedural and experiential knowledge: information on how to prepare a meal with APF, combined with APF sensory experience (observing and trying APF). Such complex interventions and policies may have a potential to trigger the change in food system determinants.

The second type of leverage points refer to social approval of APF intake, encouragement by important others (such as family members) and positive social norms (i.e. perceiving that important others approve of APF and that they are willing to consume APF themselves). These social determinants highlight the importance of behaviors and beliefs of members of close social networks. Previous systematic reviews (cf. D1.1, cf, Zaleskiewicz et al., 2023a-submitted) provided strong evidence for the links between social norms and consumers' choices of APF. A recent review of research addressing physical environment (D.1.2, cf. Zaleskiewicz et al., 2023b-submitted) suggested that the social norms and social encouragement by an important other (e.g., a romantic partner) may prompt unwilling young consumers to try new APF in a restaurant. Earlier studies (reviewed in D1.1 and D1.2), however, focused on direct associations between social approval/norms and APF choice indicators, whereas the present study suggests that the respective social determinants may effectively trigger a change in the system of other determinants of APF intake. Practice implications may refer to using messages highlighting the social acceptability of APF by important others and indicating that consuming APF is a social norm and a socially appreciated behavior.

Social influence strategies are also central for the third group of leverage points identified in systems maps, such as influencers' actions, advertising, and promotion campaigns. The stakeholders participating in systems mapping workshops indicated that leverage points in food system determinants include these types of planned/structured/organized forms of social influence, delivered not via consumers' social networks but via mass-media, in retail settings or via social media.

Concluding, 17 systems mapping workshops conducted across 13 countries suggest at least three types of leverage points which are well connected with other well-connected determinants in the system of predictors of consumers' choices of APF. These leverage points were shared by at least 6 out of 17 maps. They address knowledge (APF literacy, procedural knowledge on how to prepare meals with APF and experiential knowledge to increase APF familiarity), social norms and social encouragement (by the important others in the consumer's own social network), and the use of social influence strategies in APF advertising and promotion campaigns (delivered by institutions, organizations, or influencers).

4.2 Key micro-, meso- and macro-level determinants and key food polices operating in food systems

The findings from the post-workshop survey conducted among the stakeholders, complement the results obtained in the systems mapping. Regarding the food system policies, advertising policies and food

composition regulations were indicated as the most important determinants of the increased uptake of APF. These two were followed by marketing policies and education policies. The results of the survey are consistent with the results of systems mapping. The survey included a list of nine types of food policies, accounted for in the Food-EPI taxonomy of food system policies (Pineda et al., 2022). However, the stakeholders participating in the survey consistently indicated the highest importance of the same types of policies as those which were found to constitute the leverage points in the systems maps. Although regulations on food composition were among leverage points less frequently identified in systems maps, various APF healthiness and safety issues were identified as the top leverage points in four maps.

Regarding specific micro, meso-, and macro-level factors the highest importance for the increase of APF intake was assigned to three economic factors, including disposable income in families, costs of living in the country, and producer/retailer costs of introducing novel food. The price of APF products was also among most consistently mentioned determinants across all systems maps: it was included into 17 out of 17 maps, but it was the top interconnected determinant (i.e., a leverage point) only in one map, developed in Czech Republic. Thus, although economic factors may not constitute the leverage points identified across the food systems, micro- and meso-level economic factors should certainly be taken into consideration in future actions promoting APF uptake. It should be noted that groups of lower socioeconomic position may be more price-sensitive, therefore they may be more likely to change purchase patterns in response to price changes, taxation, or subsidy policies (Lovhaug et al., 2022). Future policies promoting APF may include fiscal strategies (e.g., subsidizing APF, taxation of traditional proteins) or public procurement policies (e.g., regulations on inclusion of APF into food catered/sold in schools). Taxation policies, such as sugar-sweetened beverages taxes received preliminary support in changing people's nutrition habits and their health outcomes (such as obesity) (cf. e.g., Gracner et al., 2022). It is possible that using fiscal policies to promote APF may also shift intake of APF across groups of consumers varying in socioeconomic position, similarly to the effects observed after the introduction of sugar-sweetened beverages taxes.

Besides economic factors, stakeholders participating in the systems mapping workshops assigned the highest importance to local/ and organic food trends, trends highlighting food ethics, and trends towards sustainable/climate protection choices. Food ethics and sustainability issues also emerged among the leverage points in at least three systems maps. Beliefs referring to food ethics/animal and sustainability beliefs are among the beliefs which are the most consistently associated with APF choices, as indicated in a systematic review conducted by Zaleskiewicz et al. (2023a-submitted, see also D 1.1).

4.3 The importance of beliefs and actions of consumers compared to other food system stakeholders

The findings of the post-workshop survey suggest that workshops' stakeholders believe consumers to be more important food system stakeholders than retailers, producers, or policy makers. Regardless of the type of stakeholders providing their opinion, consumers were consistently indicated as the most important. Furthermore, consumers beliefs, knowledge, skills and actions were rated as more important than any policies or other meso-level or macro-level determinants. These findings might suggest the stakeholders' responsiveness to consumer needs.

The stakeholders' confidence in the importance of consumers beliefs and actions should be placed in the context of relatively low purchase and intake of APF in Europe, as well as APF-related retail practices across Europe. In particular, producers and retailers of APF may await for the signs of interest from consumers (appreciating that the consumers' actions are the most important determinants of how to promote/sell APF). For plant-based APF previous research found that supermarket retailers await clear demand signals before introducing new APF products (Brooker et al., 2021). Furthermore, retailers believe that placing APF such as plant -based meat substitutes away from meat sections may address the concerns of vegetarians and vegans

(Brooker et al., 2021). Such beliefs and actions of retailers ("we do it, because consumer' beliefs and preferences are the most important") may lead retailers to presenting plant-based APF in "hidden" sections of supermarkets and groceries. Research on consumer behavior, conducted in experimental food sale outlets indicate that placement of APF on shelves with vegetarian food or in fruit and vegetable departments results in lower sales of APF, while higher sales occur when APF are placed in the meat section (Vandenbroele et al., 2021). Besides, an increase in APF sales is also achieved when presenting sandwiches with plant-based APF in: the same refrigerator, next to sandwiches with meat (compared to a separate refrigerator), or in the refrigerator visible from the shop entrance (versus with its back to the entrance) (Vandenbroele et al., 2021).

To conclude, in the current context of low purchases of APF, some of the stakeholders' conviction that consumers may hinder the uptake of APF, unless the sales strategies are based on consumer research rather than on stakeholders' beliefs about consumers.

4.4 Limitations

The systems maps developed in this study were of very high heterogeneity, in terms of included determinants, the connections between them, and the identified leverage points. Within-country differences were also present, as suggested by findings obtained in 5 workshops, conducted in Poland. The chosen approach of systems mapping data analysis, focusing on calculating eigenvector centrality indices, has its limitations and it provides no insight into more complex associations. These may be elucidated by a qualitative analysis of feedback loops, which better represent the system characteristics and its non-linear, circular associations (Crielaard et al, 2023).

The systems mapping approach represents knowledge, beliefs, and experiences of the stakeholders participating in the workshop. Small samples and a lack of representativeness of the stakeholders (for the overall national networks of food system stakeholders) are another limitation, that hinder any generalizations. Systems mapping may be considered a first step to more complex research, which, in the end, should inform policy and intervention practices.

The findings for 17 systems maps, presented in this study, focus on between-country similarities. National-level policies and the interventions should be informed rather by within-country findings, which are not systematically analyzed in this study.

Last but not least, D1.3 focuses on empirical analysis of the complex system using consumers' actions and beliefs as the key entry points allowing to understand the interrelations between various elements and stakeholders, jointly shaping the food systems in each European country. Therefore, we were able to characterize only a part of the food system, its elements and associations, whereas the elements and activities of other food system stakeholders were not investigated, if they were not directly related to the actions, perceptions, or beliefs of the consumers.

Translating the findings presented in D1.3 into practice requires further studies elucidating the key actions of other food system stakeholders (food producers and processors, retailers, marketing specialists, policy makers, etc.), that may constitute "the leverage points," facilitating the system change. Addressing the "leverage points" that represent the actions of *all* food system stakeholders may substantially increase the likelihood of a food system transformation, characterized by a switch from traditional proteins to alternative proteins in everybody and everywhere, followed by a maintenance of new food habits (represented by common choices of alternative proteins) among consumers.

5. Conclusions

Regardless of the limitations, this study offers new insights into the complex systems of the determinants of APF choices. Seventeen systems maps drawn by the stakeholders in 13 European countries indicate a variety of individual-level factors, environmental, social, and economic factors as well as policies that are interrelated and may prompt a change in the system or balance the system, promoting its status quo. The analyses addressing the so-called leverage points (the determinants which are well-connected with other well-connected determinants in the system) indicated that several leverage points were consistently included across 6-8 maps. They include:

- Formal and experiential knowledge about APF and efforts to educate consumers
- Social encouragement of APF intake and social norms indicating approval and popularity of APF among important others
- Advertising, promotion and influencers' actions (other than education; delivered by organizations, institutions)
- Additionally, 3-4 maps included leverage points, referring to: (1) regulations and perception of APF as a healthy, balanced and safe product; (2) fear of novelty and curiosity, (3) food culture in respective country, (4) perceiving APF as ultra-processed food, (5) environmental and sustainability issues, (6) animal welfare or ethics.

Additionally, post-workshop survey results highlight the importance of economic factors, such as cost of living and disposable income, as well as prices of APF as determinants rated as most important for consumers' choices of APF. In the context of a broader uptake of APF the stakeholders agree that the consumers may be the most important stakeholders of the food system.

6. References

Aschemann-Witzel, J., Futtrup Gantriis, R., Fraga, P., & Perez-Cueto, F. J. A. (2021). Plant-based food and protein trend from a business perspective: Markets, consumers, and the challenges and opportunities in the future. *Critical Reviews in Food Science and Nutrition*, 61(18), 3119-3128. https://doi.org/10.1080/10408398.2020.1793730

Béné, C., Prager, S. D., Achicanoy, H. A. E., et al. (2019). Global map and indicators of food system sustainability. *Scientific Data,* 6, 279. https://doi.org/10.1038/s41597-019-0301-5

Boccardo, A., Hagelaar, G., & Lakemond, C. (2023). Evaluation of crises suitability of food systems: A comparison of alternative protein sources. *Food Security*, 15. https://doi.org/10.1007/s12571-023-01390-4

Borkman, T. (1976). Experiential knowledge: An analysis of self-help groups. *Social Service Review, 50*(3), 445–456.

Brooker, P. G., Hendrie, G. A., Anastasiou, K., & Colgrave, M. L. (2022). The range and nutrient profile of alternative protein products sold in Australian supermarkets between 2014 and 2021. *International Journal of Food Science & Nutrition, 73*(8), 1067–1079.

Castro, E. M., Van Regenmortel, T., Sermeus, W., & Vanhaecht, K. (2018). Patients' experiential knowledge and expertise in health care: A hybrid concept analysis. *Social Theory & Health.* doi:10.1057/s41285-018-0081-6

Crielaard, L., Quax, R., Sawyer, A.D.M., et al. (2023). Using network analysis to identify leverage points based on causal loop diagrams leads to false inference. *Scientific Reports, 13*(1), 21046. https://doi.org/10.1038/s41598-023-46531-z

De Boer, J., & Aiking, H. (2022). Do EU consumers think about meat reduction when considering to eat healthy, sustainable diet and to have a role in food system change? *Appetite*, 170, 105880. https://doi.org/10.1016/j.appet.2021.105880.

Díaz-Méndez, C., & Lozano-Cabedo, C. (2020). Food governance and healthy diet: An analysis of the conflicting relationships among the actors of the agri-food system. *Trends in Food Science & Technology*, 105, 449-453. https://doi.org/10.1016/j.tifs.2019.08.025

Ericksen, P. J. (2008). Conceptualizing food systems for global environmental change research. *Global Environmental Change*, 18, 234–245.

Gorzelsky, G. (2013). Experiential knowledge: How literacy practices seek to mediate personal and systemic change. *College English, 75*(4), 398-419. https://doi.org/10.2307/24238181

Gračner, T., Marquez-Padilla, F., & Hernandez-Cortes, D. (2022). Changes in weight-related outcomes among adolescents following consumer price increases of taxed sugar-sweetened beverages. *JAMA Pediatrics, 176*(2), 150–158. https://doi.org/10.1001/jamapediatrics.2021.5044

HLPE. (2017). *Nutrition and food systems: A report by the High Level Panel of Experts on Food Security and Nutrition of the Committee on World Food Security, Rome*

Hoek, A. C., Malekpour, S., Raven, R., Court, E., & Byrne, E. (2021). Towards environmentally sustainable food systems: Decision-making factors in sustainable food production and consumption. *Sustainable Production and Consumption*, 26, 610-626. https://doi.org/10.1016/j.spc.2020.12.009.

Hovmand, P. (2013). *Community based systems dynamics*. New York: Springer.

Hayward, J., Morton, S., Johnstone, M., Creighton, D., & Allender, S (2020).Tools and analytic techniques to synthesise community knowledge in CBPR using computer-mediated participatory system modelling. NPJ *Digital. Medicine, 3*, 22. https://doi.org/10.1038/s41746-020-0230-x

Ingram, J. (2011). A food systems approach to researching food security and its interactions with global environmental change. *Food Security*, 3(4), 417–431. https://doi.org/10.1007/s12571-011-0149-9

James, S. W., Friel, S., Lawrence, M. A., Hoek, A. C., & Pearson, D. (2018). Inter-sectoral action to support healthy and environmentally sustainable food behaviors: A study of sectoral knowledge, governance and implementation opportunities. *Sustainability Science*, 13(2), 465-477.

Király, G., & Miskolczi, P. (2019). Dynamics of participation: System dynamics and participation—an empirical review. *Systemic Research in Behavioral Science*, 36, 199-210.

Kröger, T., Dupont, J., Büsing, L., & Fiebelkorn, F. (2022). Acceptance of insect-based food products in Western societies: A systematic review. *Frontiers in Nutrition*, 8. https://doi.org/10.3389/fnut.2021.759885

Littlejohns, L. B., Hill, C., & Neudorf, C. (2021). Diverse approaches to creating and using causal loop diagrams in public health research: Recommendations from a scoping review. *Public Health Reviews*, 42, 1604352. https://doi.org/10.3389/phrs.2021.1604352

Løvhaug, A. L., Granheim, S. I., Djojosoeparto, S. K., Harrington, J. M., Kamphuis, C. B. M., Poelman, M. P., Roos, G., Sawyer, A., Stronks, K., Torheim, L. E., Twohig, C., Vandevijvere, S., van Lenthe, F. J., & Terragni, L. (2022). The potential of food environment policies to reduce socioeconomic inequalities in diets and to improve healthy diets among lower socioeconomic groups: An umbrella review. *BMC Public Health, 22*, 433. https://doi.org/10.1186/s12889-022-12827-4

McGlashan, J., Johnstone, M., Creighton, D., de la Haye, K., & Allender, S. (2016). Quantifying a Systems Map: Network Analysis of a Childhood Obesity Causal Loop Diagram. *PLOS ONE* 11(10): e0165459. https://doi.org/10.1371/journal.pone.0165459

Meadows, D. (1999). *Leverage points: Places to intervene in a system*. World. https://doi.org/10.1080/02604020600912897

Meadows, D. H. (2008). *Thinking in systems: A primer*. White River Junction, VT: Chelsea Green Publishing.

Murphy, R., & Jones, P. (2020). Leverage analysis. *Form Akademisk*, 13, 1–25. https://doi.org/10.7577/formakademisk.3384.

Mylan, J., Andrews, J., & Maye, D. (2023). The big business of sustainable food production and consumption: Exploring the transition to alternative proteins. *Proceedings of the National Academy of Sciences of the United States of America*, *20*(47), e2207782120. https://doi.org/10.1073/pnas.2207782120

Pineda, E., Poelman, M. P., Aaspõllu, A., Bica, M., Bouzas, C., Carrano, E., De Miguel-Etayo, P., Djojosoeparto, S., Gabrijelčič Blenkuš, M., Graca, P., Geffert, K., Hebestreit, A., Helldan, A., Henjum, S., Huseby, C. S., Gregório, M. J., Kamphuis, K., Laatikainen, T., Løvhaug, A. L., Leydon, C., Luszczynska, L., Mäki, P., Martínez, J. A., Raulio, S., Romaniuk, P., Roos, G., Salvador, C., Sassi, F., Silano, M., Sotlar, I., Specchia, M. L., Telo de Arriaga, M., Terragni, L., Torheim, L. E., Tur, J. A., von Philipsborn, P., Harrington, J. M., & Vandevijvere, S. (2022). Policy implementation and priorities to create healthy food environments using the Healthy Food Environment Policy Index (Food-EPI): A pooled level analysis across eleven European countries. *Lancet Regional Health - Europe*, 23, 100522. https://doi.org/10.1016/j.lanepe.2022.100522

Rotz, S., & Fraser, E. (2015). Resilience and the industrial food system: Analysing the impacts of agricultural industrialization on food system vulnerability. *Journal of Environmental Studies and Sciences*, 5(3), 459–473.

Sawyer, A.D.M., van Lenthe, F., Kamphuis, C.B.M. et al. (2021). Dynamics of the complex food environment underlying dietary intake in low-income groups: A systems map of associations extracted from a systematic umbrella literature review. *International Journal of Behavioral Nutrition and Physical Activity*, 18, 96. https://doi.org/10.1186/s12966-021-01164-1

Savona, N., Macauley, T., Aguiar, A., Banik, A., Boberska, M., Brock, J., Brown, A., Hayward, J., Holbæk, H., Rito, A. I., Mendes, S., Vaaheim, F., van Houten, M., Veltkamp, G., Allender, S., Rutter, H., & Knai, C. (2021). Identifying the views of adolescents in five European countries on the drivers of obesity using group model building. *European Journal of Public Health*, 31(2), 391–396.

Savona, N., Brown, A., Macauley, T., et al. (2023). System mapping with adolescents: Using group model building to map the complexity of obesity. Obesity Reviews, 24(S1), e13506. doi:10.1111/obr.13506

Tendall, D. M., Joerin, J., Kopainsky, B., & Edwards, P. (2015). Food system resilience: Defining the concept. *Global Food Security*, 6, 17–23.

Willett, W., Rockström, J., Loken, B., Springmann, M., Lang, T., Vermeulen, S., ... & Jonell, M. (2019). Food in the Anthropocene: The EAT–Lancet Commission on healthy diets from sustainable food systems. *The Lancet*, 393(10170), 447-492

Vandecandelaere, É., Arfini, F., Belletti, G., Marescotti, A., Allaire, G., Cadilhon, J.J., Casabianca, F., Damary, P., Estève, M., Hilmi, M., Jull, C., Coent, A.L., Lecourtois, E., Mounsey, J.P., Perret, A.O., Sautier, D., Tartanac, F., Thévenod-Mottet, E., & Wallet, F. (2009). *Linking people, places and products.* Food and Agriculture Organization of the United Nations (FAO) and SINER-GI. https://www.fao.org/3/i1760e/i1760e.pdf

Vandenbroele, J., Slabbinck, H., Van Kerckhove, A., & Vermeir, I. (2021). Mock meat in the butchery: Nudging consumers toward meat substitutes. *Organizational Behavior and Human Decision Processes, 163*, 105–116. https://doi.org/10.1016/j.obhdp.2019.09.004

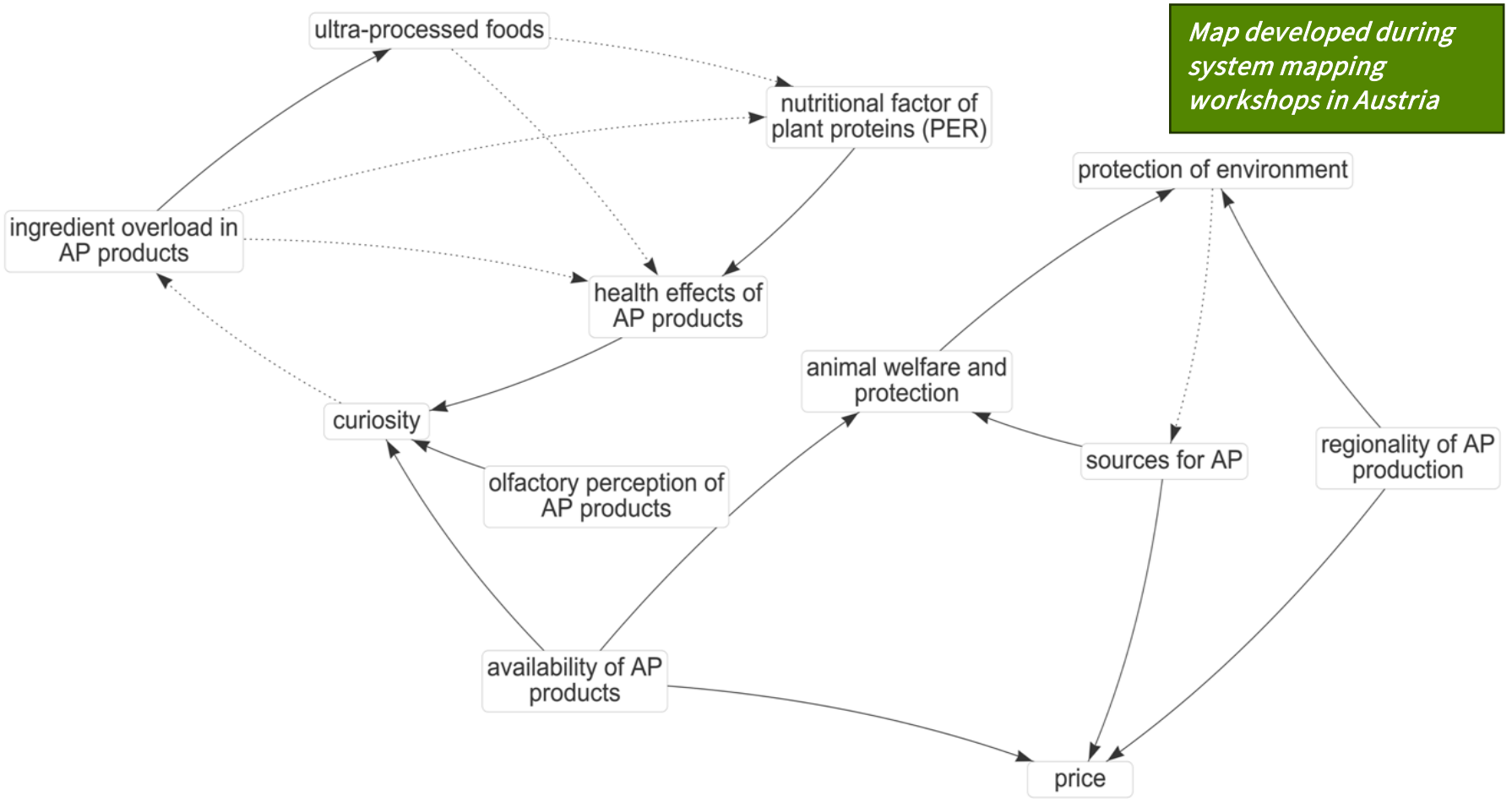
Zaleskiewicz, H., Kulis, E., Siwa, M., Szczuka, Z., Banik, A., Grossi, F., Chrysochou, P., Nystrand, B. T., Perrea, T., Samoggia, A., Xhelili, A., Krystallis, A., & Luszczynska, A. (2023a). Capabilities, perceived opportunities, motivation, and sociodemographic characteristics of consumers and their alternative protein choices intake: A meta-review. *Health Psychology Review,* Manuscript in revision.

Zaleskiewicz, H., Kulis, E., Siwa, M., Szczuka, Z., Banik, A., Chrysochou, P., Nystrand, B. T., Perrea, T., Samoggia, A., Xhelili, A., Krystallis, A., Luszczynska, A. (2023b). Types of Built Food Environment and Their Characteristics Associated with Alternative Protein Choices by Consumers: Systematic Review and Evidence-Based Typology. *International Journal of Behavioral Nutrition and Physical Activity.* Manuscript submitted for publication.

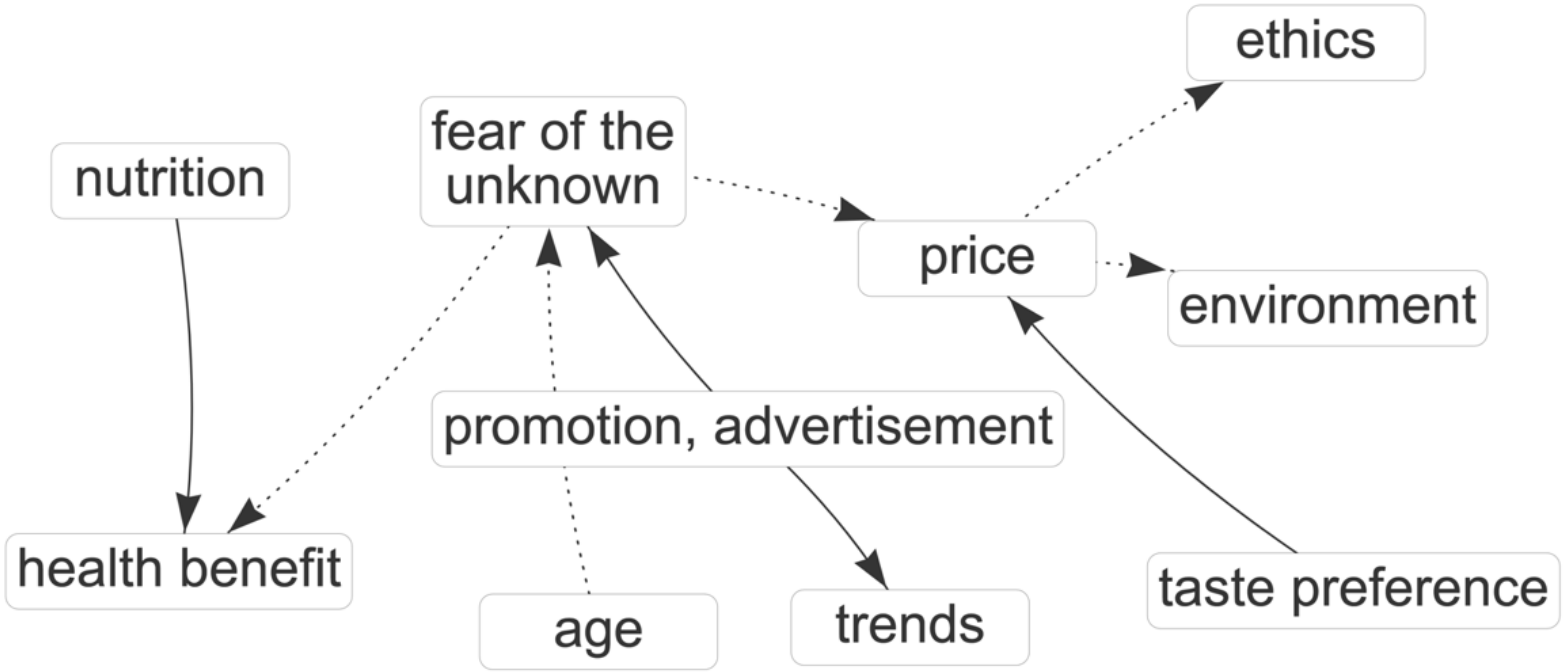
7. Annexes

- **Annex I. Maps developed during system mapping workshops in 13 countries as a Task 1.3 in WP 1 in LIKE-A-PRO project.**

Note: solid lines represent positive associations, dotted lines represent negative associations.



Map developed during system mapping workshops in Czech Republic



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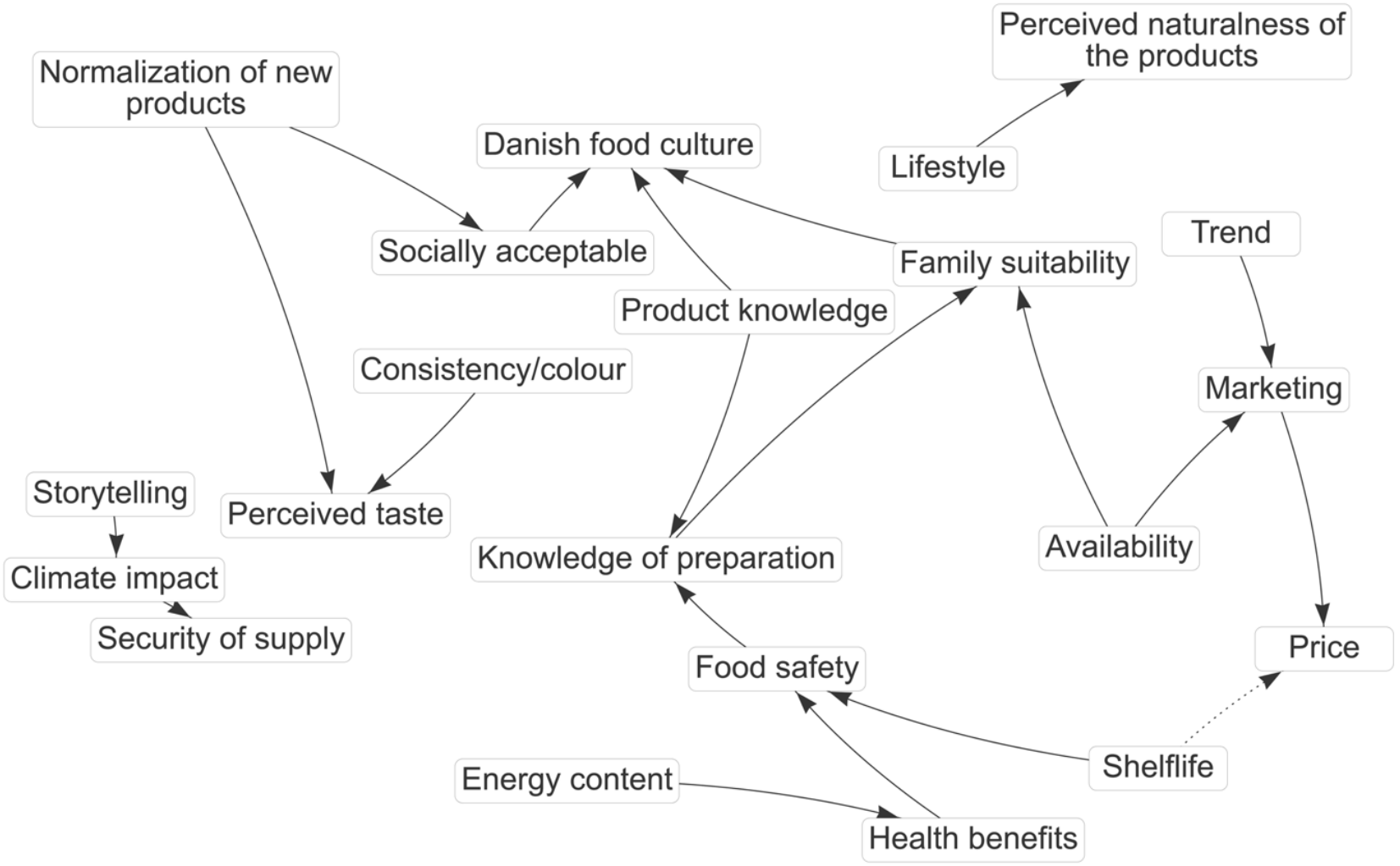
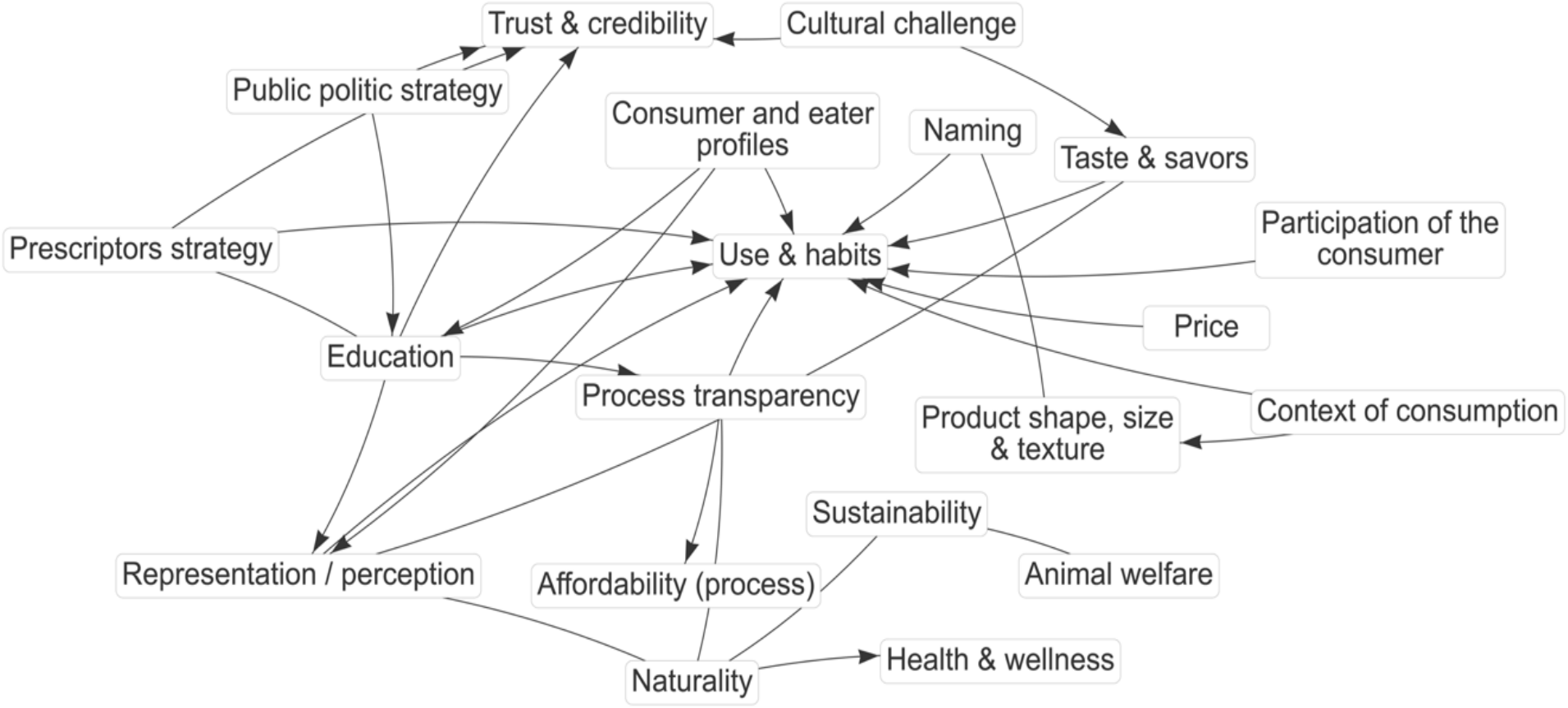
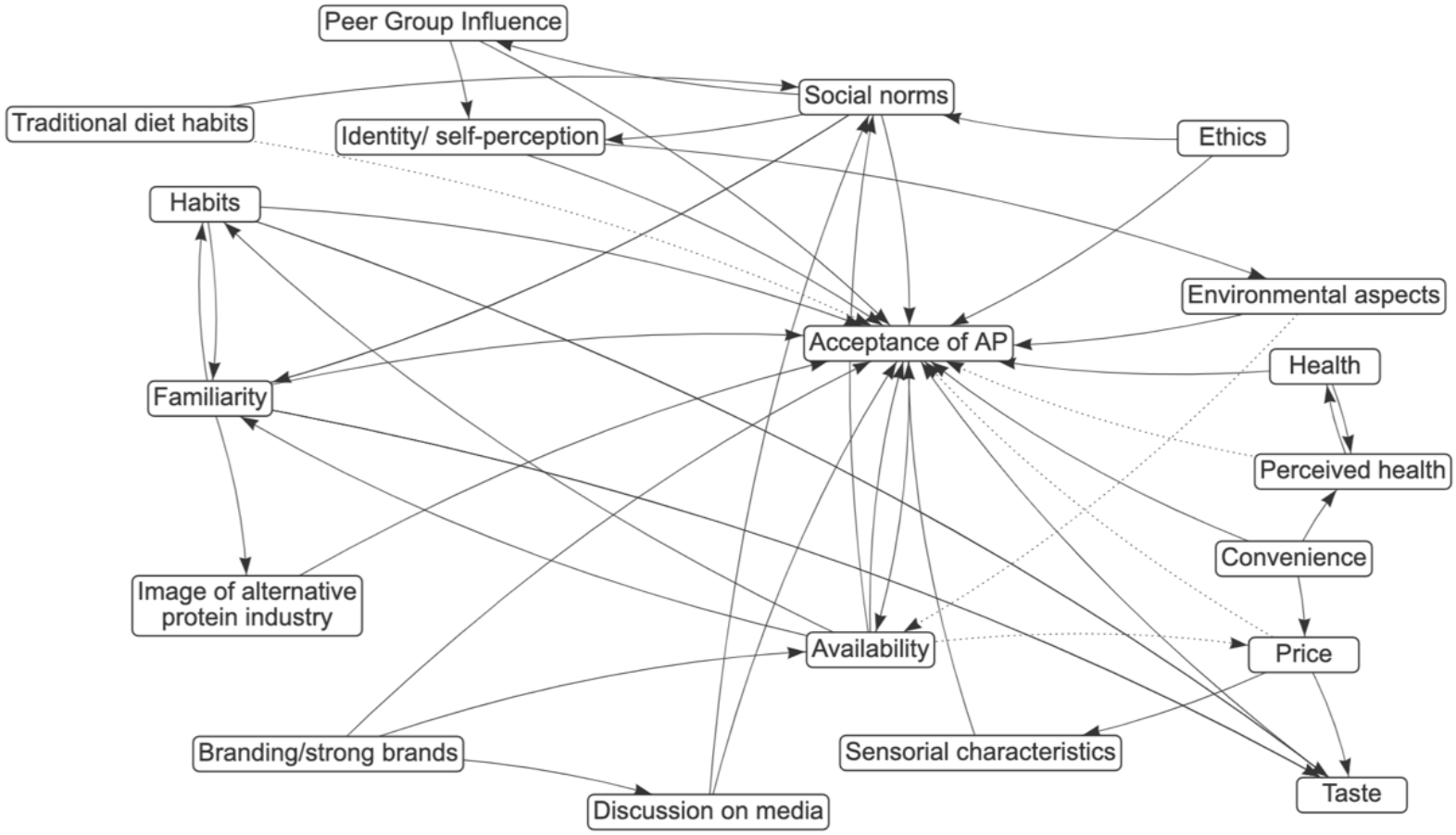


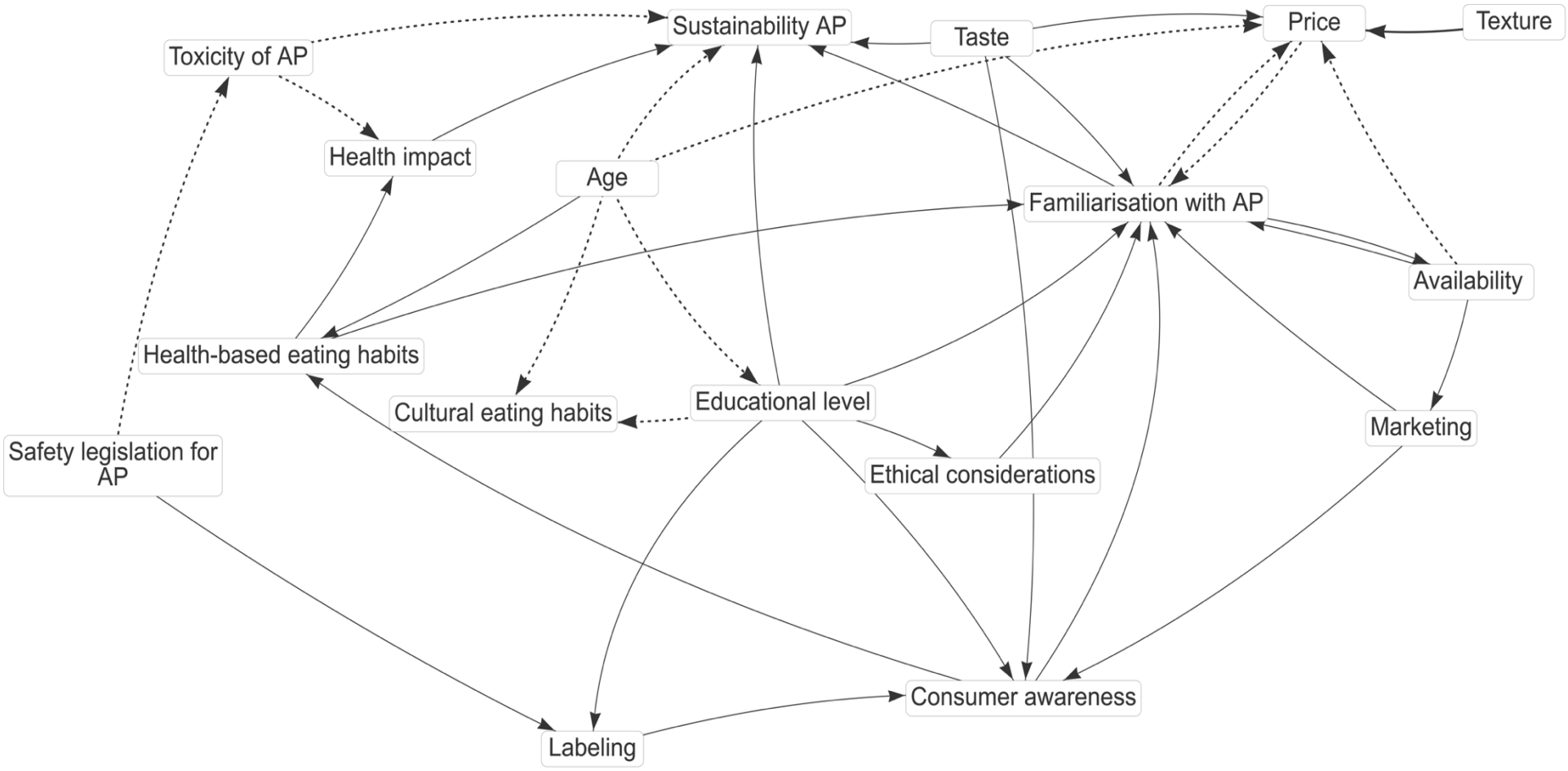
Map developed during system mapping workshops in France



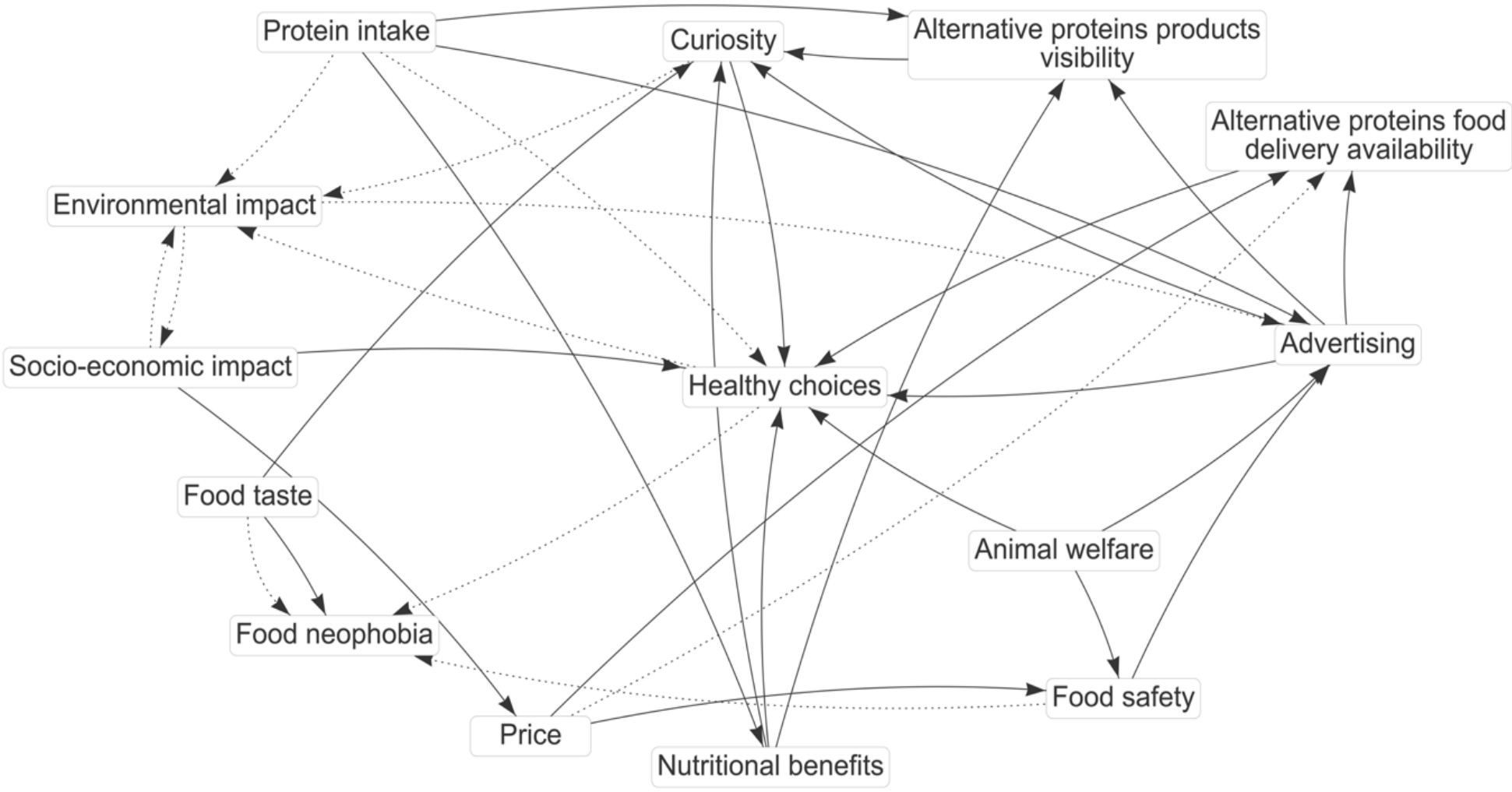
Map developed during system mapping workshops in Germany



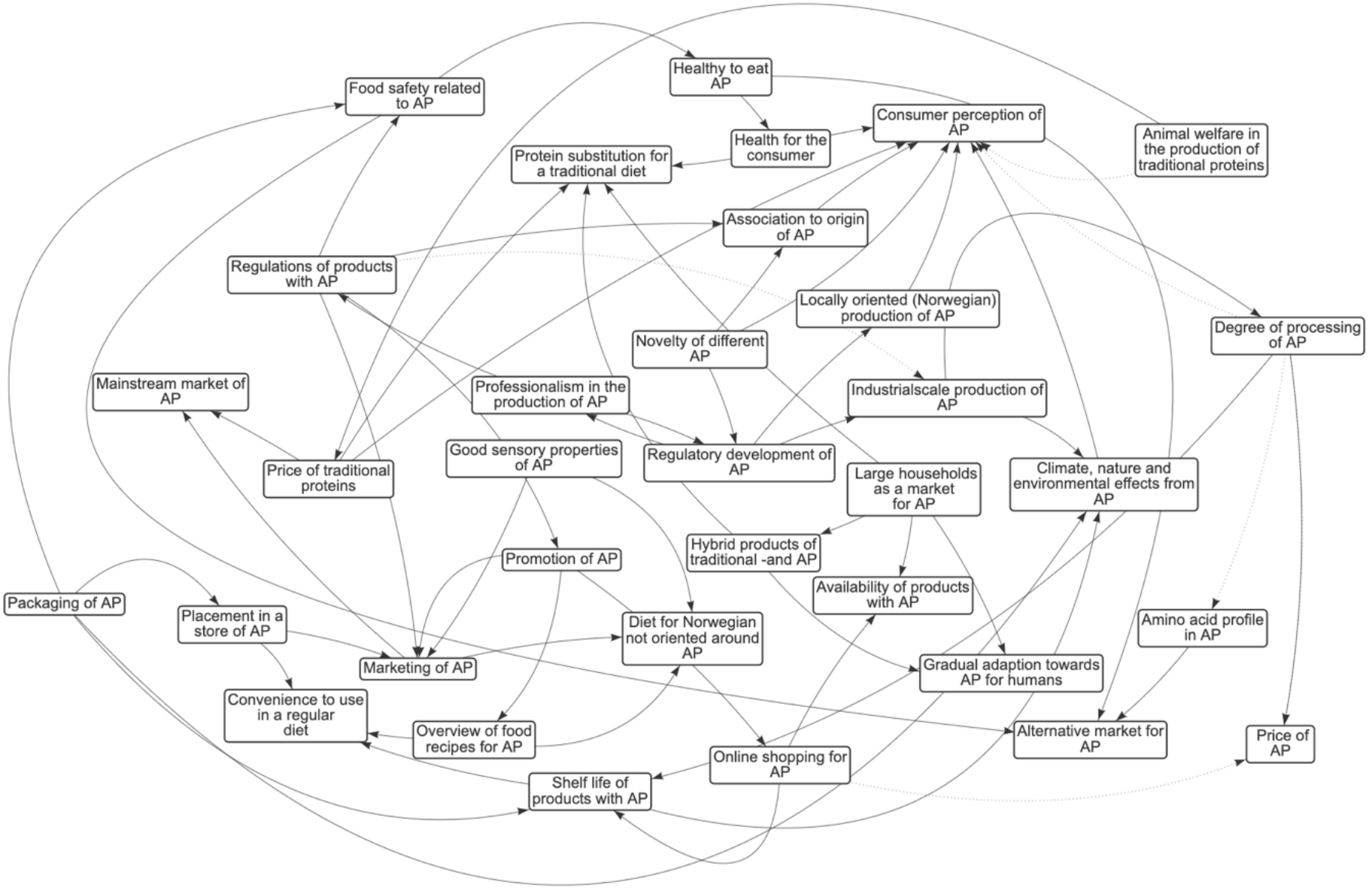
Map developed during system mapping workshops in Greece



Map developed during system mapping workshops in Italy

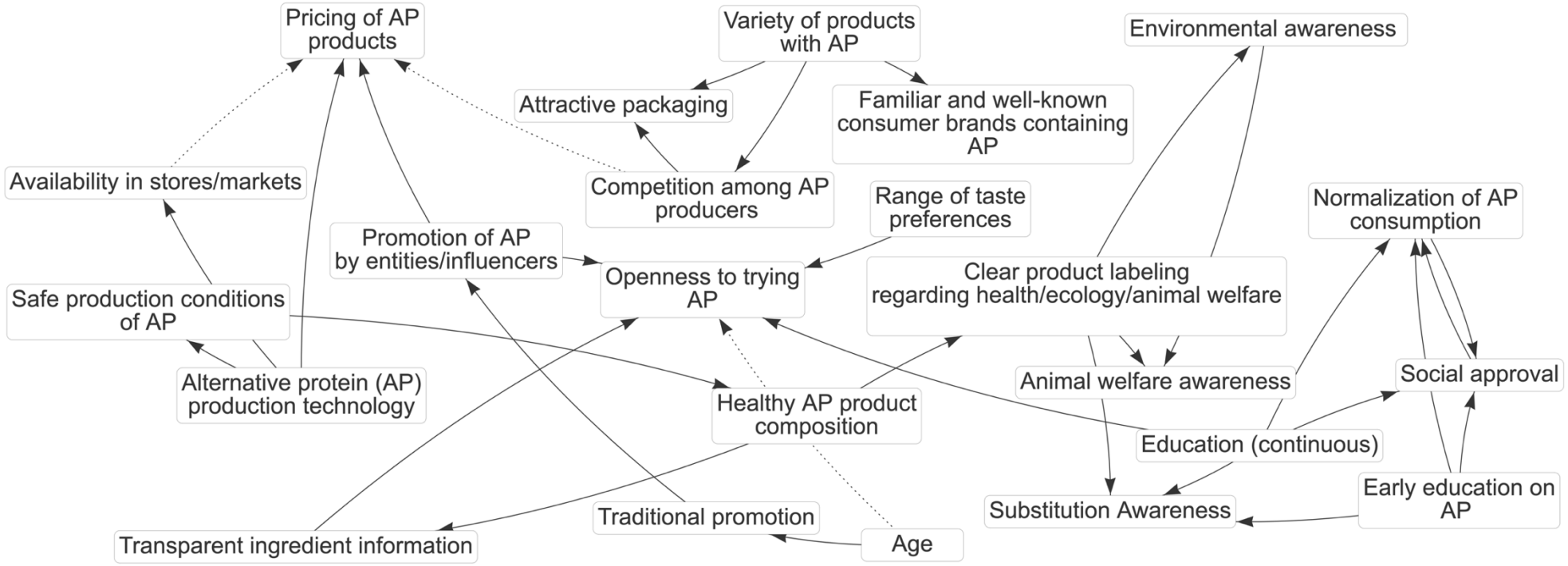


Map developed during system mapping workshops in Norway

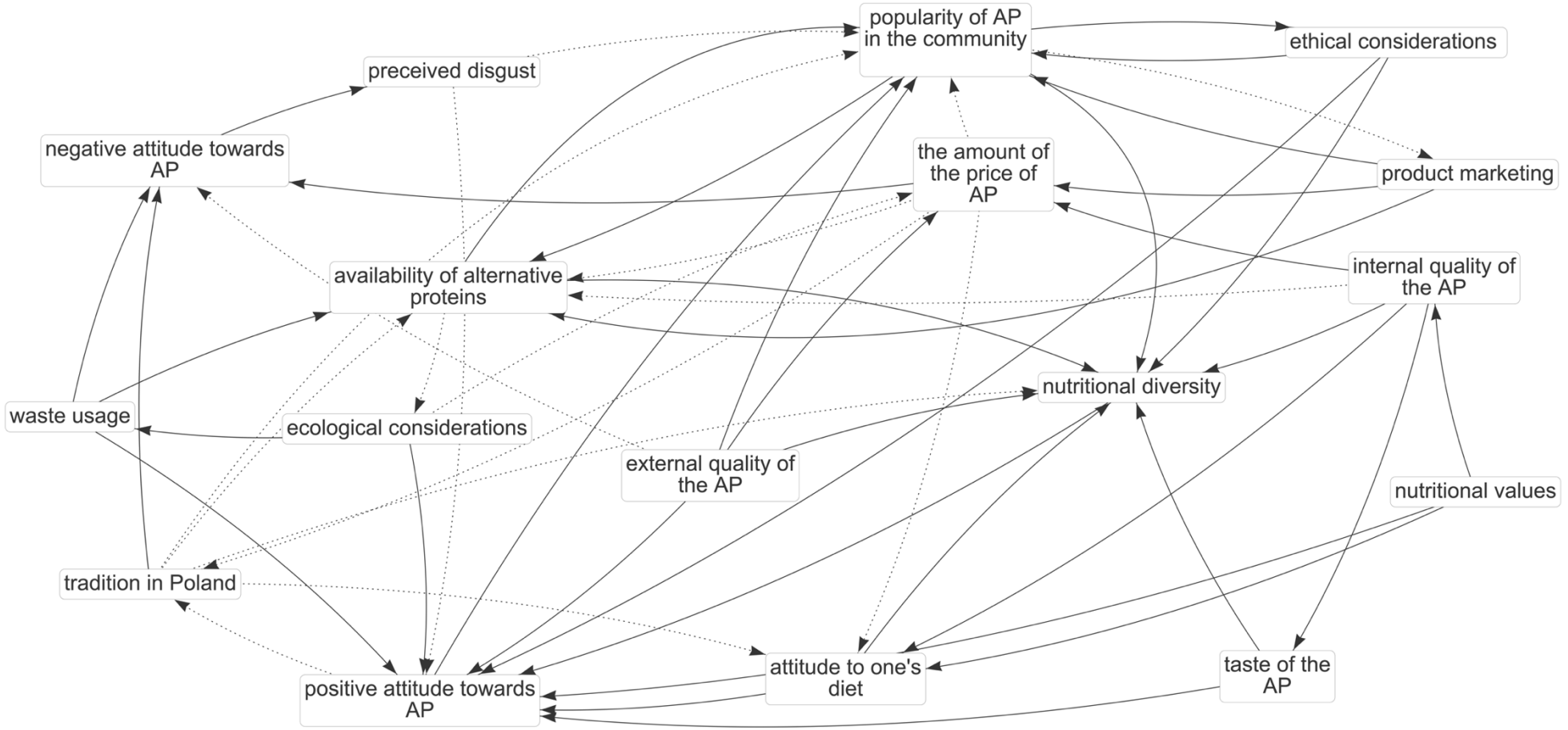


Like a PRO
Funded by the European Union

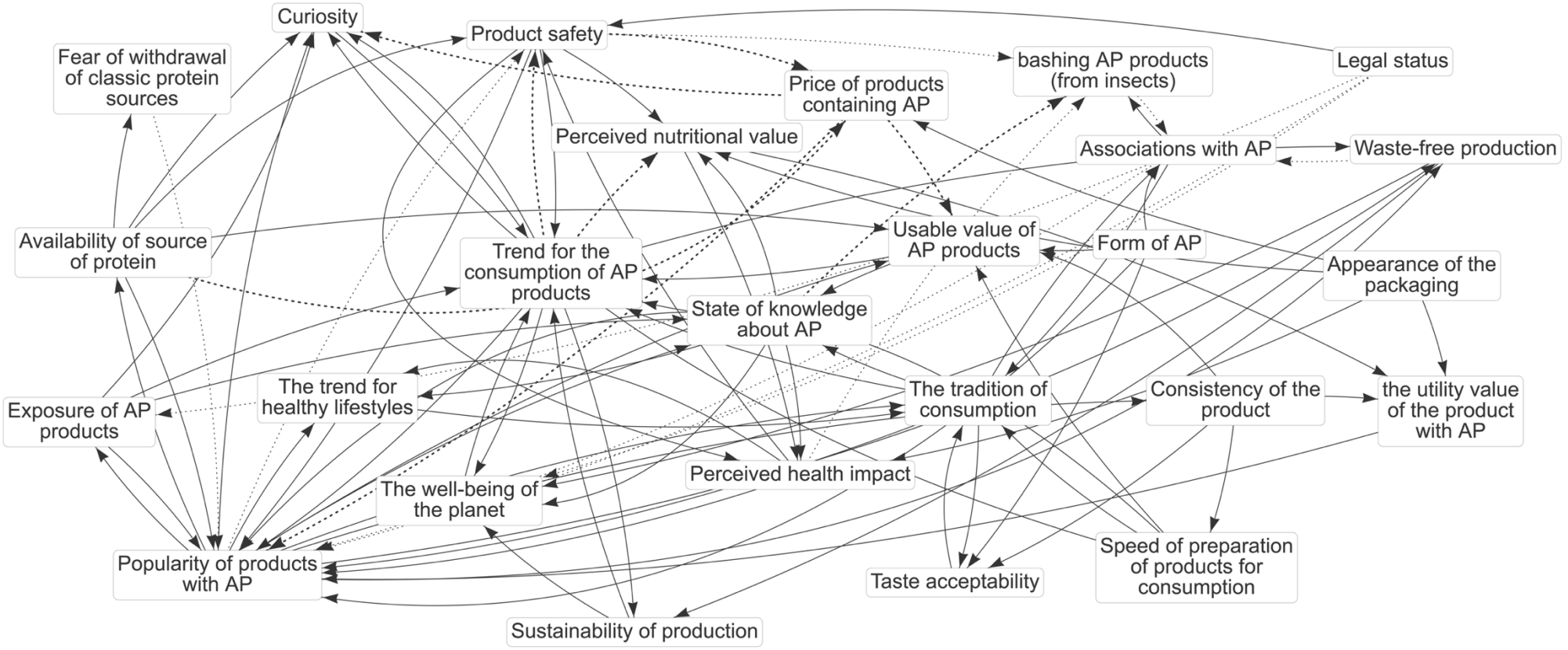
Map developed during 1st system mapping workshops with young adults in Poland



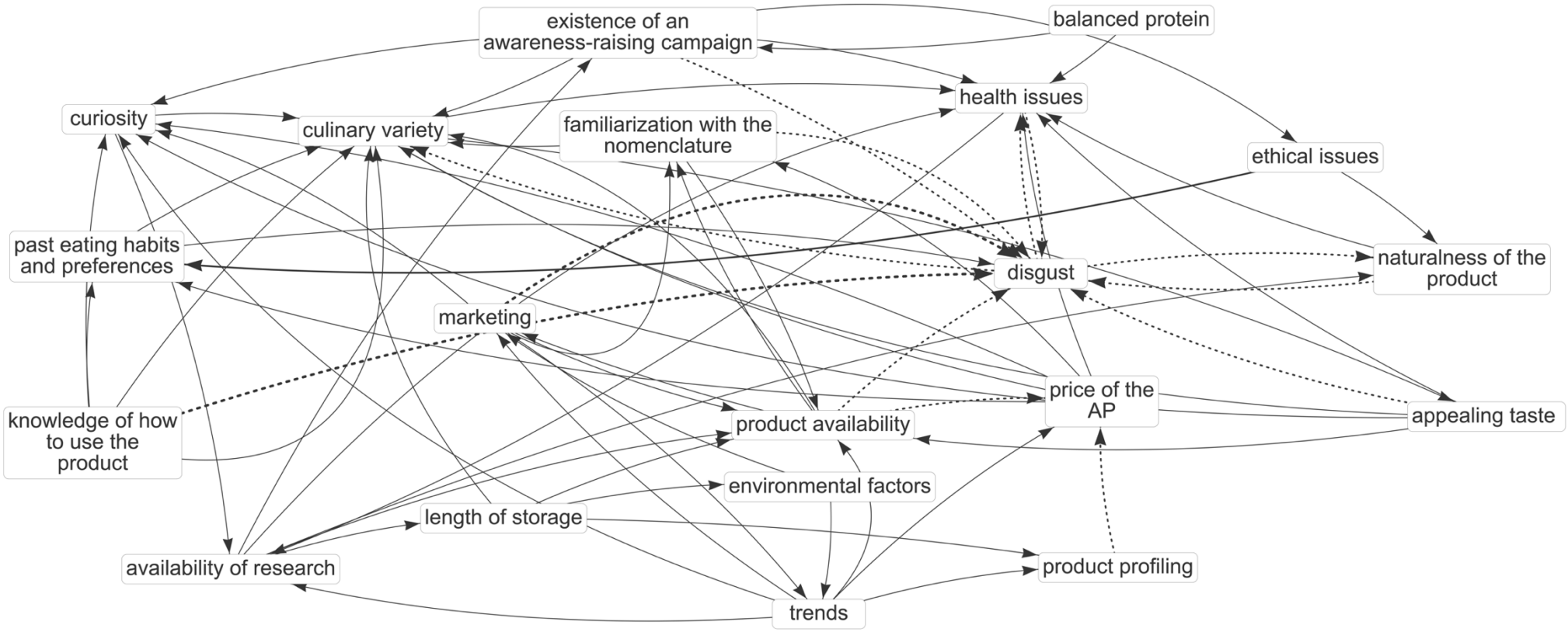
Map developed during 2nd system mapping workshops with young adults in Poland



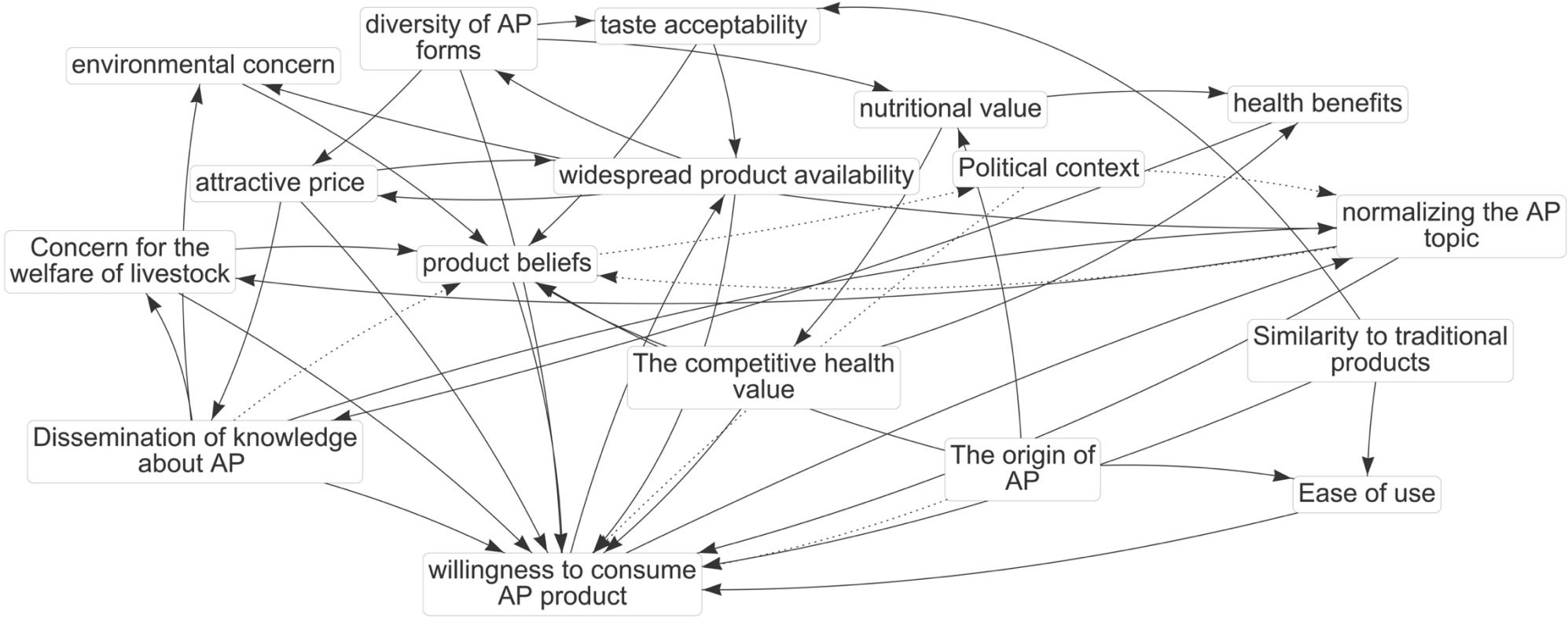
Map developed during 1st system mapping workshops with nutrition specialists in Poland



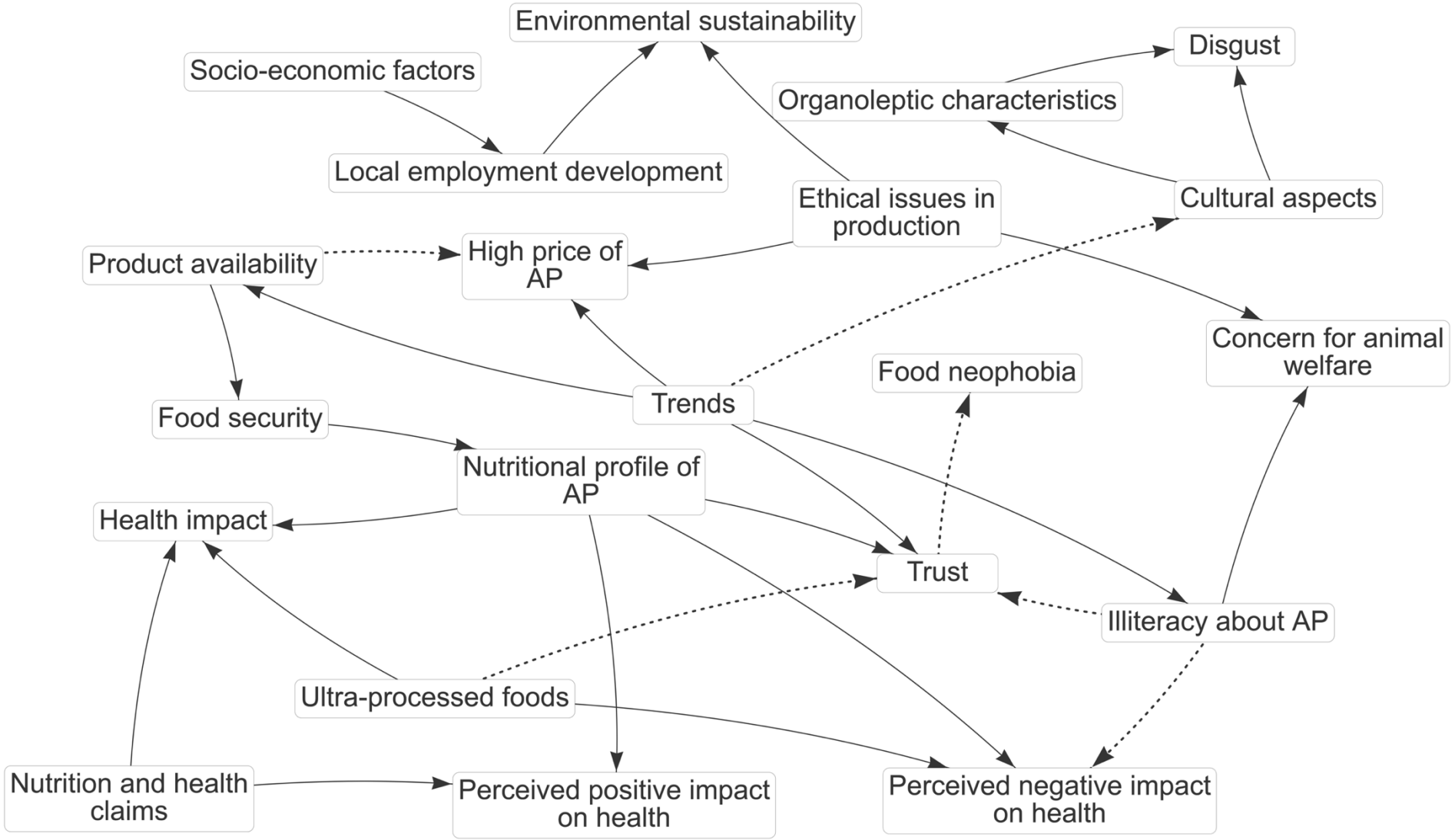
Map developed during 2nd system mapping workshops with nutrition specialists in Poland



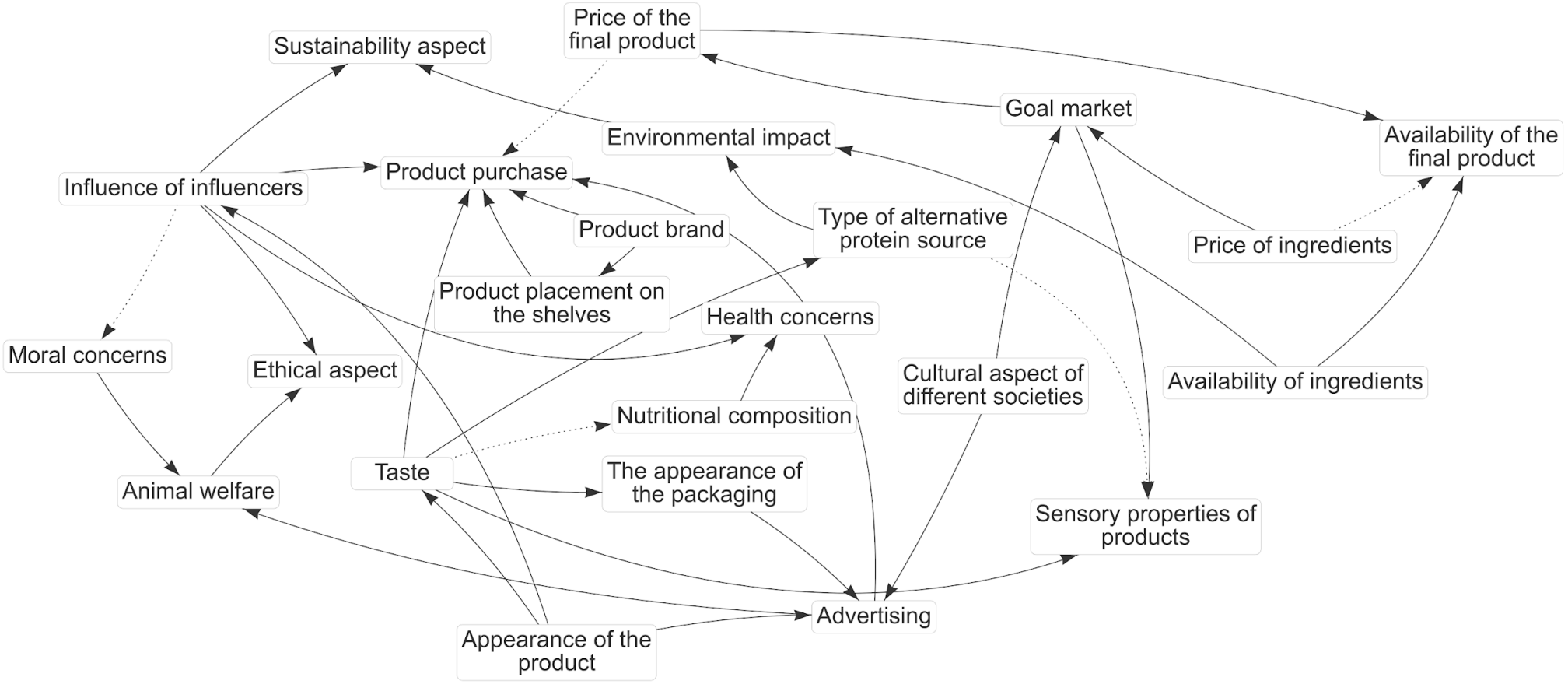
Map developed during 3rd system mapping workshops with nutrition specialists in Poland



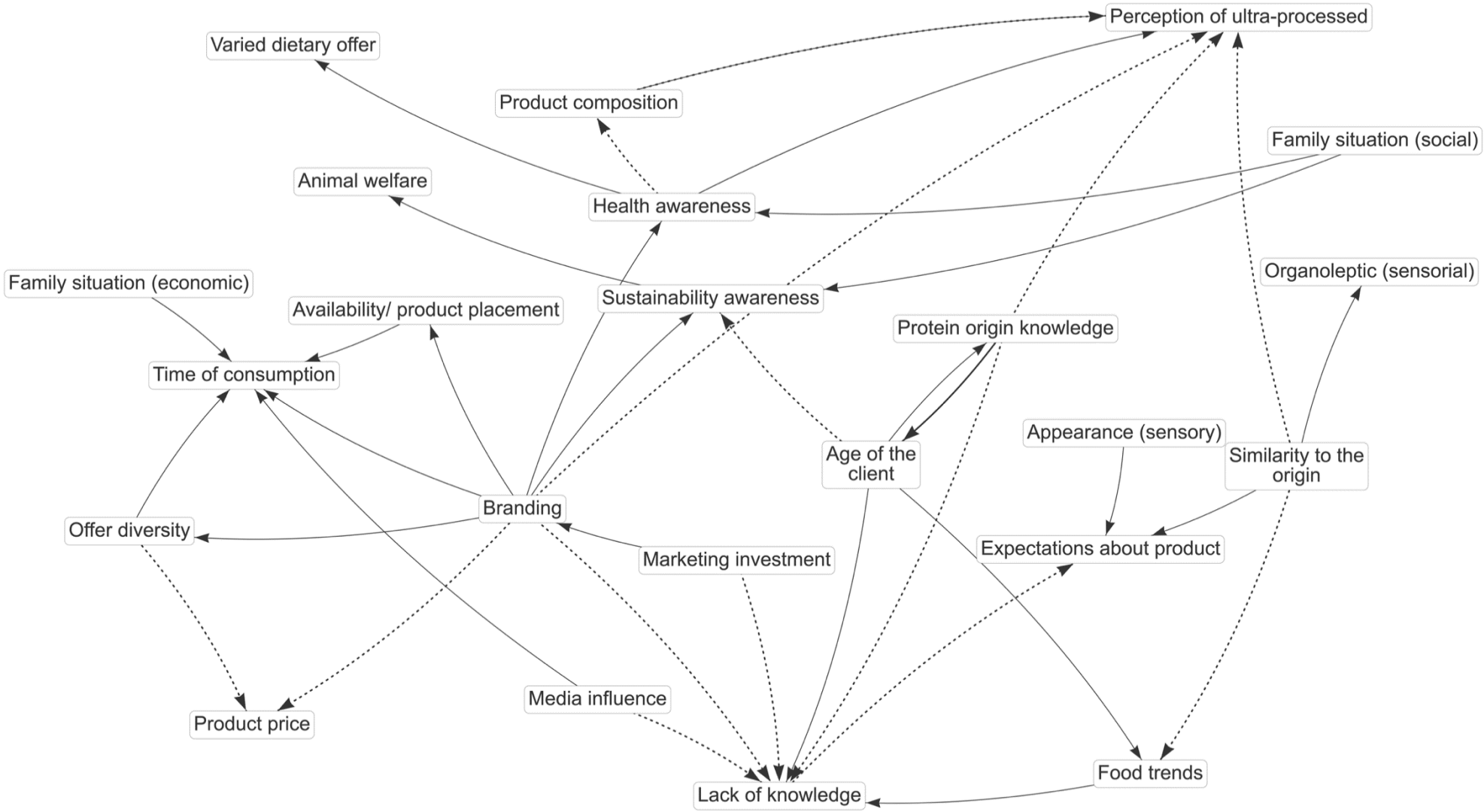
Map developed during system mapping workshops in Portugal



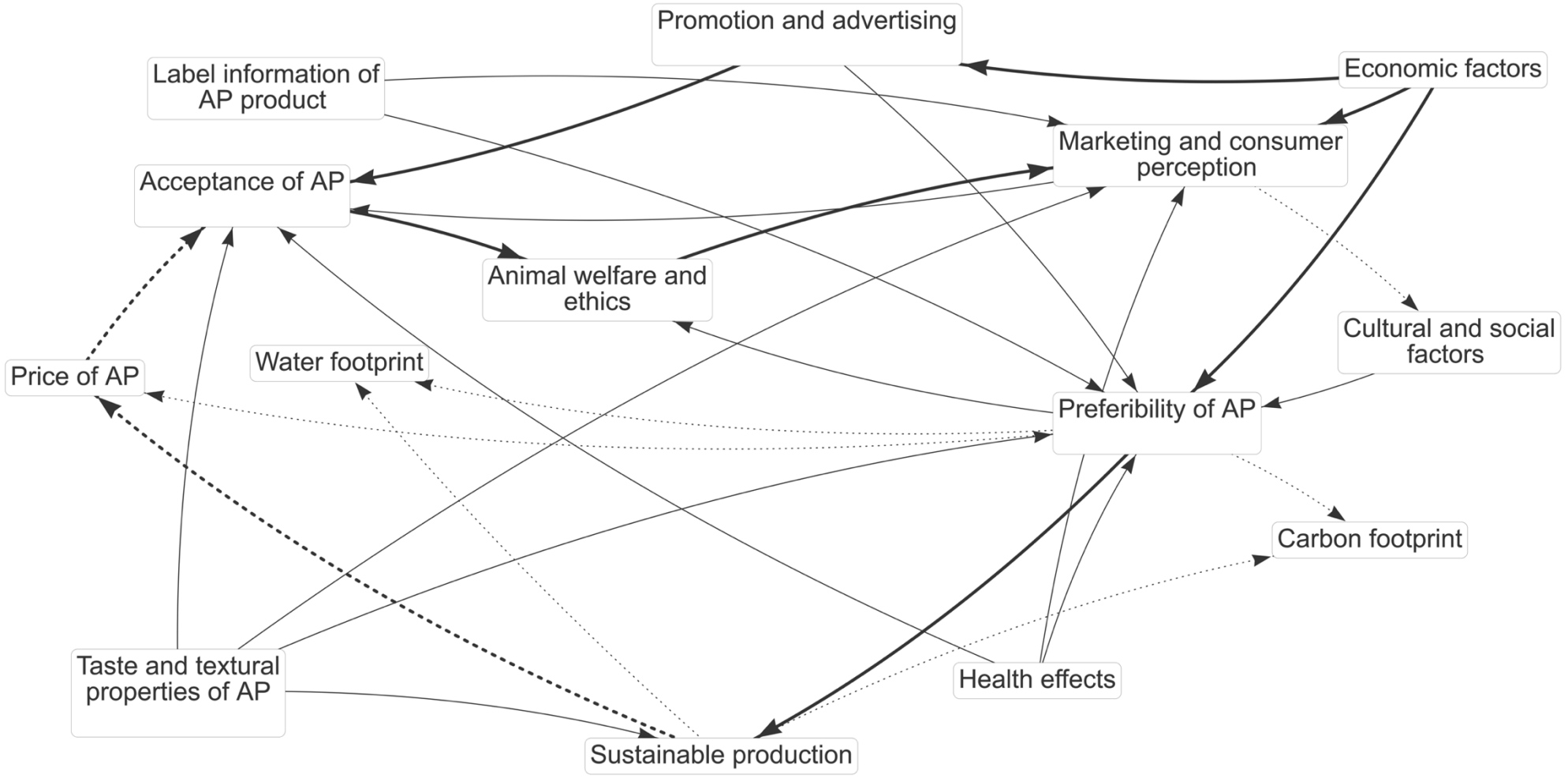
Map developed during system mapping workshops in Slovenia



Map developed during system mapping workshops in Spain



Map developed during system mapping workshops in Türkiye



Annex II: Supplementary Tables

Supplementary Table 1. Names and definitions of determinants identified in system mapping workshops in each country

Country	Name of the factor in original language[1]	Name of the factor in English	Definition of the factor
Austria			
	-	Regionality of APF production	Due to more regional/European production of AP, independence from international markets can be maintained
	-	Health effects of APF products	Different metabolization of plant proteins may impact health status
	-	Ultra-processed foods	Very high level of processing and treatment of ingredients and raw material in APF products
	-	Price	Price is a factor that influences purchasing decisions
	-	Curiosity	People are curious about trying out things they don't know
	-	Nutritional factor of plant proteins (PER)	Plant proteins are differently metabolized than animal proteins; PER = protein efficiency ratio
	-	Animal welfare and protection	When buying APF products purchase of animal products can be avoided
	-	Sources for AP	Conflict: protein sources for APF products can better fulfill sustainable criteria than animal production on a large scale - vs. more arable land is necessary
	-	Protection of environment	Greenhouse gas emissions are linked to animal-based product production. Due to APF choices, GHG emissions can be reduced. - contradiction: due to more arable land necessary to cultivate raw material for AP, more land is needed for the cultivation of plants for APF products
	-	Ingredient overload in APF products	AP products can contain lots of additional ingredients (e.g., preservatives, flavors, gelling agents) to ensure adequate product quality
	-	Availability of APF products	The more APF products are available the higher the possibility that consumers with buy them
	-	Olfactory perception of APF products	New olfactory factors (new taste, new smell, new mouth feel) have an effect on the buying behavior of customers.
Czech Republic			

Country	Name of the factor in original language[1]	Name of the factor in English	Definition of the factor
	-	Taste and textural properties of AP	The taste and texture of the alternative proteins affect preferences of consumers
	-	Price	The price of the alternative protein products affects their acceptance by the consumers.
	-	Acceptance of APF	Ability of alternative protein-based product to substitute animal-based product.
	-	Animal welfare and ethics	Inadequate animal production conditions
	-	Marketing and consumer perception	The marketing of these products affects their acceptance among consumers.
	-	Economic factors	Animal protein production costs will be higher in following years, so consumers can prefer alternative proteins which will be more cost effective.
	-	Ethics	The plant-based products can be chosen because of their health effects, environmental conditions and ethical issues, more than animal-based products.
	-	Life philosophy	Consumption trends of APF can be changed according to cultural and regional factors.
	-	Carbon footprint	Plant-based production leads to lower carbon footprint than animal production.
	-	Health benefits	There are some concerns over red and processed meat links to diseases. Because of that consumers can accept the plant-based products more.
	-	Environment	Sustainable production of alternative protein products could be more possible than animal protein products.
	-	Method of protein production	Plant-based production leads to lower water footprint than animal production.
	-	Label information of APF product	Explanatory and transparent label information of alternative protein products affects consumer's preferences.

Country	Name of the factor in original language[1]	Name of the factor in English	Definition of the factor
	-	Promotion, advertisement	If we could promote the plant-based proteins, we can increase the preferences and consumption of them.
	-	Tradition and family habits	Continuation of habits in a two or more family generation.
	-	Social status	Financial disposition of the family. Family with low-income background will never prioritize buying expensive alternative protein products, while in the middle and high class there is a high chance of victory of curiosity and healthy lifestyle in the young and middle-aged generation.
	-	Age	See previous determinant´s explanation.
	-	Nutrition	Higher nutritional benefits that can profit our body and soul.
	-	Taste preference	Dependence of taste preferences; each person prefers different taste more than another one.
	-	Fear of the unknown	You will hardly purchase something expensive without having a clue if you like it.
	-	Product appearance	In case of positive appearance of product, colorful, well-minded with emphasized health benefits, there´s a higher probability of market sale success.
	-	Trends	Trends in food market, strong promotion via social media, TV media
	-	Pleasure of eating	High taste properties
Denmark			
	-	Danish food culture	The Danish food culture is very meat-based
	-	Perceived taste	It is the consumer's experience of taste that determines whether the consumer uses APF or not - e.g. umami
	-	Availability	The products must be present on the supermarket shelves for the consumer to buy and use them.

Country	Name of the factor in original language[1]	Name of the factor in English	Definition of the factor
	-	Climate impact	Whether the use of APF will give a CO2 reduction compared to conventional protein. And other factors as well.
	-	Knowledge of preparation	The consumer's knowledge of how the products are used in cooking and how they should be prepared
	-	Health benefits	Can make people choose APF if they have knowledge about it or opt out if they do not have sufficient knowledge
	-	Price	The price the consumer must pay
	-	Impact on biodiversity	Become independent from deforestation and buy locally
	-	'Normalization' of new products - clear description of unique serving proposition (USP)	People may feel that they are compromising if the product is highlighted as 'different', e.g. CO2-neutral, vegan etc. USP (unique selling proposition), is the essence of what makes your product or service better than competitors
	-	Socially acceptable	-
	-	Energy content	Knowledge of how many insects is equivalent to a chicken leg
	-	Family suitability	There can be challenges in getting the whole family to accept/eat AP
	-	Lifestyle	Some consumers actively choose APF on the basis of e.g. climate considerations and a desire for self-sufficiency
	-	Storytelling	Small, committed, dedicated, local producers. What is the core narrative of AP?
	-	Texture/colour	-
	-	Marketing	Does it matter who is the sender of the message? The government, influencers, chefs
	-	Product knowledge	Knowledge of the raw material, clean label, what is it that we get into our bodies
	-	Animal welfare	AP means a reduction in meat production and thus expectedly better conditions for animals in production

Country	Name of the factor in original language[1]	Name of the factor in English	Definition of the factor
	-	Trend	Focus in the media increases awareness
	-	Shelf life	Is it easy to store, for example, compared to meat?
	-	Food safety	-
	-	Perceived naturalness of the product	Milk from a cow vs drink made in a tank
	-	Security of supply	We need APF to feed the world population
France			
	-	Taste & savors	Today, taste is not ready yet. Veggie proteins doesn't taste great. Proteins have a strong influence on the texture. Produce unique texture to create to new products.
	-	Process transparency	We need to explain how products are made.
	-	Cultural challenge	Non identifiable eatable products. People don't understand what is a protein. Nutrition is unknown. Representation issues. Culture will influence it
	-	Naming	Denomination / semantics / naming is pretty key. Importance of the vocabulary used. Take into account cultural specificities. Need to take into account regulatory aspects as well.
	-	Price	Are products accessible? Affordability. Price to be compared to traditional meat proteins. If lower price, would people eat it more easily?
	-	Affordability (process)	Cost of the technology; Price related to the process
	-	Public politic strategy	Make accessible alternative proteins. Give financial support. Public support of production. Give access to nutritional knowledge / educate.
	-	Availability	-
	-	Use & habits	We need to take into account of people habits // cannot be to frontal; Connected to environmental factors, familial situation (children, +1...), knowledge, uses, habits... what are we used to do? (Culinary) heritage,

Country	Name of the factor in original language[1]	Name of the factor in English	Definition of the factor
			generation habits. Alimentary. Do I know how to cook something healthy? Do I want to cook something healthy?
	-	Education	How to cook; Culinary knowledge; How to add, know-how and easy way of cooking alternative proteins. Make a first try possible...and then make people come back.
	-	Sustainability	Once cultural barrier is taken out, environmental impact can be taken into account.
	-	Animal welfare	-
	-	Health & wellness	Nutritional benefits; Anti nutritional factors; Digestion; Allergenicity; Nutrition deficiency linked to certain types of diets (iron, collagen, vitamin B, etc.)
	-	Naturality	Clean label; How to define the naturality of a product; how the food is grown? how the food is produced (ingredient, process)?
	-	Product shape, size & texture	How is it sold? what kind of product; Where is the product bought? Is it something the user already know?
	-	Category management	Packaging; clear / straight message; desirability of the product; Merchandising; Where, in the supermarket, is the product sold?; Shelf strategy
	-	Trust & credibility	Can I trust the brand (producer) & product?; New product, easier if it's a recommendation; Brand trust; Brand equity
	-	Safety	Safety & quality; Consistency: consistent quality; some isolates or concentrates have non consistent quality; hard to use to formulate finish goods; But consistency of FG is key.
	-	Prescriptions strategy	-
	-	Participation of the consumer	Co construction of the product / product range; Chefs in collective restauration is possible as well. Other actors should be involved.

Country	Name of the factor in original language[1]	Name of the factor in English	Definition of the factor
	-	Context of consumption	Depending of where is the product eaten, it will affect the experience / taste of the product
	-	Consumer and eater profiles	Take into account different consumers profile / generation; Age gap&; Differentiate product from younger age to make some food pairing for later
	-	Representation / perception	Image / full experience; Representation of the product; Acceptability; Picture of the product
Germany			
	Ethik	Ethics	-a framework of values that an individual already brings with them -animal welfare is part of this (my values influence how I assess animal welfare) -are less relevant across the general population, rather only for certain groups in society
	Umweltaspekte	Environment Aspects	-are particularly relevant in a social context, otherwise there wouldn't be so much talk about sustainability -Vegans/veggies tend to choose alternative proteins for ethical reasons -environmental aspects are less relevant in the wide society
	Gesundheit	Health	-many people should eat less meat due to health problems, then alternative proteins could be good alternative (but only if price/sensory properties fit) -Food intolerances might also fall under it
	wahrgenomenne Gesundheit	Perceived Health	-includes health that is characterized by the discussion about a product, e.g., fear of additives/flavourings
	-	Convenience	-especially important for preparation/ production
	Preis	Price	-the most limiting factor for people -People choose the product with a lower price when same products are offered
	Geschmack	Taste	-is one of the points that is discussed intensively in all conversations -if it doesn't taste good, nobody buys it or won't buy it again
	Sensorik	Sensorial Characteristics	-taste is a factor that makes up the whole of sensory life -sensory perception also includes texture, odour, taste and appearance

Country	Name of the factor in original language[1]	Name of the factor in English	Definition of the factor
			-the first contact is visual (in the supermarket) before tasting (flavour), i.e., the appearance of the product/packaging is decisive
	Verfügbarkeit	Availability	-when something is widely available, it suggests a norm
	Mediale Diskussion	Discussion on media	-how the media report on alternative proteins
	Branding/starke Marken	Branding/ strong brands	-Beyond Meat, Vegetarian Butcher as examples -Form the basic acceptance and thereby support the establishment and acceptance of private labels of the retailers
	Branchenimage der alternativen Proteine	Image of alternative protein industry	-Producers, marketing, brands etc. that are representative of alternative proteins shape the overall image of alternative proteins in society, characterise the image/reputation of the product
	Vertrautheit	Familiarity	-Lack of familiarity can possibly lead to neophobia (e.g., fear of new things, eating insects, soya etc.) -can be a "death sentence" for acceptance
	Gewohnheit	Habits	-is limiting and reinforcing -if you have bought something, you tend to buy it again -if you've never bought something before, you probably wouldn't buy it either
	Traditionelle Ernaehrungsgewohnheiten	Traditional diet habits	-cultural influences on eating habits -is accompanied by habit
	Identiaet/Selbstwahrnehmung	Identity/ Self-perception	-Depending on where I place myself, I may enter the debate about alternative proteins with stronger prejudices, e.g., whether I am a farmer, political views, where I stand in the climate debate
	Peer-Group-Einfluss	Peer-Group-Influence	-degree of familiarity with something is determined and communicated by the peer group and opinions are formed by these groups -Confirmation bias, bias assimilation play a role as well
	Soziale Norm	Social Norms	-can be divided into injunctive and descriptive (the latter play a stronger role here) -injunctive: perception of what behaviour is dis-/approved by others -descriptive: perception about how others behave actually

Country	Name of the factor in original language[1]	Name of the factor in English	Definition of the factor
Greece			
	-	Taste	Taste of the end product with AP
	-	Texture	Texture of final product with AP
	-	Cultural eating habits	Based on the society-culture in which you live you are used to certain foods
	-	Price	Price of the final product with AP
	-	Toxicity of APF	-
	-	Ethical considerations	The ethical considerations someone has for exp. regarding animal welfare, environmental protection etc.
	-	Marketing	Marketing - Promotion of products to overcome stereotypes
	-	Familiarization with APF	Some APF are more familiar to certain cultures. Greek consumers prefer legumes/pea-based APF than insect-based AP. Based on their culture; they are more likely to choose products with APF that they are more familiar with.
	-	Availability	Availability of products with AP
	-	Age	Consumers age
	-	Sustainability of AP	Sustainability of the final product with APF
	-	Safety legislation for APF	The consumer want to know that the final product is safe based on the legislation
	-	Health impact	Impact of alternative proteins on consumer health
	-	Consumer awareness	To be aware for the safety of these products for example
	-	Health-based eating habits	When a consumer has a health problem or has to eat/avoid certain foods.
	-	Educational level	Regardless of the information people receive, they cannot all perceive/accept the positive outcomes
	-	Labeling	Info about APF to the consumers (exp. in terms of animal welfare/production without the involvement of animals or their abuse)
Italy			
	-	Healthy choices	Consumers' propensity to choose food products with a positive health-related impact, such as Alternative Proteins Products (APP); a growing trend for various reasons, such as reducing non-communicable diseases and adopting more sustainable lifestyles and balanced diets.
	-	Socio-economic impact	Promote social sustainability, local economic development, and new job creation.

Country	Name of the factor in original language[1]	Name of the factor in English	Definition of the factor
	-	Environmental impact	Alternative Proteins (AP) production is perceived as an activity with less environmental impact.
	-	Protein intake	Alternative proteins products are perceived to be a good alternative to animal proteins, with a balanced protein intake.
	-	Curiosity	Consumers are developing curiosity about alternative proteins; the trend is spreading thanks to advertisements promoting these products, as well as the dissemination of scientific studies supporting the positive impact of these products.
	-	Alternative proteins products visibility	The visibility of APF through advertising and a strategic positioning on the shelves of retailers is considered important to make consumers develop interest in them.
	-	Alternative proteins food delivery availability	The availability of APF in food delivery apps can increase the number of consumers of these novel products and enlarge the selection of foods for consumers with special needs (e.g. vegans, vegetarians).
	-	Advertising	Good advertising and valuable marketing strategy of APF can play a pivotal role in increasing the buyer base for this type of product.
	-	Animal welfare	APF can replace animal meat production, tackling ethical issues and respecting animal welfare. Choosing APF, consumers preserve animals.
	-	Food safety	Safety of APF is one of the main considerations that consumers make when they evaluate the purchase of APP.
	-	Nutritional benefits	Nutritional benefits of APF can differ with regards to raw materials used for these food products, the presence among ingredients of vitamins/minerals.
	-	Price	APF are usually more expensive, thus becoming niche goods.
	-	Food neophobia	Consumers' perception of disgust towards new food products.
	-	Food taste	The good food taste, texture and smell of APF is crucial to have a positive impact on consumers.
Norway			
	-	Packaging for APF	Material and quality of packaging

Country	Name of the factor in original language[1]	Name of the factor in English	Definition of the factor
	-	Placement in the store for APF	where it is placed in the store- next to traditional protein sources or separate, in the back of the store or in the front -
	-	Novelty of different APF	- How novel a product is
	-	Gradual adaption towards APF for humans	- Gradual approach for introducing alternative proteins
	-	Regulations for products with APF	- Laws and regulations for products from alternative proteins
	-	Availability of products with APF	- how many products of APF are available in the market
	-	Amino acid profile in APF	- Quality of the product from APF- amino acid profile
	-	Protein substitution for a traditional diet	- Protein sources that can be implemented in a traditional diet
	-	Hybrid products of traditional -and APF	- Combination of both traditional and alternative proteins-hybrid
	-	Marketing of APF	- Advertisement, how is the products promoted
	-	Overview of food recipes for APF	User manual in how to make food with APF, Online information platform for APF
	-	Price of traditional proteins	The price of traditional proteins, high or low, might influence the consumers choices for APF
	-	Promotion of APF	Influencers, social media, other promotions
	-	Professionalism in the production line of APF	How professional the production site/production line of APF is
	-	Industrial scale production of APF	Large scale production of products from APF
	-	Degree of processing of APF	to what degree is the product processed (ultra-processed vs not processed at all)
	-	Locally oriented (Norwegian) production of APF	Production locally in Norway
	-	Food safety related to APF	Are the products safe to eat- food safety
	-	Climate, nature and environmental effects from APF	how does production of APF affect climate, nature and the environment
	-	Association to origin of APF	Many might have more issues with products made of insects compared to peas
	-	Good sensory properties of APF	Both taste, smell and texture
	-	Price for APF	The price of products made of APF
	-	Healthy to eat APF	Are the products made from APF healthy for the consumer

Country	Name of the factor in original language[1]	Name of the factor in English	Definition of the factor
	-	Convenience to use in a regular diet	How easy is to incorporate APF in a regular diet
	-	Diet for Norwegians not oriented around APF	Traditional Norwegian diet is based on traditional protein sources
	-	Animal welfare in the production of traditional proteins	Animal welfare for traditional protein sources might affect the consumers to choose APF
	-	Health for the consumer	The consumers' health
	-	Mainstream market for APF	not a niche, but a large marked with high interest for more than a small part of the community/consumers
	-	Large household as a market for APF	Cafeteria, institutions, food service and out of home - sectors
	-	Alternative market for APF	Sports (protein supplement), Elderly (undernourished)
	-	Online shopping for APF	- Available products for sale online
	-	Regulatory development for AP	The regulatory adapt and is updated towards new products and markets
	-	Consumer perception for APF	How consumers perceive APF
	-	Shelf life of products with APF	Shelf life of products might influence the consumer choices
Poland			
	Zdrowy skład produktu	Healthy APF product composition	Refers to the ingredients included in a product that promote our health.
	Przejrzysta informacja o składzie	Transparent ingredient information	The ingredient information is clearly visible on the packaging.
	Świadomość dot. zastępstwa	Substitution Awareness	Refers to the awareness among the general public regarding the possibility of replacing animal protein with other forms of protein.
	Świadomość dot. dobra zwierząt	Animal welfare awareness	Public awareness of the overuse of animals for meat production.
	Świadomość dot. ekologii	Environmental awareness	Public's knowledge of the impact of animal meat production on environment (e.g., gas emissions) compared to plant-based alternatives.
	Jasne oznaczenie produktu dot. ekologii/ dobra zwierząt	Clear product labeling regarding health/ecology/animal welfare	Transparent labels on products, providing essential information about their impact on health, the environment, and animal rights; guiding consumers towards informed decisions by highlighting healthier or eco-friendly alternatives.
	Znane/ tradycyjne produkty (dla konsumentów) zawierające AP	Familiar and well-known consumer brands containing APF	Inclusion of alternative protein sources in products by established and recognized brands; well-known brands

Country	Name of the factor in original language[1]	Name of the factor in English	Definition of the factor
			should indicate on their product packaging if they contain alternative proteins. This can encourage manufacturers to use alternative proteins.
	Edukacja wczesna dot. AP	Early education on APF	Integration of knowledge about alternative protein sources into early educational programs (targeting both children and their parents).
	Normalizacja konsumpcji AP	Normalization of APF consumption	To normalize APF consumption by making APF products widely available.
	Cena produktów AP	Pricing of APF products	Pricing of APF products should be equalized to well-known products in the market, such as meat.
	Atrakcyjna oprawa graficzna opakowań	Attractive packaging	AP products are packed in an attractive manner that appeals to consumers, influencing their desire to choose the product.
	Dostępność w sklepach/ marketach	Availability in stores/markets	Availability of products in both large and small stores in urban and rural areas.
	Otwartość na próbowanie AP	Openness to trying APF	Curiosity and openness about trying new APF products.
	Zakres preferencji smakowych	Range of taste preferences	Range of individuals taste preferences; a narrow range of taste preferences makes it more challenging to choose AP, as consumers may be less willing to try new or unfamiliar flavors. Conversely, a broad taste preference range facilitates the selection of AP).
	Różnorodność produktów z AP	Variety of products with APF	Providing a greater variety of APF products options.
	Bezpieczne warunki produkcji AP	Safe production conditions of APF	Assurance of health and safety standards in the manufacturing process of APF (need for strict rules and clear methods in producing APF to make sure people can trust that these foods are safe and good quality).
	Promocja APF przez autorytetów/ influencerów	Promotion of APF by entities/influencers	Involvement of well-known entities/influencers in the field of nutrition advocating for the choice of AP.
	Wiek	Age	Influence of age on trying/openness to new products from AP.
	Starzejące się społeczeństwo	Aging society	Changes over the course of a person's life in attitudes toward AP.
	Promocja tradycyjna	Traditional promotion	Refers to the promotion of APF products through conventional advertising channels such as print media (newspapers, magazines) and broadcast media (TV, radio).

Country	Name of the factor in original language[1]	Name of the factor in English	Definition of the factor
	Technologia produkcji AP	Alternative protein (AP) production technology	Modern, widespread, and advanced methods used in the production of alternative proteins
	Edukacja (ustawiczna)	Education (continuous)	Ongoing educational efforts to inform and engage individuals about APF at every stage of development and age
	Konkurencja między producentami	Competition among producers	AP producers competing against each other; competition makes producers work harder to improve what they sell, making these foods more appealing and affordable for everyone
	Aprobata społeczna	Social approval	The belief that people have about the behavior of others, and the desire to conform to their actions. The more a product is consumed, the more socially acceptable it becomes.
	Względy etyczne	Ethical considerations	Welfare of the animals
	Negatywna postawa wobec alternatywnych białek	Negative attitude towards AP	Negative attitudes and beliefs. Personal attitude towards eating specific products containing APF e.g., eating insects may trigger negative attitudes.
	Wykorzystanie odpadków	Waste usage	Reusing products few times in a row.
	Wysokość ceny alternatywnych białek	Price of APF	Price of APF product.
	Wartości odżywcze	Nutritional values	Good quality ingredients in APF product.
	Jakość wewnętrzna alternatywnych białek	Internal quality of the APF	No pesticides or preservatives, accurate way of preserving product.
	Dostępność alternatywnych białek	Availability of alternative proteins	High availability of APF product may encourage people to buy them, it is important that APF products should be available in fast-food restaurants or regular restaurants.
	Popularność altern. białek w społeczeństwie	popularity of APF in the society	Commonness of APF in society, other people can encourage us to buy AP.
	Urozmaicenie żywienia	Nutritional diversity	Diet rich in diverse sources of protein.
	Smak alternat. białek	Taste of the AP	Taste preferences of individual.
	Stosunek do własnej diety	Attitude to one's diet	Caring or not caring about one's diet, keeping a healthy diet to maintain good health
	Tradycja w Polsce	Tradition in Poland	Religious, cultural and social attitudes about eating.
	Względy ekologiczne	Ecological considerations	Caring for the environment.
	Odczuwany wstręt	Perceived disgust	Characteristic of a product that encourage or discourage to eat AP.
	Jakość zewnętrzna alternatywnych białek	External quality of the APF	Aesthetic of a product.
	Marketing produktu	Product marketing	Promotion of APF product.
	Pozytywna postawa wobec alternatywnych protein	Positive attitude towards AP	Positive attitude, positive beliefs, individual attitude towards eating APF

Country	Name of the factor in original language[1]	Name of the factor in English	Definition of the factor
			products e.g., not eating meat is more ethical.
	Tradycja spożycia	Tradition of consumption	The tradition of consuming products in the region, family and country (Poland).
	Dostępność do źródła białka	Availability of source of protein	The availability of products or raw materials related to AP.
	Cena produktów zawierających AP	Price of products containing APF	The effect of price on the willingness to buy products containing AP. Price of APF products comparable to classic protein sources.
	Akceptowalność smaków	Taste acceptability	An individual characteristic of the taste of the finished product containing AP.
	Dobro planety	Well-being of the planet	Care for and impact on the environment.
	Stan wiedzy na temat AP	State of knowledge about APF	Consumer's knowledge about AP.
	Szybkość przygotowania produktów do spożycia	Quickness of preparation of products for consumption	The ease of self-preparation of dishes from products containing APF at home.
	Postrzegana wartość odżywcza	Perceived nutritional value	Consumers' perception of the nutritional value of a given APF product compared to a classic protein source.
	Skojarzenia z AP	Associations with APF	Perceptions about AP, for example, insects, can be associated with pests which can make it difficult to accept APF as a product for consumption when one feels, for example, revulsion.
	Popularność produktów z AP	Popularity of APF	Knowing that one's consumption of products with alternative proteins is influencing and encouraging others to buy products with alternative proteins
	Forma AP	Form of APF	Processed products/unprocessed sources of alternative proteins. The form of APF from insects in processed form may be more likely to be eaten.
	Zrównoważona produkcja	Sustainability of production	Positive and safe impact on the environment
	Bezpieczeństwo produktu	Product safety	Information on whether or not products with APF contain pesticides, etc.
	Postrzegany wpływ na zdrowie	Perceived health impact	How a person perceives the product in terms of safety for their own health.
	Wartość użytkowa produktów AP	Usable value of APF products	What consumers can make from an APF product; for example, a certain dish for dinner or sweet baked goods.
	Moda na zdrowy styl życia	Trend for healthy lifestyle	Seeking alternative protein products because it can help with maintaining a healthy lifestyle

Country	Name of the factor in original language[1]	Name of the factor in English	Definition of the factor
	Moda na spożycie produktów z AP	Trend for the consumption of APF products	The influence of known figures on the desire to buy APF products which is not associated with nutritional values.
	Wygląd opakowania	Appearance of the packaging	Attractiveness of the packaging and visible product composition on the package.
	Konsystencja produktu	Consistency of the product	An individual's preferred consistency of a product.
	Pomysł na użycie w diecie produktów z AP	Ideas of using APF products in the diet	Knowledge of variety of recipes in which APF products can be used.
	Obawa przed stopniowym wycofywaniem klasycznych źródeł białka	Fear of phasing out classic protein sources	The concern that when alternative products will be popular, they will exclude products that are familiar (products with classic protein sources).
	Ciekawość	Curiosity	The desire to try new/other products that contain alternative proteis.
	Hejt na produkty z APF (z insektów)	Abhorrence/hate referring APF products (from insects)	Negative public perceptions/opinions/ hate- comments in social media, dealing with the consumption of APF products from, for example, insects.
	Ekspozycja produktów z APF przez autorytety	Exposure of APF products by known figures	Exposure of APF products by prominent, popular people on TV or social media. A form of trend and continuous exposure of the consumer to see these products on TV or social media.
	Status prawny	Legal status	The legal application/implementation of new foods which affects the supply and popularity of products and positively affects the safety and legality of the product.
	Produkcja bezodpadowa	Waste-free production	Producing protein with no or limited waste which affects sustainable production.
	Dotychczasowe nawyki i preferencje żywieniowe	Existing food habits and preferences	Individual habits and choices of new products.
	Atrakcyjny smak	Attractive taste	A generally tasty flavor that encourages consumers to try a product. An unattractive taste can discourage.
	Cena AP	APF price	Comparable price to traditional protein sources that will attract consumers.
	Istnienie kampanii uświadamiających	Existence of an awareness campaigns	The emergence of an APF campaigns which can make potential consumers more aware of its existence.
	Kwestie zdrowotne	Health issues	Health recommendations aimed to reduce animal protein in the diet
	Trend	Trend	Promotion of APF by influencers/known figures on social media.
	Wiedza jak zastosować produkt	Knowledge of how to use the APF product	Knowledge of how to prepare and use the product in recipes. Ready recipes containing alternative proteins.

Country	Name of the factor in original language[1]	Name of the factor in English	Definition of the factor
	Dostępność produktów z AP	Availability of APF products	Presence of APF products in local stores.
	Urozmaicenie kulinarne	Culinary variety	Readiness to diversify dishes by adding APF products.
	Kwestie etyczne	Ethical issues	A campaign to make people aware of the suffering of animals that are used in animal protein or dairy production.
	Pełnowartościowe białko	Whole food protein	One serving of an APF product containing the approximate amount of protein as meat.
	Dostępność badań	Availability of research	Availability of studies that prove the safety of APF products.
	Czynniki środowiskowe	Environmental factors	Information on the use of water, carbon footprint and energy in the production of APF vs. traditional protein sources.
	Wstręt	Disgust	Aversion towards APF from insects, lab-produced protein and soy chops.
	Marketing tradycyjny	Traditional marketing	Presenting and promoting APF through radio and TV to reach various audiences.
	Oswojenie z nazewnictwem	Familiarity with nomenclature	Name of the product should encourage consumption; e.g., soy burger may reach some consumers. Possible changes in naming to completely different names, not linked to animal protein product names.
	Profilowanie produktów	Product profiling	Matching APF products to the affluence of the consumer.
	Ciekawość	Curiosity	Interest in trying new products.
	Długość czasu przechowywania	Length of shelf life	The expiration date of a product; how long a product can be stored at home.
	Naturalność produktu	Naturalness of the product	Less processed products, no pesticides or preservatives.
	Pochodzenie AP	The origin of AP	The origin of protein in European culture and society; protein not from insects is more openly consumed in Europe and consumers from Asian countries will be more likely to eat APF from insects.
	Kontekst polityczny	Political context	Influence of politics on protein selection approach. The dependence of the approach to APF is related to political views.
	Powszechna dostępność	Widespread availability	The ease of purchasing APF products in the market/stores.
	Troska o środowisko	Concern for the environment	Person concerned more about the environment would be more open to purchasing products with AP.
	Chęć spożycia produktu z AP	Willingness to consume products from AP	The desire/wish to consume substantial amounts of protein from alternative sources without disgust.

Country	Name of the factor in original language[1]	Name of the factor in English	Definition of the factor
	Przekonania dot. produktów	Product beliefs	Attitudes/beliefs/frequent aversion to APF from insects based on knowledge.
	Akceptowalność smaków	Flavor acceptability	More attractive taste for the consumer compared to traditional products.
	Wartość odżywcza produktów z AP	Nutritional value of products from AP	Good composition of products, high amount of protein and no preservatives.
	Podobieństwo do tradycyjnych produktów	Similarity to traditional products	Substitution of traditional, well-known products for APF products.
	Atrakcyjna cena	Attractive price	Lower/similar price of products from APF as traditional products.
	Łatwość zastosowania	Easiness of using	Convenience of using or adding products from APF to meals.
	Upowszechnienie wiedzy o AP	Dissemination of knowledge about AP	The greater knowledge about AP, the more consumption/tasting of products from AP.
	Troska o dobro zwierząt hodowlanych	Concern for the welfare of livestock	Concern for the welfare of animals destined for meat.
	Normalizacja tematu AP	Normalization of APF topic	The universality of APF topic in media, TV and campaigns.
	Konkurencyjna wartość zdrowotna produktów z AP	The competitive health value of APF products	Greater nutritional value of APF products than of original/traditional products.
	Korzyści zdrowotne	Health benefits	Public perception of health/environmental values of APF products.
	Różnorodna forma AP	Diverse form of APF	More products with APF and a variety of forms (e.g. burgers, gyros, sausages, etc.) increasing the chance of finding a product that suits us.
Portugal			
	-	Socio-economic factors	Promote social sustainability, local economic development, job creation
	-	Environmental sustainability	Alternative Proteins (AP) production is perceived as an activity with less environmental impact
	-	Organoleptic characteristics	Smell, taste and texture of Alternative Proteins
	-	Disgust	Disgust for the product
	-	Local employment development	Locality of Alternative Proteins
	-	Cultural aspects	Loss of connection with the culture of origin and influence on eating habits
	-	Ethical issues in production	Example: deforestation
	-	High price of Alternative Proteins	Alternative Proteins products are usually more expensive
	-	Product availability	Availability of Alternative Proteins products

Country	Name of the factor in original language[1]	Name of the factor in English	Definition of the factor
	-	Concern for animal welfare	Alternative Proteins are chosen because the consumer considers that by choosing APF they are protecting animals
	-	Food security	Food security definition: when all people, at all times, have physical and economic access to sufficient safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life
	-	Trends	The consumer tries AP, because it is a trend
	-	Food neophobia	Aversion to new food
	-	Nutritional profile of APF	Nutritional profile of APF products
	-	Health impact	Positive or negative impact on health
	-	Trust	Consumer trust in APF products
	-	Ultra-processed foods	AP are perceived as unnatural, have a long list of ingredients
	-	Illiteracy about AP	Lack of knowledge and information about AP
	-	Nutrition and health claims	Nutrition and health claims made on APF products labels
	-	Perceived positive impact on health	Perceived positive impact on health by the consumer
	-	Perceived negative impact on health	Perceived negative impact on health by the consumer
Slovenia			
	Cenovna dostopnost končnega produkta	Price of the product	the main reason whether a consumer will buy (any) product. It is believed that plant-based products are less burdensome for the environment but if they are more expensive compared to conventional animal-based products, the consumer will not buy them often enough. Among the first things that the consumer checks when going to the store is the price of the product. The price of alternative proteins must be competitive with animal-based products.
	Razpoložljivost končnega izdelka	Availability of the product	the availability of plant-based proteins is now limited to supermarkets and biggest food stores. Usually in smaller stores, the places on the shelves are limited, and plant-based products are often not found or limited in their offer.
	Ciljno tržišče	Goal market	sustainability, animal welfare, and ethics aren't as equally important in all markets. In Slovenia for example less than in Western markets.

Country	Name of the factor in original language[1]	Name of the factor in English	Definition of the factor
	Cenovna dostopnost surovin	Price of ingredients	alternatives are not cheap compared to animal-based ingredients
	Razpoložljivost surovin	Availability of ingredients	Slovenia is a small country, and it is often hard to obtain certain ingredients for certain products, namely because low quantities are usually ordered by a company, and with that, the price is usually higher.
	Vpliv na okolje	Environmental impact	plant-based products are considered to have less impact on the environment by the consumer. The workshop participants point out that a lot of sources (water etc.) can be used to obtain some plant-based protein sources (e.g. soy protein). Especially in B2B sales, sustainability certificates are very sought after (especially the sustainability of soy protein).
	Trajnostni vidik (trajnostne študije)	Sustainability aspect	Nowadays, decreasing carbon footprint is the focus and considered important, as well as a life cycle analysis that must be done.
	Vpliv vplivnežev	Influence of influencers	if a company approaches the consumer with transparent communication, and explains the sustainability and animal welfare aspects, the consumers will maybe be willing to pay more to contribute to a better life on our planet.
	Blagovna znamka izdelka	Product brand	with time, the reputation of a certain company is being built as well as trust and acceptance of consumers. More often they decide to buy a product from a brand that is “verified” and known.
	Pozicioniranje izd. na policah	Product placement on the shelves	the consumer’s journey through the store is well-known and documented. Product placement (e.g. special designated areas, placement in the middle shelves,…), is an important factor when the consumer is choosing a product.
	Moralni pomisleki	Moral concerns	insect proteins are not yet accepted by the consumer as it was recently demonstrated in Slovenia. With every new product/ingredient/technology, it is important to communicate transparently and to break down all myths.
	Etični vidik	Ethical aspect	Negative feelings towards animal proteins. We should be aware of and preserve animal diversity.

Country	Name of the factor in original language[1]	Name of the factor in English	Definition of the factor
	Dobrobit živali	Animal welfare	plant-based protein products are considered to cause less harm to animals.
	Oglaševanje	Advertising	products that are advertised correctly, will be sold more.
	Videz izdelka	Appearance of the product	There are more senses that decide the attractiveness of the product to the consumer. The product needs to be visually appealing for the consumer to buy it.
	Okus	Taste	consumers who buy plant-based products have a special taste and perceive those products differently than the consumers who buy animal-based products. They focus on different sensory properties and aftertastes. The taste of alternative protein products does not need to be the same as the proteins they are substituting, but it has to be good.
	Videz embalaže izdelka	The appearance of the packaging	the packaging must be visible to the consumer when they are in the store. The packaging can also represent what is inside the packaging and is a good communication tool for the consumer.
	Hranilna sestava	Nutritional composition	Fiber content, protein value, energy value, and (saturated) fat composition in alternative protein products are considered superior by consumers, compared to animal products.
	Vpliv beljakovin na zdravje	Health concerns	the consumer is looking for functional benefits of alternative protein sources, they are looking for “healthy proteins”. Every person wants to take care of themselves and avoid nutrients that are considered not the best in animal-based products.
	Senzorične lastnosti izdelkov	Sensory properties of a product	A product needs to be sensory appealing. We produce food – it is not a souvenir; it has a purpose to be eaten and consumers expect to have a pleasant experience when they consume it.
	Kulturni vidik različnih družb	The cultural aspect of different societies	Some cultures are much more prone to plant-based diets than Western cultures are.
	Vrsta alternativnega vira beljakovin	Type of alternative protein source	Acceptance of certain plant-based proteins, such as soy, is much more negative compared to other plant-based proteins. Consumers may have an extremely negative relationship

Country	Name of the factor in original language[1]	Name of the factor in English	Definition of the factor
			towards certain plant-based protein sources, such as soy.
Spain			
	Oferta dieta variada	Varied dietary offer	Alternative protein products can provide us some nutrients that traditional ones do not provide.
	Factor novedad	Food trends	Innovative products attract attention and many people consume them out of curiosity. If they are also trendy, they generate more interest in the consumer.
	Percepcion de ultraprocesado	Perception of ultra-processed	New products made with alternative proteins may create the perception in the consumer that they are ultra-processed products because several ingredients must be included to achieve the final product.
	Composición	Product composition	Composition of a product understood as the quantity of ingredients and additives it contains.
	Conocimiento de procedencia de fuente proteica	Protein origin knowledge	The average consumer is not aware of alternative proteins to traditional ones. The consumer will positively value knowing the origin of the raw materials or the source. For example, peas, as opposed to insects.
	Desconocimiento	Lack of knowledge	Consumers are ignorant of the existence of alternative proteins and their potential health or environmental benefits.
	Visibilidad mediatica	Media influence	Visibility of these products made from alternative proteins in communication channels, social networks and television advertisements mainly. There is no place in media channels for this kind of products.
	Inversión marketing	Marketing investment	Investment in advertising by a company to advertise new products. For example, a company with traditional products launches a new line of novel foods and does not advertise it.
	Organoleptico (sensorial)	Organoleptic (sensory)	Organoleptic characteristics of the product: texture, palatability, taste, flavour.
	Expectativas del producto	Expectations about the product	The consumer's initial expectations or judgement of this type of product.
	Precio del producto	Product price	Final price of the product.
	Situación familiar (social)	Family situation (social)	Structure of the family unit and its components. Whether the food provider is aware of these new proteins

Country	Name of the factor in original language[1]	Name of the factor in English	Definition of the factor
			or not, or whether the food provider has to take care of children or only himself/herself.
	Situación familiar (economica)	Family situation (economic)	Financial situation of the family.
	Edad de comprador	Age of the client	Age of food providers or household members.
	Diversidad de oferta	Offer diversity	Diversity of new products with alternative protein, not only meat analogues.
	Promocion de consumo	Promotion of consumption	Promotion of consumption of this kind of products by the institutions.
	Disponibilidad/Inclusión	Availability/producto placement	Availability of this kind of products on the supermarket and included with the rest of the traditional products (the opposite would be to find them in a section of the supermarket for plant-based or analogous products).
	Concienciación sostenibilidad	Sustainability awareness	Consumer awareness of potential sustainability benefits. Sometimes influences a small group.
	Aspecto (sensorial)	Appearance (sensory)	First sight perception of the product and its presentation (packaging). Visual impact, attractiveness.
	Concienciación salud	Health awareness	Consumer awareness of potential health benefits. Sometimes influences a small group, the vegan/vegetarian niche.
	Momento de consumo	Time of consumption	Consumption opportunities of the products (time of consume) and their inclusion in the traditional diet or cuisine of the country.
	Similtud al origen	Similarity to the origin	Similarity to the product it replaces or imitates by including the alternative protein in an existing matrix or creating a new matrix or product.
	Bienestar animal	Animal welfare	The consumption of alternative protein products reduces the consumption of traditional animal products.
Türkiye			
	-	Acceptance of APF	Ability of alternative protein-based product substitute animal-based product.
	-	Animal welfare and ethics	Inadequate animal production conditions
	-	Marketing and consumer perception	The marketing of these products affect their acceptance among consumers.
	-	Economic factors	Animal protein production costs will be higher in next years so consumers can prefer alternative proteins more, because they are more cost effective.

Country	Name of the factor in original language[1]	Name of the factor in English	Definition of the factor
	-	Preference of APF	The plant-based products can be preferred for their health effects, environmental conditions and ethic issues more than animal-based products.
	-	Cultural and social factors	Consumption trends of APF can be changed according to cultural and regional factors.
	-	Carbon footprint	Plant-based production leads to lower carbon footprint than animal production.
	-	Health effects	There are some concerns over red and processed meat links to diseases. So consumers can accept more the plant-based products.
	-	Sustainable production	Sustainable production of alternative protein products could be more effective than animal proteins.
	-	Taste and textural properties of APF	The taste and texture of the alternative proteins effects preferability of consumers.
	-	Price of APF	The price of the alternative protein products affects their acceptance by the consumers.
	-	Water footprint	Plant-based production leads to lower water footprint than animal production.
	-	Label information of APF product	Explanatory and transparent label information of alternative protein products affects consumer's preferences.
	-	Promotion and advertising	If we could promote the plant-based proteins, it will increase the preference and consumption of them.

Note. [1]*Not every country has provided name of the factors in their original language. APF = Alternative proteins.*

Supplementary Table 2. Results of network analysis

Country	Degree	Betweenness centrality	Closeness centrality	Eigenvector centrality
Austria	Curiosity = 4 Health effects of APF products = 4	Curiosity = 34 Availability of APF products = 30.5 Animal welfare and protection = 10.5	Availability of APF products = 0.52 Curiosity = 0.52 Animal welfare and protection = 0.42	Ingredient overload in APF products = 0.49 Health effects of APF products = 0.49

	ingredient overload in APF products = 4		Health effects of APF products = 0.42 Ingredient overload in APF products = 0.42 Price = 0.42	Nutritional factor of plant proteins (PER) = 0.41 Ultra-processed foods = 0.41
Czech Republic	Fear of the unknown = 5 Price = 4	Fear of the unknown = 28 Price = 21 Health benefit = 8	Fear of the unknown = 0.64 Price = 0.56 Health benefit = 0.45	Fear of the unknown = 0.58 Price = 0.49 Promotion = 0.45
Denmark	Family suitability = 4	Family suitability = 53 Food safety = 36 Knowledge of preparation = 35	Family suitability = 0.47 Knowledge of preparation = 0.43 Food safety = 0.39 Availability = 0.39	Family suitability = 0.49 Danish food culture = 0.38 Knowledge of preparation = 0.38
France	Use & habits = 10 Education = 7 Representation / perception = 5	Use & habits = 88.8 Naturality = 50.7 Process transparency = 38	Use & habits = 0.59 Education = 0.53 Representation / perception = 0.53	Use & habits = 0.51 Education = 0.45 Representation / perception = 0.35
Germany	Familiarity = 7 Availability = 8 Social norms = 8	Familiarity = 3.2 Social norms = 7.6 Availability = 5.6	Familiarity = 0.60 Social norms = 0.64 Availability = 0.62	Familiarity = 0.32 Availability = 0.36 Social norms = 0.36
Greece	Familiarisation with APF = 11 Educational level = 7 Sustainability APF = 6 Price = 6 Consumer awareness = 6	Familiarisation with APF = 35.4 Sustainability APF = 21.2 Educational level = 20.9	Familiarisation with APF = 0.67 Educational level = 0.62 Sustainability APF = 0.59	Familiarisation with APF = 0.47 Educational level = 0.37 Age = 0.26
Italy	Advertising = 8 Curiostiy = 7	Advertising = 12.7 Curiosity = 12	Advertising = 0.72 Curiosity = 0.68	Advertising = 0.43 Curiosity = 0.38

	Environmental impact = 6	Food safety = 4.9	Environmental impact = 0.62	Environmental impact = 0.32 Protein intake = 0.32
Norway	Regulations for products with APF = 6 Marketing of APF = 6 Regulatory development for APF = 5 Shelf life of products with APF = 5	Regulations for products with APF = 101.5 Marketing of APF = 86.6 Degree of processing of APF = 66.8	Regulations for products with APF = 0.42 Degree of processing of APF = 0.40 Marketing of APF = 0.39 Nature and environmental effects from APF = 0.39	Regulations for products with APF = 0.28 Nature and environmental effects from APF = 0.27 Degree of processing of APF = 0.26
Poland (1st workshop)	Popularity of APF in the society = 12 Positive attitude towards APF = 11 The price of APF = 9 Availability of alternative proteins = 9	Positive attitude towards APF = 27.5 Popularity of APF in the society = 14.2 The price of APF = 11.4	Positive attitude towards APF = 0.76 The price of APF = 0.70 Popularity of APF in the society = 0.70 Nutritional diversity = 0.70	Nutritional diversity = 0.35 Popularity of APF in the society = 0.35 Positive attitude towards APF = 0.35
Poland (2nd workshop)	Social approval = 4 Normalization of APF consumption = 4 Education (continuous) = 4	Openness to trying APF = 100.3 Pricing of APF products = 91.8 Promotion of APF by entities/influencers = 72.8	Openness to trying APF = 0.39 Promotion of APF by entities/influencers = 0.37 Pricing of APF products = 0.35 Education (continuous) = 0.35	Education (continuous) = 0.44 Normalization of APF consumption = 0.37 Social approval = 0.37
Poland (3rd workshop)	Popularity of products with APF = 24 Trend for the consumption of APF products = 15	Popularity of products with APF = 120 Trend for the consumption of APF products = 37.4	Popularity of products with APF = 0.81 Trend for the consumption of APF products = 0.64	Popularity of products with APF = 0.47 Trend for the consumption of APF products = 0.32 State of knowledge about APF = 0.30

	Product safety = 11	The tradition of consumption = 20	State of knowledge about APF = 0.63	
Poland (4th workshop)	Culinary variety = 13 Disgust = 12 Product availability = 11	Culinary variety = 19.4 Disgust = 19.1 Health issues = 16.4	Culinary variety = 0.70 Disgust = 0.66 Curiosity = 0.63 Price of the APF = 0.63	Culinary variety = 0.37 Disgust = 0.33 Product availability = 0.32
Poland (5th workshop)	Willingness to consume APF product = 15 Product beliefs = 9 Normalization of the APF topic = 8	Willingness to consume APF product = 46.2 Product beliefs = 18.4 Dissemination of knowledge about APF = 11.6	Product beliefs = 0.70 Dissemination of knowledge about APF = 0.64 Normalization of the APF topic = 0.59	Willingness to consume APF product = 0.47 Dissemination of knowledge about APF = 0.33 Normalization of the APF topic = 0.32
Portugal	Nutritional profile of APF = 5 Trends = 5 Trust = 5	Trends = 73.4 Trust = 60.9 Ethical issues in production = 52.8	Trends = 0.44 Trust = 0.42 Illiteracy about APF = 0.41	Trust = 0.44 Trends = 0.40 Illiteracy about APF = 0.36
Slovenia	Influence of influencers = 6 Product purchase = 6 Taste = 6	Product purchase = 80.3 Influence of influencers = 61.6 Taste = 51.3	Product purchase = 0.54 Taste = 0.48 Influence of influencers = 0.47	Product purchase = 0.42 Taste = 0.39 Influence of influencers = 0.33
Spain	Promotion of consumption = 9 Perception of ultra-processed = 7 Lack of knowledge= 7	Promotion of consumption = 108.7 Lack of knowledge = 56.9 Perception of ultra-processed = 48	Promotion of consumption = 0.60 Perception of ultra-processed = 0.51 Lack of knowledge = 0.51	Promotion of consumption = 0.50 Lack of knowledge = 0.37 Perception of ultra-processed = 0.28
Türkiye	Preference of APF = 11 Marketing and consumer perception = 7 Sustainable production = 5	Preference of APF = 39 Marketing and consumer perception = 9.5 Sustainable production = 3.7	Preference of APF = 0.87 Sustainable production = 0.62 Marketing and consumer perception = 0.62	Preference of APF= 0.49 Marketing and consumer perception = 0.35 Taste = 0.30

- **Annex III: The preparatory materials for workshop participants**

MATERIALS FOR STAKEHOLDERS: WORKSHOP ON FOOD SYSTEM MAPPING

What is LIKE-A-PRO?

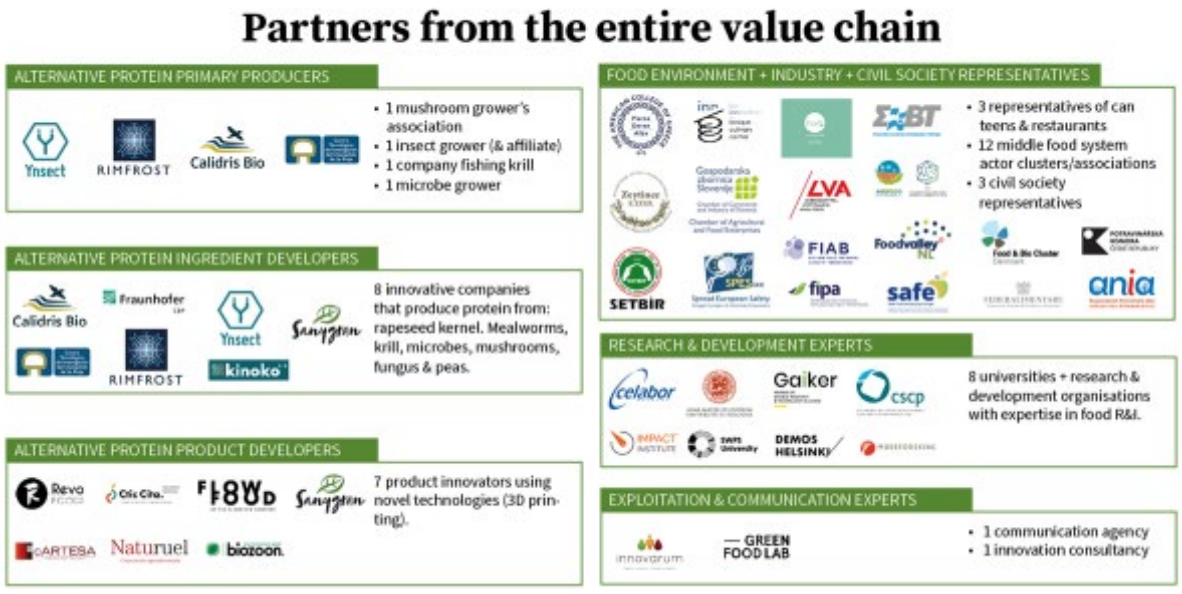
The LIKE-A-PRO project aims to facilitate sustainable and healthy diets by shifting promising alternative proteins and products from niche to mainstream - making them more available, accessible, and acceptable to all population groups. This includes young people, adults, elderly, vulnerable groups, such as people of low socio-economic status, ethnic minorities, and those living in rural locations.

LIKE-A-PRO has set out to….

- Understand what determines consumer behaviour and the necessary food ecosystem governance frameworks that enable a higher uptake of alternative protein products.
- Diversify the alternative protein supply & developing new alternative protein products, increasing the availability of these products in the European market while ensuring consumer acceptability.
- Empower food system stakeholders to make alternative protein products an easy and economically viable choice via their diversified & increased market supply and ensured favourable food ecosystem conditions.

Ensure that the project developments in alternative protein products and FEs will bring positive changes in terms of health and sustainability of the European food system, while remaining in line with regulatory frameworks and ethical requirements

LIKE-A-PRO unites 42 dedicated partners across 17 countries



visit us on https://www.like-a-pro.eu/ **for more information**

Which alternative proteins will be discussed?

RAPESEED KERNEL PROTEIN (by FRAUNHOFER)

- Protein concentrate obtained from rapeseed after oil extraction in a process that guarantees high protein content (55%) & quality. The LIKE-A-PRO rapeseed kernel protein has good functional properties (solubility, foaming, emulsifiability) and a very good amino acid profile. Rapeseed is a widely grown EU crop that is GMO-free.

MEALWORM PROTEIN (by YNSECT)

- High protein concentrate (70-80%) - dossier sent to EFSA for two protein concentrates - derived from the processing of the larvae of lesser mealworm (*Alphitobius diaperinus*) and yellow mealworm (*Tenebrio molitor*). Mealworm proteins are well digestible, contain all 9 essential amino acids, are high in vitamins, minerals & fibre (chitin).

KRILL PROTEIN (by MOREFOSKING + RIMFROST)

- Protein concentrate derived from Atlantic krill (*Euphausia superba*, small crustaceans rich in high quality protein, while low in fat). Currently, krill fisheries produce oil supplements for the human consumption, while by- products (krill meal/krill shells) are underutilized (applied mainly for aquacultural or petfood). Thus, increasing krill raw material sustainable uses is a clear market need. The LIKE-A-PRO krill protein concentrate has high protein content and contains antioxidant astaxanthin and polyphenols.

MICROBIAL PROTEIN (by CALIDRIS)

- Microbial biomass of fast-growing Methylotrophs (proprietary natural and non-GMO strain), produced via fermentation of renewable methanol. The microbial biomass has a high protein content (65-70%), with a high amount of essential amino acids (meeting the human nutrition needs as by FAO/WHO). It has excellent functionality (e.g., emulsion capacity) allowing for clean label products and has constant quality (easy to blend in standard food formulations)

CULTIVATED MUSHROOM PROTEIN (by CTICH)

- Protein concentrate from discarded cultivated mushrooms such as white button mushroom (*Agaricus bisporus*), oyster mushroom (*Pleurotus ostreatus*) or shiitake (*Lentinula edodes*). Mushroom industry by-products are managed like waste, even though they are a rich source of nutritionally useful essential amino acids.

FERMENTED FUNGAL PROTEIN (by KINOKO)

- Obtained from fermentation of the mycelium of an edible fungus on pulses such as lentils, chickpea, lupin or pea. An heirloom fungal strain is used, packed with important nutrients, minerals, fibre, and protein (contains all 9 essential amino). The fermented fungal protein is of great mouthfeel, texture, and taste.

PEA PROTEIN (by SANYGRAN)

- Protein concentrate obtained from yellow peas (*Pisum sativum*). It has a good essential amino acid profile and a homogeneous powder form, suitable for different food formulations.

What is a systems map?

A systems map in psychology research is a visual representation of the complex interplay among various components of a system within a specific psychological construct. It can include elements such as individuals, groups, institutions, and environmental factors, and their relationships or interactions. They help to identify key factors, their relationships, and how changes in one component might affect others.

In a system map, components of the system are often depicted as nodes, and their relationships are depicted as lines or arrows. The nature of these relationships can vary widely - they can be causal relationships, correlations, influences, or dependencies, for example.

Source: Castellani, B. (2018). Map Your Theory: An Introduction to System Dynamics Modeling for the Social and Behavioral Sciences. *Springer.*

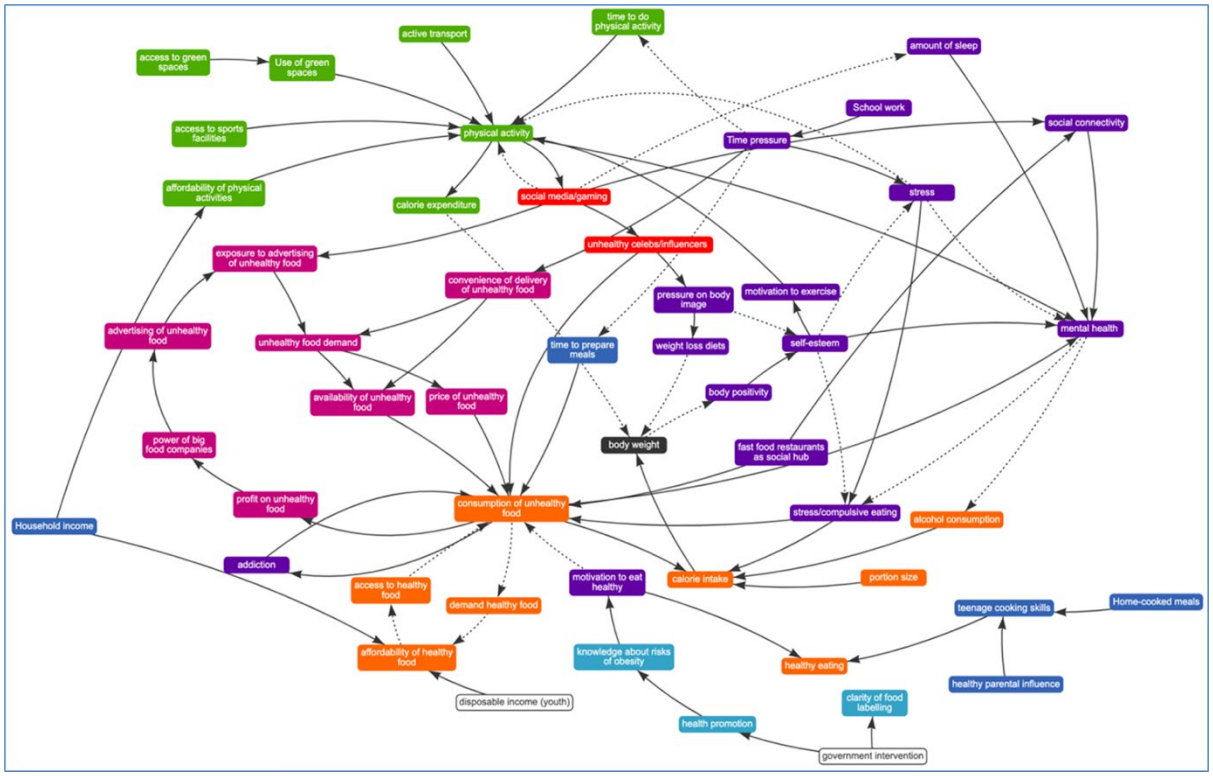


Figure: *An example of a system map of factors that contribute to adolescent obesity. The map shows not just the factors but also the ways in which they may be causally related to each other and to obesity; solid lines - positive relationship, dotted lines - negative relationship; (taken from: Savona et al., 2021).*

What is a food system?

Food systems comprise all the people, institutions, places, and activities that play a part in growing, processing, transporting, selling, marketing, and, ultimately, eating food. Food systems influence diets by determining what kinds of foods are produced, which foods are accessible, both physically and economically, and peoples' food preferences. They are also critical for ensuring food and nutrition security, people's livelihoods, and environmental sustainability.

As shown in the framework below, the different parts of the food system include food supply chains, food environments, and individual factors. Food systems also encompass crosscutting issues and drivers (factors that push or pull at the system, some being exogenous to food systems). The components, crosscutting issues, and drivers all shape food systems and can lead to both positive and negative outcomes.

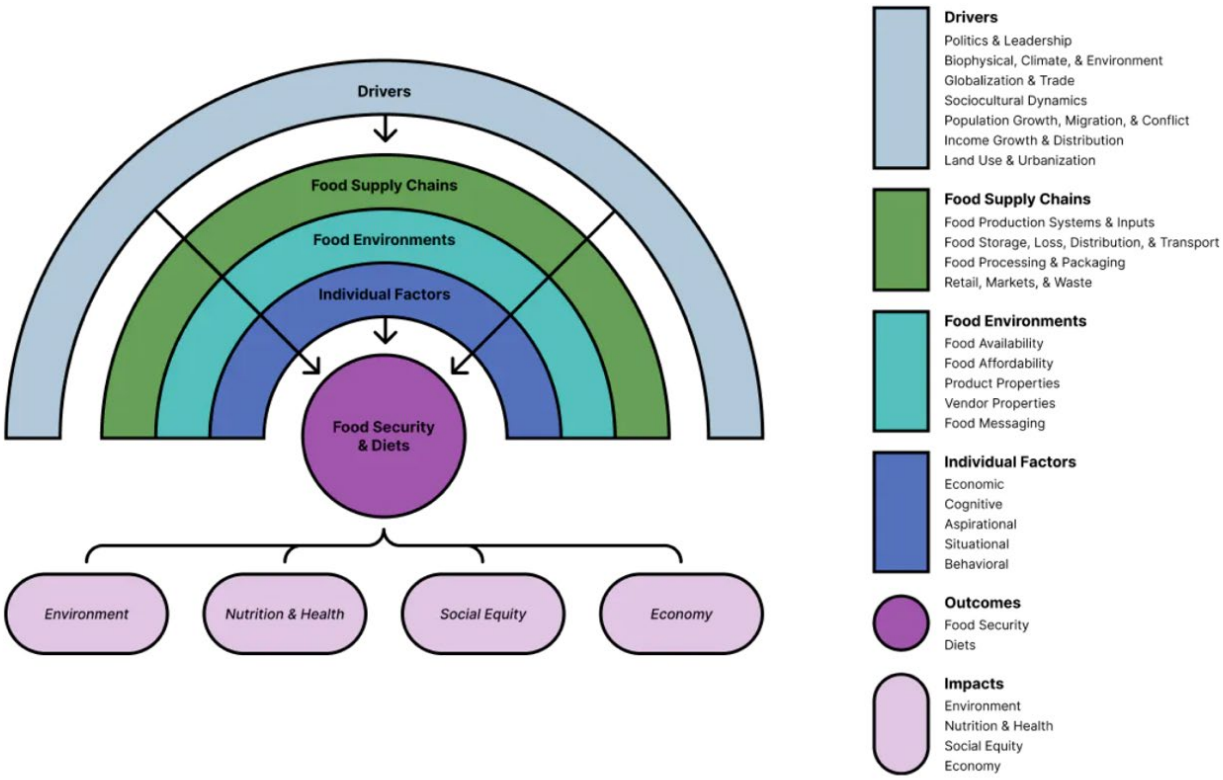


Figure source: foodsystemsdashboard.org/information/about-food-systems

What types/group of determinants are influencing alternative protein choices?

The adoption of alternative proteins is shaped by a multifaceted interplay of determinants, encompassing environmental concerns, health motivations, ethical considerations, cultural and social influences, technological advancements, economic factors, and the impact of advocacy and education. As these determinants continue to evolve, the landscape of alternative protein choices will likely undergo further transformations, contributing to a more sustainable and diversified global food system.

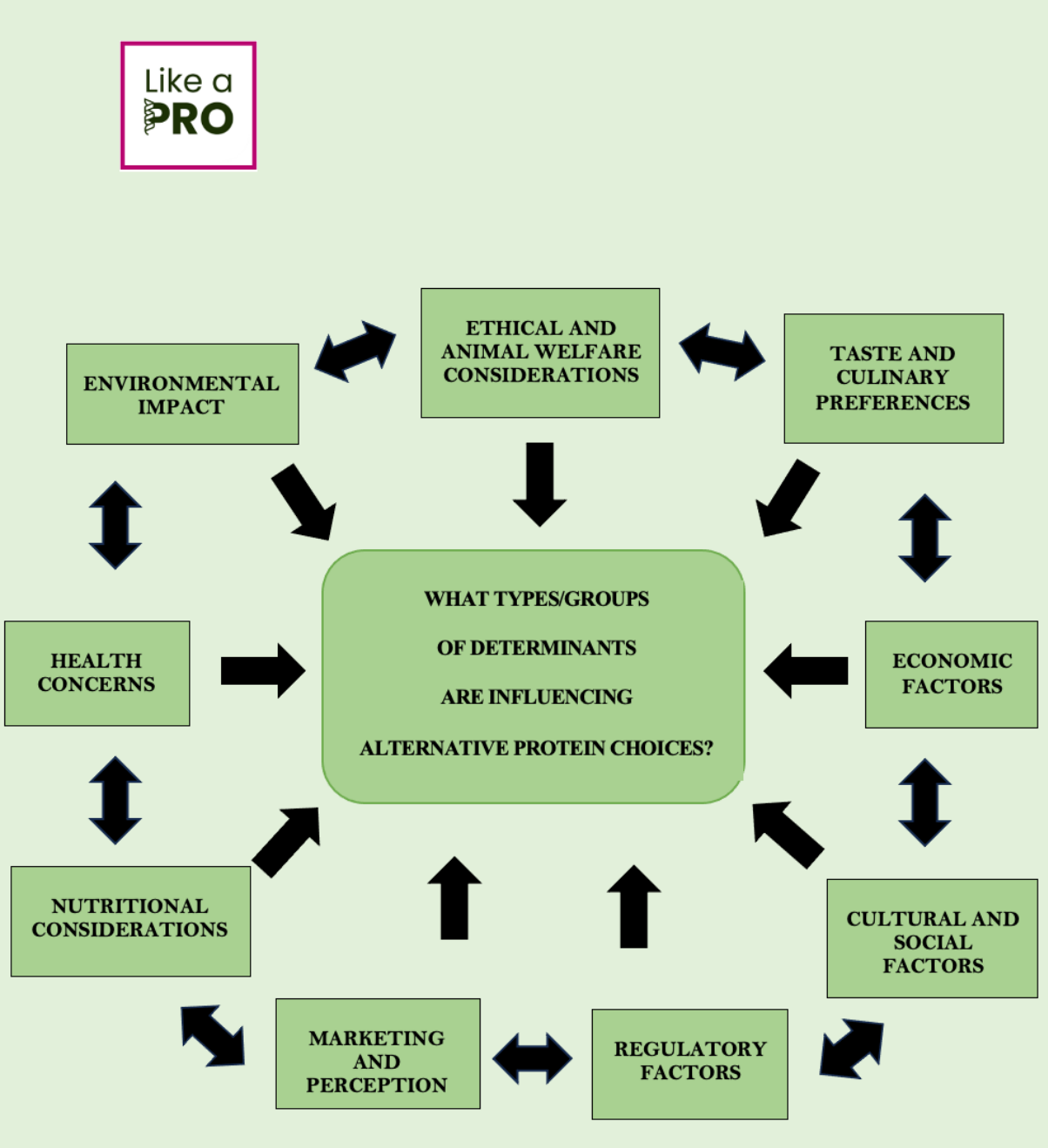
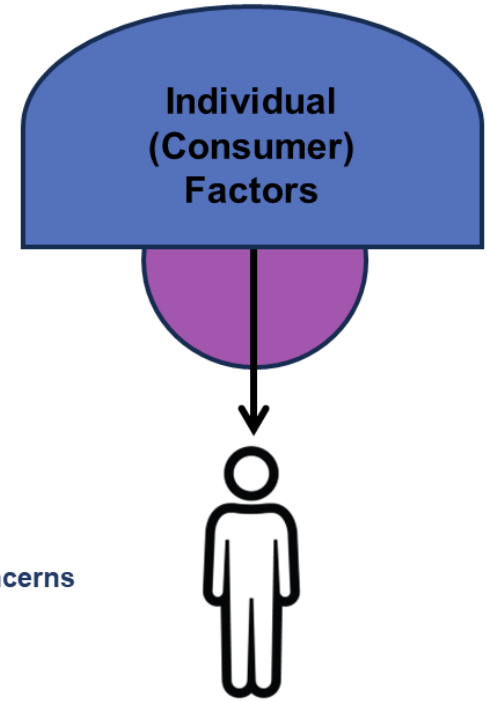


Figure based on Bhat et al., 2014; Bouvard et al., 2015; Craig, 2009; Dossey et al., 2016; Gochfeld & Burger, 2005; Savaiano, 2014; Tack et al., 2020, Dewan & Tamang, 2007; Lusk & Norwood, 2011; van Huis, 2013; Zeller & Pauly, 2005

Moreover, based on the increasing amount of research, the factors that may be specific to individuals (or consumers) include:

- ✓ Income
- ✓ Knowledge
- ✓ Values
- ✓ Preferences
- ✓ Home and work environment
- ✓ Mobility
- ✓ Location
- ✓ Time resources
- ✓ Social norms
- ✓ Religious beliefs
- ✓ Environmental concerns
- ✓ Disgust
- ✓ Culture
- ✓ Neophobia



- ✓ Gender
- ✓ Health Concerns
- ✓ Ethical beliefs
- ✓ Diet
- ✓ Enjoyment of eating
- ✓ Taste preferences
- ✓ Nutritional needs
- ✓ Mental health
- ✓ Health benefits
- ✓ Familiarity
- ✓ Access
- ✓ Animal welfare
- ✓ Identity
- ✓ Fear
- ✓ Risk perception

Source: Batat et al., 2020; Eckl et al., 2021; Onwezen et al., 2021

Like a PRO
This project has received funding from the European Union under Grant Agreement No 101083961
Funded by the European Union

Information Sheet

Project acronym	LIKE A PRO
Project full name	From niche to mainstream – alternative proteins for everybody and everywhere
Project number	101083961
Project duration	01/11/2022 - 31/10/2026
Activity title	Stakeholder workshops (13 countries): food system mapping
Principal investigator	Prof. Aleksandra Luszczynska, PhD, SWPS University; aluszczynska@swps.edu.pl
Local investigator	
Activity duration	September 2023--November 2023

INTRODUCTION

You are invited to take part in a research activity within the LIKE A PRO project in the form of **STAKEHOLDER WORKSHOPS: FOOD SYSTEM MAPPING**. In this Information sheet we will give you information about the purpose of the project and what your participation will involve. Please read through this document carefully before deciding whether you will confirm your participation or not. We encourage you to ask all the questions you may have; it is important that you understand all the procedures, including possible risks and benefits. At all times, we assure the compliance with the applicable EU, international and national law on data protection.

PURPOSE OF THE PROJECT AND THE ACTIVITY

The LIKE A PRO project aims to accelerate the shift towards healthier and more sustainable dietary patterns by diversifying and increasing the availability, accessibility and uptake of alternative sources of protein and specific products. 16 new alternative protein products will be developed during the course of the project, based on ingredients from 7 protein sources which are novel, sustainable, EU-based, healthy, affordable and industry viable. In addition to these products, LIKE A PRO will co-design and promote other type of solutions, such as governance mechanisms which hold the potential to promote alternative protein supply and products in food environments.

The aim of the activity in which you will be involved is **to develop a map of determinants of consumers' choices of alternative proteins. The maps will be developed in 13 countries and account for any relevant individual, social, environmental, policy-related, organization-related, etc. determinants and links between them.**

PARTICIPANT SELECTION

The workshops are organized in 13 EU countries. In each country, the local workshop organizers invite a group of 10-20 people who are representatives of food system stakeholders (e.g., producers, policy makers, retailers, consumers, etc.).

PROCEDURES, BENEFITS & RISKS

The stakeholder workshop will last approximately 2.5hours. It will take place online/in person at the _____(date). The stakeholders will discuss the determinants of alternative protein choices operating in the food system in their country. The workshop will be recorded only for the purpose of securing that the stakeholders' definitions of the determinants are correctly noted. The recording will be permanently deleted at not later than 30 days after the workshop. Directly after the workshop, the participants will be asked to fill in a brief questionnaire, regarding stakeholders' own opinions about the importance of the determinants, and basic information regarding the participant (the type of stakeholder, years of experience, country, age, gender).

The activity presents little or no risk to the participants, which is comparable to the risk encountered during an ordinary office work.

DURATION
This activity will take approximately 2.5 hour.

VOLUNTARY PARTICIPATION
Please understand that your participation is purely voluntary. If you decide to participate, you will be required to fill out and sign an Informed Consent Form as an affirmation of your participation. Should you decide to withdraw you/ your data during the study, please do inform us. Your withdrawal will not affect you in any way. In case you withdraw from this study before completion of the data collection, all information, including the consent will be deleted.

CONFIDENTIALITY AND ANONIMITY
Should you wish to participate, we will ask you for your personal information, such as age and gender. These personal data will be used for the description of the whole stakeholder group (age range, gender distribution).
Privacy: we will process your personal data confidentially and in accordance with the applicable international, EU and national law (in particular, the General Data Protection Regulation 2016/679, national data protection laws and other relevant legislation).
The collected data will be used for project purposes only and always while protecting the identity of participants.

YOUR RIGHTS

So long as you can be identified in the collected data, you have the right to:
- access the personal data that is being processed about you
- request that your personal data is deleted
- request that incorrect personal data about you is corrected/rectified
- receive a copy of your personal data (data portability), and
- send a complaint to the Data Protection Officer regarding the processing of your personal data-

CONTACT INFORMATION
Principal Investigator: Aleksandra Luszczynska, PhD, SWPS University, aluszczynska@swps.edu.pl
If you have questions or concerns about this activity, or want to exercise your rights, contact:
- [Insert the name of institution responsible for the activity] via [insert the name and contact details of the Local Principal investigator].
- Our Data Protection Officer: [insert the name and contact details of the DPO at the institution responsible for the activity]

CONSENT FORM

Thank you for your interest in participating in the LIKE-A-PRO project (No. 101083961).
By signing this document, you are agreeing to take part in the project activity **STAKEHOLDER WORKSHOPS: FOOD SYSTEM MAPPING**. You will be given a copy of this document for your records and one copy will be kept by [insert the name of institution responsible for the activity] with the activity records. Be sure that questions you have about the activity have been answered and that you understand what you are being expected to do. If you have any additional questions arising from the Information Sheet or the explanations already given to you, please ask [insert the name of institution responsible for the activity] before you agree to take part in this activity.

Participant's Statement

I, the undersigned, by completing this form and with my signature at the bottom, confirm that (please, tick box as appropriate):

- I am 18 years or older and am competent to provide consent
- I have read and understood the LIKE-A-PRO Information Sheet and I have been fully informed about the purposes of the project, the activities in which I am involved and the purposes of my involvement. I have been given the opportunity to ask questions and have had them answered to my satisfaction.
- I understand that participation is voluntary and that I am free to withdraw myself and my data from the project at any time without giving a reason immediately without consequences.
- I understand that my participation in the activity will include the processing of personal data as described in the Information Sheet.
- I understand that any further use of this information will require my separate consent.
- I have received a copy of this document.

I hereby give my consent to participate in **STAKEHOLDER WORKSHOPS: FOOD SYSTEM MAPPING** activities.

This consent form is made pursuant to the relevant national, European and international data protection laws and regulations and personal data treatment obligations. Specifically, this consent document complies with the current GDPR laws operating in this country [insert references to data protection laws, in particular the GDPR and other relevant legislation].

……
Name and surname of participant , date and signature of the participants

Statement of investigator's responsibility: I have explained the nature and purpose of this study, the procedures to be undertaken and any risks that may be involved. I have offered to answer any questions and fully answered such questions. I believe that the participant understands my explanation and has freely given informed consent.

…… ……
Name and surname of the investigator date, signature of the investigator

○ Annex IV: Materials for facilitators of the workshop

Alternative Proteins System Mapping Workshops
Materials for Facilitators
June, 2023

Table of Contents

Acknowledgements: Materials presented were documented and developed through the support of research project "From niche to mainstream - alternative proteins for everybody and everywhere", funded from the European Union under Grant Agreement No 101083961.

Recommended reads before the workshops

We strongly recommend familiarizing yourself with the following materials along with our 4-page leaflet, to prepare for the upcoming workshops.

They include four essential texts and a brief introductory video on the concept of system thinking.

By engaging with these materials, you will gain a thorough understanding of complex system approach and ecological perspective on determinants of health behaviors (such as dietary behaviors or choosing protein alternatives):

- In these chapters, an ecological approach is used to explore the determinants of health behaviors through multi-level ecological models, both in brief and in greater detail.
- Savona et al.'s (2021) publication provides an excellent example of system thinking approach-based study with a system map of drivers of obesity. We also urge you to watch this video for a better grasp of how to employ system thinking in designing health interventions.
- Another valuable resource is Onwezen et al.'s (2021) overview of drivers of consumer acceptance of a wide range of alternative proteins.
- On the GAIN (The Global Alliance for Improved Nutrition) website, you can access the definition and graphic representation of food systems and their components. This information may be useful for the workshop preparations.
- In the following section, you will discover **evidence-based information about the factors that determine alternative protein choices** (both, shorter and longer versions). This will give you a comprehensive understanding of the various determinants, which can be broadly categorized into different groups. Knowing this information can assist you in facilitating a discussion during the workshops.

References:

The Food Systems Dashboard. The Global Alliance for Improved Nutrition (GAIN). 2023. Geneva, Switzerland. https://www.foodsystemsdashboard.org. https://doi.org/10.36072/db

Goines, G. (2020). *Ecological Model*. https://pressbooks.pub/btugman/chapter/ecological-model/

James Swanson (Director). (2014, October 30). *Systems Thinking*! https://www.youtube.com/watch?v=GPW0j2Bo_eY

Onwezen, M. C., Bouwman, E. P., Reinders, M. J., & Dagevos, H. (2021). A systematic review on consumer acceptance of alternative proteins: Pulses, algae, insects, plant-based meat alternatives, and cultured meat. *Appetite*, *159*, 105058. https://doi.org/10.1016/j.appet.2020.105058

Salmon, J., Hesketh, K. D., Arundell, L., Downing , K. L., & Biddle, S. J. H. (2020). Changing Behavior Using Ecological Models. In K. Hamilton, L. D. Cameron, M. S. Hagger, N. Hankonen, & T. Lintunen (Eds. *The Handbook of Behavior Change* (pp. 237–250). Cambridge University Press. https://doi.org/10.1017/9781108677318.017

Savona, N., Macauley, T., Aguiar, A., Banik, A., Boberska, M., Brock, J., Brown, A., Hayward, J., Holbæk, H., Rito, A. I., Mendes, S., Vaaheim, F., van Houten, M., Veltkamp, G., Allender, S., Rutter, H., & Knai, C. (2021). Identifying the views of adolescents in five European countries on the drivers of obesity using group model building. *European Journal of Public Health*, *31*(2), 391–396. https://doi.org/10.1093/eurpub/ckaa251

* - the full-texts of these publications are attached at the end of this file (see: Attachments)

What types/groups of determinants are influencing alternative protein choices? SHORT VERSION

The choice for alternative proteins is influenced by a complex array of determinants that can be broadly grouped into several categories:

Nutritional aspects are vital for alternative protein acceptance, with key considerations being protein content, vitamin & mineral composition, fiber content, fats, calorie content, and amino acid profile (Gorissen et al., 2018; Sá et al., 2020). Environmental impact is also a concern, favoring proteins that produce fewer greenhouse gases and use fewer resources (Smetana et al., 2015).

Health implications of different protein sources vary, with concerns over red and processed meat's links to diseases, poultry's potential for foodborne illnesses, fish's mercury levels, dairy's fat and cholesterol content, allergies and nutrient balance in plant-based proteins, potential allergies from insect proteins, and unknown long-term effects of lab-grown meat (Bhat et al., 2014; Bouvard et al., 2015; Craig, 2009; Dossey et al., 2016; Gochfeld & Burger, 2005; Savaiano, 2014; Tack et al., 2020).

Ethical considerations and animal welfare significantly influence choices for alternative protein. There are various concerns related to animal welfare in factory farming and the harmful effects of overfishing on the environment. However, there are lesser concerns regarding plant-based and single-cell protein sources. As for insect proteins and lab-grown meat, there are evolving questions and issues that need further exploration (Bhat et al., 2014; Dewan & Tamang, 2007; Lusk & Norwood, 2011; van Huis, 2013; Zeller & Pauly, 2005).

Taste and culinary preferences play a key role in alternative protein acceptance. People have different preferences when it comes to meat alternatives. Plant-based meats are getting better, but they still have their own distinct taste. Insects may not appeal to Western diets due to their taste. Cultured meat is similar to traditional meat, but it is not yet widely accepted. Plant proteins offer versatility in different dishes. Mycoprotein has a unique flavor. Algae is appreciated in specific cultures (Bhat et al., 2014; Finnigan et al., 2017; Hoek et al., 2011; Sá & Alexandre, 2020; Tan et al., 2015; Wells et al., 2017).

Economic factors like price, availability, production costs, economic impact, government policies, and investment play a key role in the adoption of alternative proteins. As technology matures, many of these proteins are becoming more cost-competitive, with availability largely improving as consumer demand

increases (Alexander et al., 2017; Godfray et al., 2018; McMichael et al., 2007; Mostafa, 2020; Post, 2014; Sexton et al., 2019; Stephens et al., 2019).

Cultural and societal factors also significantly influence alternative protein acceptance. Traditional diets, religious beliefs, health perceptions, cultural norms, societal values, gender norms, food trends, media influence, and education significantly affect consumer behavior towards these protein sources (FAO, 2018; Frewer et al., 2013; Kubberød et al., 2002; Looy et al., 2014; Riaz & Chaudry, 2003; Rozin et al., 2012; Scrinis & Parker, 2016; Verain et al., 2015; Verbeke et al., 2015).

Regulatory factors, including food safety regulations, labeling laws, novel food regulations, GMO regulations, environmental laws, animal welfare laws, trade regulations, and government policies, have substantial impacts on alternative protein development, production, and distribution (Beghin et al., 2015; Broom, 2010; European Union, 2015; FAO & WHO, 2004; Garnett, 2011; Key & Sneeringer, 2014; Paarlberg, 2010; Sexton, 2018; Stephens et al., 2018).

The success of alternative proteins also hinges on **marketing and public perception**. Factors like branding, product placement, taste perception, health messaging, sustainability claims, celebrity endorsements, cultural sensitivity, and transparent communication shape consumer acceptance and the consequent market penetration (Aschemann-Witzel & Zielke, 2017; Erdogan, 1999; Graça et al., 2019; Hartmann & Siegrist, 2017; Hoek et al., 2011, 2017; Lynch & Pierrehumbert, 2019; Riefler & Diamantopoulos, 2007; Siegrist et al., 2018; Van Loo et al., 2020; Verbeke et al., 2015).

In conclusion, understanding these determinants is vital for promoting alternative proteins and ensuring their broad acceptance (Schyver & Smith, 2005).

What types/groups of determinants are influencing alternative protein choices? LONG VERSION

The choice for alternative proteins is influenced by a complex array of determinants that can be broadly grouped into several categories:

Nutritional considerations. The nutritional aspects of alternative proteins are essential as consumers actively seek protein alternatives comparable or superior to traditional animal proteins in nutritional benefits (Henchion et al., 2017) (Henchion et al., 2017).
Primary nutritional considerations for alternative proteins include:

- **Protein content.** The quantity of protein present in the alternative sources is a crucial consideration (Gorissen et al., 2018; Sá et al., 2020)
- **Vitamins & minerals.** The content of essential micronutrients in these protein sources can contribute to their overall nutritional value (Boye et al., 2010).
- **Fiber.** Fiber content is particularly relevant in plant-based proteins and contributes to their health benefits (Dekkers et al., 2018).
- **Fats.** The type and amount of fats in alternative proteins can affect their nutritional profile and health implications (Hughes et al., 2011).
- **Calories.** The caloric content of alternative proteins can impact their suitability for different dietary needs (Henchion et al., 2017).
- **Amino acid profile:** The composition of amino acids, including essential amino acids, in these proteins determines their quality and biological utility (Tomé & Bos, 2000; van Vliet et al., 2015).

Environmental impact. Given the escalating concerns about climate change and sustainability, the environmental impact of food production has become a pivotal factor. Alternative proteins requiring fewer resources and producing fewer greenhouse gases are progressively favored (Smetana et al., 2015), e.g., boxes for beef could be indicative of high greenhouse gas emissions (a factory with smoke), significant land use (a field or pasture), and high water use (a water droplet) (Eshel et al., 2014).

Health concerns. Rising awareness about the health implications of excessive or certain types of meat consumption (red and processed meats) has prompted consumers to explore healthier protein alternatives (Bouvard et al., 2015).

The health concerns associated with protein sources can vary substantially depending on the specific source. Here are some examples:

- **Red and processed meat**: Consuming large quantities of red and processed meats has been correlated with an increased risk of heart disease, certain types of cancer (especially colorectal cancer), and other health conditions due to high levels of saturated fat, cholesterol, and compounds produced during processing or high-temperature cooking of these meats (Bouvard et al., 2015).
- **Poultry**. While generally leaner than red meat, poultry can be high in cholesterol and a significant source of foodborne illnesses if not appropriately handled and cooked (Tack et al., 2020).
- **Fish**. Fish, a healthy source of protein and omega-3 fatty acids, may contain high levels of mercury and other environmental contaminants harmful in large amounts, especially to pregnant women and young children (Gochfeld & Burger, 2005).
- **Dairy**: Dairy products can be high in saturated fats and cholesterol, and some people may have lactose intolerance (Savaiano, 2014).
- **Plant-based proteins:** While plant-based proteins are generally associated with positive health outcomes, some people may be allergic to specific sources such as soy or nuts. Additionally, obtaining all the essential amino acids from plant-based sources alone can be more challenging (Craig, 2009)
- **Insect proteins:** Despite being highly sustainable and nutrient-rich, insects are a novel food source in many cultures and may trigger allergies, especially in people with shellfish allergies (Dossey et al., 2016)
- **Lab-grown or cultured meat:** As a newer technology, the long-term health effects of consuming lab-grown meat are not yet fully understood (Bhat et al., 2014)

Ethical and animal welfare considerations. Ethical concerns centered on animal welfare and industrial farming practices have prompted numerous consumers to switch to plant-based or lab-grown proteins (Stoll-Kleemann & Schmidt, 2017).

The ethical and animal welfare considerations represent significant drivers for those opting for alternative protein sources. Here are some considerations for various protein sources:

- **Factory farming.** Intensive animal farming, also known as factory farming, often involves the confinement of livestock in restricted spaces, leading to substantial animal welfare concerns. There are also ethical worries related to the use of antibiotics and growth hormones (Lusk & Norwood, 2011).
- **Overfishing.** Overfishing can lead to the depletion of fish populations and cause damage to marine ecosystems. Fishing methods can also unintentionally capture and kill non-target species, a phenomenon known as bycatch (Zeller & Pauly, 2005).
- **Plant-based proteins.** Plant-based proteins like legumes, nuts, and seeds do not involve animal harm and are generally considered to have fewer ethical and animal welfare concerns. However, large-scale agriculture can affect local ecosystems and biodiversity (Godfray et al., 2018).
- **Insects.** The practice of rearing insects for food, often termed entomophagy, generally entails fewer welfare concerns due to the nature of insect biology and life cycles. However, ethical considerations persist as the understanding of insect sentience and welfare evolves (van Huis, 2013).
- **Lab-grown or cultured meat:** Lab-grown meat could significantly reduce the need for raising and slaughtering animals, thus addressing many animal welfare issues. Yet, it might raise new ethical questions, such as issues about naturalness and artificiality (Bhat et al., 2014).
- **Single-cell proteins:** Single-cell proteins, such as those derived from yeast, algae, or bacteria, bypass many ethical and welfare considerations associated with animal farming. But other considerations persist, such as the use of genetic modification technologies (Dewan & Tamang, 2007)**.**

Taste and culinary preferences. Regardless of other factors, the taste and culinary versatility of alternative proteins play pivotal roles. It is essential that alternative proteins are palatable and versatile for use in a wide range of recipes (Hartmann & Siegrist, 2017).

The taste and culinary preferences significantly influence the adoption of alternative protein sources. Here are some considerations for various protein sources:

- **Plant-based meats.** While plant-based meats have been improving in terms of taste and texture, they can still differ from conventional meat in significant ways (Hoek et al., 2011).
- **Insects.** Although they are high in protein and sustainable to farm, insects may be challenging to incorporate into Western diets due to taste and culinary preferences (Tan et al., 2015).
- **Cultured meat.** The taste and texture of lab-grown meats are similar to traditional meats, but consumer acceptance is still evolving (Bhat et al., 2014).
- **Plant proteins.** Legumes, nuts, and seeds offer a range of tastes and textures and can be incorporated into many different types of meals (Sá & Alexandre, 2020).
- **Mycoprotein.** This protein-rich food source derived from fungi is already used in a range of meat-free products, but its unique taste and texture may not appeal to everyone (Finnigan et al., 2017).
- **Algae and seaweed:** These ocean plants have a distinctive taste and texture that might be appreciated in some cultures more than others. They are already used in various forms of Asian cuisine (Wells et al., 2017).

Economic factors. The cost of alternative proteins relative to traditional proteins can significantly impact consumer choice. As technologies improve and scale up, many alternative proteins are becoming more cost-competitive (Godfray et al., 2018).

Economic factors play a considerable role in the adoption and acceptance of alternative protein sources. Here are some economic considerations:

- **Price.** The cost of alternative proteins compared to traditional ones significantly influences consumer choices. Some plant-based proteins like legumes and tofu are often less expensive than meat, while others, like plant-based meat substitutes or cultured meat, can be more expensive (Stephens et al., 2019).
- **Availability.** If alternative proteins are not widely available in grocery stores, restaurants, or online marketplaces, it can limit their adoption. Generally, availability improves as consumer demand increases and production scales up, thereby reducing costs (Alexander et al., 2017).
- **Production costs.** For manufacturers, the cost of producing alternative proteins can be high, particularly for newer technologies like lab-grown meat. However, these costs are expected to come down as the technology matures and scales up (Post, 2014).
- **Economic impact.** The development of alternative protein sources can impact economies, especially in regions heavily reliant on traditional livestock farming. However, it can also lead to new industries and job creation in other sectors (Mostafa, 2020).
- **Subsidies and regulation.** Government policies, subsidies, and regulations can significantly influence the economics of alternative proteins. For instance, subsidies for livestock farming can make meat cheaper, while taxes or regulations on greenhouse gas emissions could make some forms of meat production more expensive (McMichael et al., 2007).
- **Investment.** The flow of investment into alternative protein companies can influence their ability to scale, innovate, and reduce costs (Sexton et al., 2019).

Cultural and societal factors. Cultural acceptance and societal norms around food also play a significant role. What is considered a viable protein source can vary greatly from one culture or society to another (Kubberød et al., 2002).

Cultural and societal factors significantly influence the acceptance and consumption of various protein sources. Here are some examples:

- **Traditional diets.** Many cultures have diets rich in specific proteins. For instance, in coastal areas, seafood is traditionally a primary protein source. In contrast, some cultures, like many in India, have long-standing vegetarian diets that rely heavily on plant-based proteins (FAO, 2018)
- **Religious beliefs:** Certain religions have dietary rules that influence protein source acceptance. For example, Hindus typically avoid beef, Muslims avoid pork and require halal slaughter methods, and many Buddhists and Jains advocate for vegetarianism due to non-violence principles (Riaz & Chaudry, 2003).
- **Perceptions of health.** Society's perception of what constitutes a 'healthy' protein source can vary across different cultures and evolve over time (Frewer et al., 2013).
- **Food taboos and preferences:** Cultural norms and taboos can greatly affect the acceptance of alternative proteins. For example, while insects are consumed and enjoyed in many cultures, especially in Africa and Asia, they are often viewed with disgust in many Western societies (Looy et al., 2014).
- **Societal values.** Increasing values around animal welfare, sustainability, and health can drive interest in alternative proteins (Verbeke et al., 2015).
- **Gender norms.** In some societies, certain foods might be associated more with one gender than the other, influencing consumption patterns. For example, in many Western societies, meat (especially red meat) has been stereotypically associated with masculinity (Rozin et al., 2012).
- **Food trends and media influence.** Media and popular culture can have a significant impact on the acceptance of alternative proteins. A celebrity endorsement or a viral social media trend can quickly increase the popularity of a particular food (Scrinis & Parker, 2016)
- **Education and awareness.** Awareness about environmental issues, animal welfare, and health concerns related to traditional protein sources can influence societal attitudes towards alternative proteins (Verain et al., 2015).

Regulatory factors. The regulatory environment can influence the availability and market penetration of alternative proteins. For instance, different countries have different regulations regarding the commercialization of lab-grown meats or genetically modified organisms (GMOs) (Stephens et al., 2018).

Regulatory factors can have significant impacts on the development, production, and distribution of alternative protein sources. Here are a few examples:

- **Food safety regulations.** All food products, including alternative proteins, must meet certain safety standards. These standards can vary by country and can affect how quickly a product can be brought to market (FAO & WHO, 2004).
- **Labeling laws.** How a product can be labeled can influence its acceptance. For example, there is ongoing debate in many jurisdictions about whether plant-based products can use terms like "meat" or "milk" (Sexton, 2018)
- **Novel food regulations.** In some regions, like the EU, any new food that was not widely consumed before 1997 must go through a pre-market safety assessment before it can be sold. This can apply to certain types of alternative proteins, like insects and cultured meat (European Union, 2015).
- **Genetic modification.** The use of genetically modified organisms (GMOs) is a controversial topic and is regulated differently around the world. This can affect products like certain types of plant-based meat or single-cell proteins (Paarlberg, 2010).
- **Environmental regulations.** Laws related to greenhouse gas emissions, water use, and waste disposal can influence the viability of different protein production methods (Garnett, 2011).
- **Animal welfare laws.** In some countries, laws regarding animal welfare can affect the production of traditional animal-based proteins (Broom, 2010).
- **Trade regulations.** Import and export laws, tariffs, and trade agreements can influence the cost and availability of different types of protein (Beghin et al., 2015).
- **Subsidies and government support.** Government policies can significantly influence the economics of protein production. For example, in some countries, livestock farming is heavily subsidized, which can make it more difficult for alternative protein sources to compete on price (Key & Sneeringer, 2014).

These regulatory factors can change over time and vary greatly by country and region. It's important for companies producing alternative proteins to be aware of these regulatory factors and how they might influence their operations.

Marketing and perception. How these products are marketed, and their perception in the media and among influencers, can significantly impact their acceptance among consumers (Riefler & Diamantopoulos, 2007).

Marketing and perception greatly influence consumer choices when it comes to alternative protein sources. Here are a few examples:

- **Branding.** How a product is branded can greatly influence its acceptance. Brands like 'Beyond Meat' and 'Impossible Foods' have had success in positioning their products as sustainable, high-quality alternatives to traditional meat (Van Loo et al., 2020)
- **Product placement.** Where a product is placed in a store can influence its perception and sales. For example, plant-based meats often see increased sales when they are placed in the meat aisle rather than in a separate vegetarian section (Siegrist et al., 2018)
- **Taste perception.** Marketing that emphasizes the taste and texture of the product can help overcome perceptions that alternative proteins are inferior in these respects (Hartmann & Siegrist, 2017).
- **Health messaging.** Emphasizing the health benefits of alternative proteins, such as lower fat content or the absence of antibiotics, can attract health-conscious consumers (Verbeke et al., 2015).
- **Sustainability claims.** With growing concern about climate change and environmental sustainability, marketing that highlights the lower environmental impact of alternative proteins can be effective (Graça et al., 2019).
- **Celebrity endorsements.** Celebrities and influencers who endorse alternative protein products can significantly shape consumer perception and acceptance (Erdogan, 1999).
- **Cultural sensitivity.** Marketing campaigns that are sensitive to cultural norms and dietary habits can have a significant influence on the acceptance of alternative proteins in different societies. (Hoek et al., 2011, 2017)
- **Transparent communication.** Consumers appreciate transparency about a product's origin, production methods, and ingredients. This can be particularly important for new and unfamiliar products like lab-grown meat or insect-based proteins (Lynch & Pierrehumbert, 2019).

Marketing strategies need to be well thought out and tailored to the specific consumer base to effectively promote alternative protein sources. A one-size-fits-all approach may not be effective given the wide range of consumer attitudes, beliefs, and preferences (Aschemann-Witzel & Zielke, 2017).

Understanding these determinants is critical for researchers and food manufacturers to effectively market alternative proteins and encourage their adoption among a broad consumer base (Schyver & Smith, 2005).

References

Alexander, P., Brown, C., Arneth, A., Dias, C., Finnigan, J., Moran, D., & Rounsevell, M. D. A. (2017). Could consumption of insects, cultured meat or imitation meat reduce global agricultural land use? *Global Food Security*, *15*, 22–32. https://doi.org/10.1016/j.gfs.2017.04.001

Aschemann-Witzel, J., & Zielke, S. (2017). Can't buy me green? A review of consumer perceptions of and behavior toward the price of organic food. *Journal of Consumer Affairs*, *51*(1), 211–251.

Beghin, J. C., Maertens, M., & Swinnen, J. (2015). Nontariff Measures and Standards in Trade and Global Value Chains. *Annual Review of Resource Economics*, *7*(1), 425–450. https://doi.org/10.1146/annurev-resource-100814-124917

Bhat, Z. F., Bhat, H., & Pathak, V. (2014). Chapter 79—Prospects for In Vitro Cultured Meat – A Future Harvest. In R. Lanza, R. Langer, & J. Vacanti (Eds.), *Principles of Tissue Engineering (Fourth Edition)* (pp. 1663–1683). Academic Press. https://doi.org/10.1016/B978-0-12-398358-9.00079-3

Bouvard, V., Loomis, D., Guyton, K. Z., Grosse, Y., Ghissassi, F. E., Benbrahim-Tallaa, L., Guha, N., Mattock, H., & Straif, K. (2015). Carcinogenicity of consumption of red and processed meat. *The Lancet Oncology*, *16*(16), 1599–1600. https://doi.org/10.1016/S1470-2045(15)00444-1

Boye, J., Zare, F., & Pletch, A. (2010). Pulse proteins: Processing, characterization, functional properties and applications in food and feed. *Food Research International*, *43*(2), 414–431. https://doi.org/10.1016/j.foodres.2009.09.003

Broom, D. M. (2010). Animal welfare: An aspect of care, sustainability, and food quality required by the public. *Journal of Veterinary Medical Education*, *37*(1), 83–88. https://doi.org/10.3138/jvme.37.1.83

Craig, W. J. (2009). Health effects of vegan diets2. *The American Journal of Clinical Nutrition*, *89*(5), 1627S-1633S. https://doi.org/10.3945/ajcn.2009.26736N
Dekkers, B. L., Boom, R. M., & van der Goot, A. J. (2018). Structuring processes for meat analogues. *Trends in Food Science & Technology*, *81*, 25–36. https://doi.org/10.1016/j.tifs.2018.08.011

Dewan, S., & Tamang, J. P. (2007). Dominant lactic acid bacteria and their technological properties isolated from the Himalayan ethnic fermented milk products. *Antonie van Leeuwenhoek*, *92*(3), 343–352. https://doi.org/10.1007/s10482-007-9163-5

Dossey, A. T., Morales-Ramos, J. A., & Rojas, M. G. (Eds.). (2016). Front matter. In *Insects as Sustainable Food Ingredients* (p. iii). Academic Press. https://doi.org/10.1016/B978-0-12-802856-8.00012-0

Erdogan, B. Z. (1999). Celebrity Endorsement: A Literature Review. *Journal of Marketing Management*, *15*(4), 291–314. https://doi.org/10.1362/026725799784870379

Eshel, G., Shepon, A., Makov, T., & Milo, R. (2014). Land, irrigation water, greenhouse gas, and reactive nitrogen burdens of meat, eggs, and dairy production in the United States. *Proceedings of the National Academy of Sciences*, *111*(33), 11996–12001. https://doi.org/10.1073/pnas.1402183111

European Union. (2015). *Regulation 2015/2283—Novel foods—EU monitor*. EU Monitor. https://www.eumonitor.eu/9353000/1/j9vvik7m1c3gyxp/vjzsag4e0num

FAO. (2018, July 9). *The State of World Fisheries and Aquaculture 2018*. https://reliefweb.int/report/world/state-world-fisheries-and-aquaculture-2018

FAO, & WHO. (2004). Codex alimentarius: Food hygiene basic texts. *Codex Alimentarius: Food Hygiene Basic Texts., Ed. 3*. https://www.cabdirect.org/cabdirect/abstract/20043108497

Finnigan, T., Needham, L., & Abbott, C. (2017). Chapter 19 - Mycoprotein: A Healthy New Protein With a Low Environmental Impact. In S. R. Nadathur, J. P. D. Wanasundara, & L. Scanlin (Eds.), *Sustainable Protein Sources* (pp. 305–325). Academic Press. https://doi.org/10.1016/B978-0-12-802778-3.00019-6

Frewer, L. J., van der Lans, I. A., Fischer, A. R. H., Reinders, M. J., Menozzi, D., Zhang, X., van den Berg, I., & Zimmermann, K. L. (2013). Public perceptions of agri-food applications of genetic modification – A systematic review and meta-analysis. *Trends in Food Science & Technology*, *30*(2), 142–152. https://doi.org/10.1016/j.tifs.2013.01.003

Garnett, T. (2011). Where are the best opportunities for reducing greenhouse gas emissions in the food system (including the food chain)? *Food Policy*, *36*, S23–S32. https://doi.org/10.1016/j.foodpol.2010.10.010

Gochfeld, M., & Burger, J. (2005). Good Fish/Bad Fish: A Composite Benefit–Risk by Dose Curve. *NeuroToxicology*, *26*(4), 511–520. https://doi.org/10.1016/j.neuro.2004.12.010

Godfray, H. C. J., Aveyard, P., Garnett, T., Hall, J. W., Key, T. J., Lorimer, J., Pierrehumbert, R. T., Scarborough, P., Springmann, M., & Jebb, S. A. (2018). Meat consumption, health, and the environment. *Science (New York, N.Y.)*, *361*(6399), eaam5324. https://doi.org/10.1126/science.aam5324

Gorissen, S. H. M., Crombag, J. J. R., Senden, J. M. G., Waterval, W. A. H., Bierau, J., Verdijk, L. B., & van Loon, L. J. C. (2018). Protein content and amino acid composition of commercially available plant-based protein isolates. *Amino Acids*, *50*(12), 1685–1695. https://doi.org/10.1007/s00726-018-2640-5

Graça, J., Godinho, C. A., & Truninger, M. (2019). Reducing meat consumption and following plant-based diets: Current evidence and future directions to inform integrated transitions. *Trends in Food Science & Technology*, *91*, 380–390. https://doi.org/10.1016/j.tifs.2019.07.046

Hartmann, C., & Siegrist, M. (2017). Consumer perception and behaviour regarding sustainable protein consumption: A systematic review. *Trends in Food Science & Technology*, *61*, 11–25. https://doi.org/10.1016/j.tifs.2016.12.006

Henchion, M., Hayes, M., Mullen, A. M., Fenelon, M., & Tiwari, B. (2017). Future Protein Supply and Demand: Strategies and Factors Influencing a Sustainable Equilibrium. *Foods*, *6*(7), 53. https://doi.org/10.3390/foods6070053

Hoek, A. C., Luning, P. A., Weijzen, P., Engels, W., Kok, F. J., & de Graaf, C. (2011). Replacement of meat by meat substitutes. A survey on person- and product-related factors in consumer acceptance. *Appetite*, *56*(3), 662–673. https://doi.org/10.1016/j.appet.2011.02.001

Hoek, A. C., Pearson, D., James, S. W., Lawrence, M. A., & Friel, S. (2017). Shrinking the food-print: A qualitative study into consumer perceptions, experiences and attitudes towards healthy and environmentally friendly food behaviours. *Appetite*, *108*, 117–131. https://doi.org/10.1016/j.appet.2016.09.030

Hughes, G. J., Ryan, D. J., Mukherjea, R., & Schasteen, C. S. (2011). Protein digestibility-corrected amino acid scores (PDCAAS) for soy protein isolates and concentrate: Criteria for evaluation. *Journal of Agricultural and Food Chemistry*, *59*(23), 12707–12712. https://doi.org/10.1021/jf203220v

Key, N., & Sneeringer, S. (2014). Potential Effects of Climate Change on the Productivity of U.S. Dairies. *American Journal of Agricultural Economics*, *96*(4), 1136–1156. https://doi.org/10.1093/ajae/aau002

Kubberød, E., Ueland, Ø., Tronstad, Å., & Risvik, E. (2002). Attitudes towards meat and meat-eating among adolescents in Norway: A qualitative study. *Appetite*, *38*(1), 53–62. https://doi.org/10.1006/appe.2002.0458

Looy, H., Dunkel, F. V., & Wood, J. R. (2014). How then shall we eat? Insect-eating attitudes and sustainable foodways. *Agriculture and Human Values*, *31*(1), 131–141. https://doi.org/10.1007/s10460-013-9450-x

Lusk, J. L., & Norwood, F. B. (2011). Animal Welfare Economics. *Applied Economic Perspectives and Policy*, *33*(4), 463–483.

Lynch, J., & Pierrehumbert, R. (2019). Climate Impacts of Cultured Meat and Beef Cattle. *Frontiers in Sustainable Food Systems*, *3*. https://www.frontiersin.org/articles/10.3389/fsufs.2019.00005

McMichael, A. J., Powles, J. W., Butler, C. D., & Uauy, R. (2007). Food, livestock production, energy, climate change, and health. *Lancet (London, England)*, *370*(9594), 1253–1263. https://doi.org/10.1016/s0140-6736(07)61256-2

Mostafa, G. A. (2020). Novel meat substitutes: The revolution of plant-based meat alternatives. *Current Nutrition Reports*, *9*, 317–325.

Paarlberg, R. (2010). GMO foods and crops: Africa's choice. *New Biotechnology*, *27*(5), 609–613. https://doi.org/10.1016/j.nbt.2010.07.005

Post, M. J. (2014). Cultured beef: Medical technology to produce food. *Journal of the Science of Food and Agriculture*, *94*(6), 1039–1041. https://doi.org/10.1002/jsfa.6474

Riaz, M. N., & Chaudry, M. N. (2003). *Halal Food Production*. Routledge & CRC Press. https://www.routledge.com/Halal-Food-Production/Riaz-Chaudry/p/book/9781587160295

Riefler, P., & Diamantopoulos, A. (2007). Consumer animosity: A literature review and a reconsideration of its measurement. *International Marketing Review*, *24*(1), 87–119. https://doi.org/10.1108/02651330710727204

Rozin, P., Hormes, J. M., Faith, M. S., & Wansink, B. (2012). Is Meat Male? A Quantitative Multimethod Framework to Establish Metaphoric Relationships. *Journal of Consumer Research*, *39*(3), 629–643. https://doi.org/10.1086/664970

Sá, A. G. A., & Alexandre, L. C. (2020). Plant-based diets: Core health benefits and key recommendations for use. *Brazilian Journal of Food Technology*, *23*.

Sá, A. G. A., Moreno, Y. M. F., & Carciofi, B. A. M. (2020). Advances in low-cost technologies to valorize underutilized plant-based proteins. *Trends in Food Science & Technology*, *99*, 337–349.

Savaiano, D. A. (2014). Lactose digestion from yogurt: Mechanism and relevance123. *The American Journal of Clinical Nutrition*, *99*(5), 1251S-1255S. https://doi.org/10.3945/ajcn.113.073023

Schyver, T., & Smith, J. (2005). Reports from the future of protein: Nine reasons to look beyond the meat/potato model. *The Futurist*, *4*(39), 27–34.

Scrinis, G., & Parker, C. (2016). Front-of-Pack Food Labeling and the Politics of Nutritional Nudges. *Law & Policy*, *38*(3), 234–249. https://doi.org/10.1111/lapo.12058

Sexton, A. E. (2018). Eating for the post-Anthropocene: Alternative proteins and the biopolitics of edibility. *Transactions of the Institute of British Geographers*, *43*(4), 586–600. https://doi.org/10.1111/tran.12253

Sexton, A. E., Garnett, T., & Lorimer, J. (2019). Framing the future of food: The contested promises of alternative proteins. *Environment and Planning E: Nature and Space*, *2*(1), 47–72. https://doi.org/10.1177/2514848619827009

Siegrist, M., Sütterlin, B., & Hartmann, C. (2018). Perceived naturalness and evoked disgust influence acceptance of cultured meat. *Meat Science*, *139*, 213–219. https://doi.org/10.1016/j.meatsci.2018.02.007

Smetana, S., Mathys, A., Knoch, A., & Heinz, V. (2015). Meat alternatives: Life cycle assessment of most known meat substitutes. *The International Journal of Life Cycle Assessment*, *20*(9), 1254–1267. https://doi.org/10.1007/s11367-015-0931-6

Stephens, N., Di Silvio, L., Dunsford, I., Ellis, M., Glencross, A., & Sexton, A. (2018). Bringing cultured meat to market: Technical, socio-political, and regulatory challenges in cellular agriculture. *Trends in Food Science & Technology*, *78*, 155–166. https://doi.org/10.1016/j.tifs.2018.04.010

Stephens, N., Sexton, A. E., & Driessen, C. (2019). Making Sense of Making Meat: Key Moments in the First 20 Years of Tissue Engineering Muscle to Make Food. *Frontiers in Sustainable Food Systems*, *3*. https://www.frontiersin.org/articles/10.3389/fsufs.2019.00045

Stoll-Kleemann, S., & Schmidt, U. J. (2017). Reducing meat consumption in developed and transition countries to counter climate change and biodiversity loss: A review of influence factors. *Regional Environmental Change*, *17*(5), 1261–1277. https://doi.org/10.1007/s10113-016-1057-5

Tack, D. M., Ray, L., Griffin, P. M., Cieslak, P. R., Dunn, J., Rissman, T., Jervis, R., Lathrop, S., Muse, A., Duwell, M., Smith, K., Tobin-D'Angelo, M., Vugia, D. J., Zablotsky Kufel, J., Wolpert, B. J., Tauxe, R., & Payne, D. C. (2020). Preliminary Incidence and Trends of Infections with Pathogens Transmitted Commonly Through Food—Foodborne Diseases Active Surveillance Network, 10 U.S. Sites, 2016–2019. *Morbidity and Mortality Weekly Report*, *69*(17), 509–514. https://doi.org/10.15585/mmwr.mm6917a1

Tan, H. S. G., Fischer, A. R. H., Tinchan, P., Stieger, M., Steenbekkers, L. P. A., & van Trijp, H. C. M. (2015). Insects as food: Exploring cultural exposure and individual experience as determinants of acceptance. *Food Quality and Preference*, *42*, 78–89. https://doi.org/10.1016/j.foodqual.2015.01.013

Tomé, D., & Bos, C. (2000). Dietary protein and nitrogen utilization. *The Journal of Nutrition*, *130*(7), 1868S-73S. https://doi.org/10.1093/jn/130.7.1868S

Van Huis, A. (2013). Potential of insects as food and feed in assuring food security. *Annual Review of Entomology*, *58*, 563–583. https://doi.org/10.1146/annurev-ento-120811-153704

Van Loo, E. J., Caputo, V., & Lusk, J. L. (2020). Consumer preferences for farm-raised meat, lab-grown meat, and plant-based meat alternatives: Does information or brand matter? *Food Policy*, *95*, 101931. https://doi.org/10.1016/j.foodpol.2020.101931

van Vliet, S., Burd, N. A., & van Loon, L. J. (2015). The Skeletal Muscle Anabolic Response to Plant- versus Animal-Based Protein Consumption1. *The Journal of Nutrition*, *145*(9), 1981–1991. https://doi.org/10.3945/jn.114.204305

Verain, M. C. D., Dagevos, H., & Antonides, G. (2015). Sustainable food consumption. Product choice or curtailment? *Appetite*, *91*, 375–384. https://doi.org/10.1016/j.appet.2015.04.055

Verbeke, W., Marcu, A., Rutsaert, P., Gaspar, R., Seibt, B., Fletcher, D., & Barnett, J. (2015). 'Would you eat cultured meat?': Consumers' reactions and attitude formation in Belgium, Portugal and the United Kingdom. *Meat Science*, *102*, 49–58. https://doi.org/10.1016/j.meatsci.2014.11.013

Wells, M. L., Potin, P., Craigie, J. S., Raven, J. A., Merchant, S. S., Helliwell, K. E., Smith, A. G., Camire, M. E., & Brawley, S. H. (2017). Algae as nutritional and functional food sources: Revisiting our understanding. *Journal of Applied Phycology*, *29*(2), 949–982. https://doi.org/10.1007/s10811-016-0974-5

Zeller, D., & Pauly, D. (2005). Good news, bad news: Global fisheries discards are declining, but so are total catches. *Fish and Fisheries*, *6*(2), 156–159. https://doi.org/10.1111/j.1467-2979.2005.00177.x

Attachments

Next you will find the above mentioned publications listed in the following order:

Onwezen, M. C., Bouwman, E. P., Reinders, M. J., & Dagevos, H. (2021). A systematic review on consumer acceptance of alternative proteins: Pulses, algae, insects, plant-based meat alternatives, and cultured meat. *Appetite*, *159*, 105058. https://doi.org/10.1016/j.appet.2020.105058

Salmon, J., Hesketh, K. D., Arundell, L., Downing, K. L., & Biddle, S. J. H. (2020). Changing Behavior Using Ecological Models. In K. Hamilton, L. D. Cameron, M. S. Hagger, N. Hankonen, & T. Lintunen (Eds.), *The Handbook of Behavior Change* (pp. 237–250). Cambridge University Press. https://doi.org/10.1017/9781108677318.017

Savona, N., Macauley, T., Aguiar, A., Banik, A., Boberska, M., Brock, J., Brown, A., Hayward, J., Holbæk, H., Rito, A. I., Mendes, S., Vaaheim, F., van Houten, M., Veltkamp, G., Allender, S., Rutter, H., & Knai, C. (2021). Identifying the views of adolescents in five European countries on the drivers of obesity using group model building. *European Journal of Public Health*, *31*(2), 391–396. https://doi.org/10.1093/eurpub/ckaa251

Recommended reads before the workshops

We strongly recommend to familiarize yourself with the following materials along with our 4-page leaflet, to prepare for the upcoming workshops.

They include four essential texts and a brief introductory video on the concept of system thinking.

By engaging with these materials, you will gain a thorough understanding of complex system approach and ecological perspective on determinants of health behaviors (such as dietary behaviors or choosing protein alternatives):

- In these chapters, an ecological approach is used to explore the determinants of health behaviors through multi-level ecological models, both in brief and in greater detail.
- Savona et al.'s (2021) publication provides an excellent example of system thinking approach-based study with a system map of drivers of obesity. We also urge you to watch this video for a better grasp of how to employ system thinking in designing health interventions.
- Another valuable resource is Onwenzen et al.'s (2021) overview of drivers of consumer acceptance of a wide range of alternative proteins.
- In this FAO website you can find the definition and some graphic representation of food system and its components, which may be helpful during your workshop.

- **Annex V: System mapping workshop manual and Power Point slides for the workshops**

Alternative Proteins System Mapping Workshops

Determinants of Choosing Alternative Proteins by Consumers

July, 2023

Acknowledgements: This manual was developed by Ewa Kulis and Zofia Szczuka based on a COCREATE Systems Thinking & Project Design Meeting in London (March 2019) led by Steve Allender, Andrew Brown, and Josh Hayward from the Global Obesity Centre at Deakin University

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Understanding Determinants of Choosing Alternative Proteins by Consumers

Table of Contents

1) Roles of Facilitation Team (Richardson & Andersen, 1995)

The workshop will be conducted by **two persons in each country**: **a facilitator** and **a modeller**.

The facilitator: plays a crucial role in leading the workshop, which includes responsibilities such as: starting and ending the meeting, developing the system maps, introducing concepts from system dynamics, asking the key questions and translating participants' statements into phrases that are easier for the modeller to use. Additionally, the facilitator is responsible for translation of materials provided by SWPS University for the stakeholders and maintaining communication with them before and after the session.

General Facilitation Tips:

- **Manage power dynamics**. If someone is dominating the conversation, you can address it by saying: "Can someone who hasn't spoken share their thoughts?" This helps ensure equal participation and creates space for others to contribute.
- **"Parking lot"** refers to a technique used during discussions or meetings where any off-topic ideas, questions, or concerns raised by participants are noted down for future discussion. It allows the

facilitator to acknowledge the input without derailing the current agenda and ensures that important points are not forgotten.

- **Prioritize participants' points of view**. The facilitator role is to ask questions, encourage reflection, and create an inclusive environment where everyone feels heard and valued.
- **If someone says something truly offensive, address it.** As a facilitator, you have the responsibility to maintain a respectful socioeconomic and safe space for all participants.
- **Consider social identities** when facilitating discussions. Recognize that participants may have different backgrounds, experiences, and perspectives based on factors such as race, gender, age, or status. Creating an inclusive environment involves being aware of these identities and ensuring that all participants feel comfortable expressing their views without fear of judgment.

The modeller: operates STICKE software (drawing the constructs and connections between the constructs), shares screen with the STICKE, develops the model and helps the group reflect on model structures that emerge during the session, documents important information shared by participants (including the information that has been overlooked by the facilitator). Additionally, **the modeller** provides support to the facilitator by assisting with the translation of materials provided by SWPS University for the participants.

2) Rules of engagement

Be Respectful: All views must be treated with respect, and efforts should be made to promote mutual understanding amongst the participants. Given the multi-stakeholder and intergenerational nature of the Workshop, participants will be reminded that one opinion does not take precedence over another irrespective of age, sex, socioeconomic status, level of education, or other relevant factors.

Be open and transparent: The workshop is a space to share, listen, and learn. To promote a participatory and productive dialogue, all participants should have an equal opportunity to voice their opinions and views. Stakeholders should also be transparent about their interests and motivation to participate in the Workshop (conflict of interest).

Be sensitive to risk and assure safe expression of opinions: In certain situations, expression of views may involve risks. Moderators and participating stakeholders have a responsibility to take every precaution necessary to minimize the risk to patronize others, exploit others, or to any other negative consequence of their participation.

Promote empowerment for all: All participants should feel that their participation was meaningful and that they could affect the structure, process, and outcomes of a dialogue.

3) Research questions for the workshop

Preparation for the workshop (first and second questions are also the key questions asked to the participating stakeholders):

1) What factors influence consumers' choices regarding alternative protein-based foods? [according to stakeholders' opinion]

2) How are these factors interrelated?

3) Using a complex system approach to alternative protein choices: Do these factors form feedback loops that drive a change in a system (move alternative proteins from a niche to the mainstream) or do they maintain the status quo of the system (no change)?

4) What are similarities/differences between countries/stakeholder groups?

Evidence base list of "factors"

- Beliefs, knowledge, actions of the food system stakeholders (policy makers, lobbyists, consumers, e.g., "moving towards more sustainable food consumption is important to me," "I worry about financial losses related to changes in the production systems")

- Key food policies (e.g. financial instruments, education, labelling, advertising, public procurement, food composition, etc.)

- Infrastructure characteristics (e.g., referring to food production, processing, retail systems characteristics?)

- Economic factors (e.g., including national economy, costs of living/disposable income in families, economic impact on food producers and distribution chains

- Major events that can affect consumers' choices (major events such as pandemics, wars, technological developments (AI), political elections creating „windows of opportunity" for policy changes)

- Technological factors, in particular presence or absence of technology innovation/innovation adoption, information technology development

- Environmental and cultural factors (e.g., climate change, sustainability trends, local and organic food trends, food ethics - animal welfare)

Note! Some of these factors may be mentioned by the stakeholders, others not, or they may provide a completely different set of factors. It is up to the stakeholders in the workshop.

4) Before the workshop - timeline

Preparation for the workshop:

By September 2023

- The facilitator and modeller translate informed consents, handouts for the stakeholders (both long and short versions), and the post workshop survey (approx. 20 questions)

- The facilitator and modeler adapt the presentation shared by the team from Poland (titled LIKE-A-PRO_System_Mapping) for their workshops at the local level

September 2023

- The facilitator and modeller set the workshop date and time

- The facilitator and modeller learn how to use the STICK-E software and thoroughly comprehend each step of the workshop. It is also recommended to conduct a trial workshop to test all the procedures and ensure smooth execution in practice.

- The facilitator sends the invitations to the stakeholders

- The facilitator sends the information materials (brief info about what the workshop is about, informed consent, etc.)

- The facilitator/modeller purchases workshop promotion materials with LIKE-A-PRO logo/ thank you gifts for the participants

- The facilitator sends a first batch of the workshop promotion materials to the stakeholders who agreed to take part in the workshop (to keep them engaged)

    1 *week before the workshop (October –November 2023)*

- The facilitator sends a reminder to the participants about the workshop via e-mail, including the following information:
- Date and time
- A link to the online meeting platform. Google Meet is recommended but not obligated.
- Information that every stakeholder must have access to a large screen (computer, laptop) because it is necessary for viewing the model and map of factors that will be created during the workshops, consisting of multiple boxes, texts, and arrows. It cannot be done on a phone or tablet.
- Request for participants to ensure a stable internet connection
- The facilitator also sends the long version of the handouts about alternative proteins with the stakeholders via email
- The facilitator and modeller verify the proper functioning of the STICKE software and rehearse each step of the workshop once again
- The modeller prepares a draft version of the email to be sent to the stakeholders, containing the handouts (the same which were sent one week before the workshop), in order to have it ready to be sent at the beginning of the workshop.

During the workshop

- The modeller has a list of email addresses of the participants
- It is recommended that the facilitator and the modeller be at the same room when conducting the workshop (to consult with each other during the workshop and to make the final version of the system map)
- The modeller shares the screen with a STICKE
- The modeller is responsible for saving a final version of the system map in a .pdf, following this format: 3 first letters of the country_the date of the workshop in format: dd_mm_year_ a title: LIKE-A-PRO e.g., POL_01-09-2023_LIKE-A-PRO

Two people from the SWPS support team will be available before, during, and after the local workshops to assist the local facilitator/modeller in case any issues arise.

Ideally, the workshop should be recorded to facilitate note-taking for each factor included in the map. For example, if the map includes "advertising policies," it is important to document what stakeholders meant and how they defined it. Please note that participants should be informed in advance and given the option to provide consent for being recorded.

5) Introduction to Group Model Building Session

Steps	
	1. The facilitator welcomes the participants, thanks them for attending, introduces themselves and the modeller, introduces the agenda, breaks times, provides a purpose of the session, and asks if all participants are ready to begin. **The modeller:** Shares screen with the presentation (Slide 1, Slide 2, and Slide 3). *For example:* "Good morning, everyone! Welcome to today's LIKE-A-PRO workshop on alternative protein choices. Thank you all for attending and taking the time to join us. My name is [Facilitator's Name], and I will be leading this session alongside [Modeller's Name]. This workshop is a part of a LIKE-A-PRO project which aims to facilitate sustainable and healthy diets by shifting promising alternative proteins and products from niche to mainstream - making them more available, accessible, and acceptable to all population groups. Alternative proteins are those obtained from sources other than conventional animal-based. In particular, LIKE-A-PRO is concerned about proteins from alternative sources such as: RAPESEED KERNEL, MEALWORM, KRILL, MICROBIAL, CULTIVATED MUSHROOM, FERMENTED FUNGAL PROTEIN, PEA. Before we begin, let's quickly go over the agenda for today. We have a packed schedule ahead of us, and I want to ensure that we make the most of our time together. We will be covering the following key points: - *Exploring key determinants of alternative protein-based food choices by consumers:* We will delve into the factors that influence consumers when it comes to selecting alternative protein-based food options. - *Finding connections between different factors:* We will identify and analyze the relationships between these various factors that impact alternative protein-based food choices by consumers. - *Reviewing the model:* Towards the end of the session, we will review the model we have created, taking a closer look at its components and examining how each factor fits into the larger picture. The workshop will last about [duration of the workshop]. Throughout our time together, we have scheduled a break at [time of the break]. So, the purpose of today's workshop is to collaboratively create a comprehensive map of the factors that influence alternative protein-based foods choices by consumers. By the end of our time together, we aim to have a clearer understanding of these factors and their interconnections. Before we dive in, I want to make sure everyone is ready to begin. If you have any questions or need any clarifications, please feel free to ask." **The tips for the facilitator:** ● make sure everyone is present ● make sure that everyone is visible ● if needed, make sure everyone know how to use the platform (e.g., how to turn on/ off a microphone, camera, raise a hand) 2. **The facilitator** begins the ice-breaker game. Each participant introduces their own name and surname and states what stakeholder group they represent (e.g., producer, retail, policy maker, consumer, advertising). Next, the same participant responds to the question "Never have I ever…" (e.g., "Never have I ever been singing in a choir/ eaten 3-D printed food"). If there is a person who has done it (for example, has been singing in a choir), this person is the next to introduce themselves. When no one shows up, the just-introduced person points to the next participant. **The modeller:** Shares screen with the presentation (Slide 4). *For example:* "As we begin our workshop, I believe it's important for us to get to know each other. To facilitate this, we're going to start with an ice-breaker game. The objective is for each participant to answer the question 'Never have I ever...', introduce themselves, explain which

	stakeholder group they represent (such as producer, retailer, policy maker, consumer, advertising), and make their own 'Never have I ever...' statement. Here's how it works: I will begin by making a statement starting with 'Never have I ever.' For example, 'Never have I ever been singing in a choir.' If any of you have sung in a choir before, please raise your hand or use the 'raise your hand' feature on an online platform and introduce yourself. Share your name and state the stakeholder group you represent. Then, take your turn to make your own 'Never have I ever' statement to continue the game. The game will continue until everyone has had a chance to introduce themselves. Feel free to be creative and have fun with your statements. Now, are the rules clear? If you have any questions, please let me know. Otherwise, let's get started. My name is XX XX (Facilitator's Name and Surname) and I represent (Name of the organization represented by the facilitator). Never have I ever eaten a 3-d printed food (…)" **The tips for the facilitator:** ● make sure that everyone is visible ● make sure everyone has introduced themselves

6) Key determinants

Steps	1. **The modeller** sends an e-mail to the stakeholders at the beginning of the session, containing the handouts. The draft of this email has been prepared in advance by the modeller. 2. **The facilitator** asks stakeholders to familiarize themselves with the provided handouts (giving 10 minutes for this task), specifically focusing on the first 8 pages. Stakeholders are asked to keep their cameras on during this task. If anyone finishes before the 10-minute mark, they indicate so in the chat. ***For example***: "Now, I would like to give you some time to go through the handouts that have just been sent to your emails by [Modeller's Name]. As you may recall, these handouts were also sent to you before today's workshop. While I hope most of you are already familiar with them, I'd like us to take the next 10 minutes to review, especially focusing on the first 8 pages. It's a good opportunity to refresh our memories. Please keep your cameras on during this task. If any of you finish ahead of our 10-minute mark, please indicate so in the chat." 3. **The facilitator** instructs stakeholders that they will first work on their own and prompts them to consider the factors that affect consumers' choices of alternative proteins using a prompting question **'In your opinion, what factors influence consumers' choices regarding alternative protein-based foods?'.** It is important to ask this particular question because it aligns with the workshop's objectives and ensures consistency across all research teams involved in the LIKE-A-PRO research project. Furthermore, having a standardized research question across teams allows for meaningful comparisons and enhances the overall quality of the results. Also, emphasize that stakeholders are asked to identify factors they personally think are most important. Stakeholders are encouraged to write down at least five factors. They are given fifteen minutes to identify these factors and reflect on their relative importance. They are then asked to organize them hierarchically, placing the more important factors higher in the hierarchy and the less important ones lower. **The modeller** displays the slide with the task discussed by the facilitator [Slide 5]. ***For example***: "Now, we will take a few moments to explore the various factors that impact consumers' choices when it comes to alternative protein-based foods. I want you to consider both the barriers and facilitators that come into play. So, here's the question for you: 'In your opinion, what factors influence consumers' choices regarding alternative protein-based foods?'. Please take

some time to reflect on this question and write down at least five factors that come to mind. The factors should be:

- Clear and specific (For example, instead of using 'Food Quality' we should use 'Perceived Taste of Alternative Proteins')
- Concise (For example, instead of using 'The perceived cost-effectiveness ratio of alternative proteins compared to traditional meat products," we should use "Price of Alternative Proteins')
- Should not include adjectives that imply increasing/decreasing (For example, instead of using 'Higher Availability of Alternative Proteins' we should use 'Availability of Alternative Proteins')
- When possible, default to the positive/neutral version of the variable (For example, choose 'Support for Alternative Protein Research' rather than 'Lack of Support')

You have fifteen minutes to finish this task. Once you've identified what you believe to be the key factors influencing alternative protein choices, please organize them in a hierarchical order, with the more important factors placed higher in the hierarchy and the less important ones placed lower. When the 15 minutes are up, we will come back together and engage in a round of sharing to discuss the factors that you have identified, and I will inform you about the last 3 minutes of the task. If you finish before the 15-minute mark, please indicate so in the chat. The task is displayed on the screen."

The tips for the facilitator:

- Inform participants about the last 3 minutes remaining for the exercise. Also, provide the update when there is only 1 minute left and a question: "Does anyone need 2 more minutes?", ensuring everyone has sufficient time to complete the exercise.

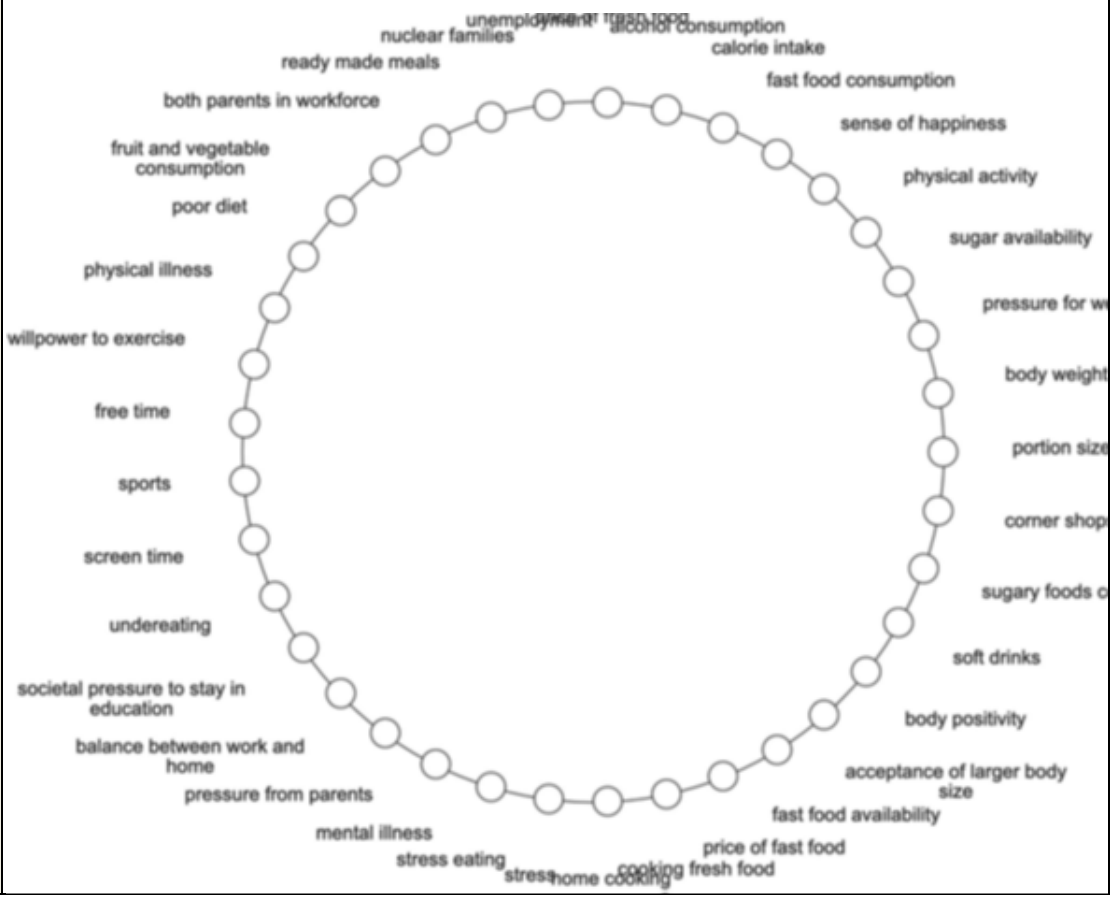
4. **The facilitator** leads a round of sharing, where stakeholders take turns sharing their factors.

The modeller: During the sharing session, the **modeller** is adding the variables suggested into STICKE on the "connection circle". What's more, the modeller shares the screen showing factors added in the circle in the STICKE. The modeller has an additional responsibility of documenting clear definitions for the factors mentioned by the stakeholders. This ensures that the meaning of the listed factors is captured accurately and without any ambiguity.

The tips for the facilitator and the modeller:

- The facilitator points to the first person and then reaches out person by person to be sure that all stakeholders presented the factors.
- The facilitator asks stakeholders for the first factor (at the top of the list) and then takes a second round of sharing the factors.
- The modeller adjusts font size to make factors visible on shared screen
- The facilitator and modeller try to remember all definitions of the factors mentioned by the stakeholders to capture the meaning of the factors.
- The modeller is prepared to write down all definitions of the factors. The definitions are not displayed for stakeholders but immediately noted by the modeller.

For example: **"**Thank you, everyone, for taking the time to identify and organize the factors influencing consumers' choices of alternative protein-based food. Now, let's move on to the next step. Now each of you will have the opportunity to share the factors you have identified. Please start by sharing the factors that are at the top of your list, the ones you consider to be the most important. Share your factor, type it in the chat, and provide a brief explanation or description for each factor as you share. Remember, we are interested in both the barriers and facilitators that influence consumers' choices. Let's begin with [stakeholder's name]. Please share the first factor from your list."

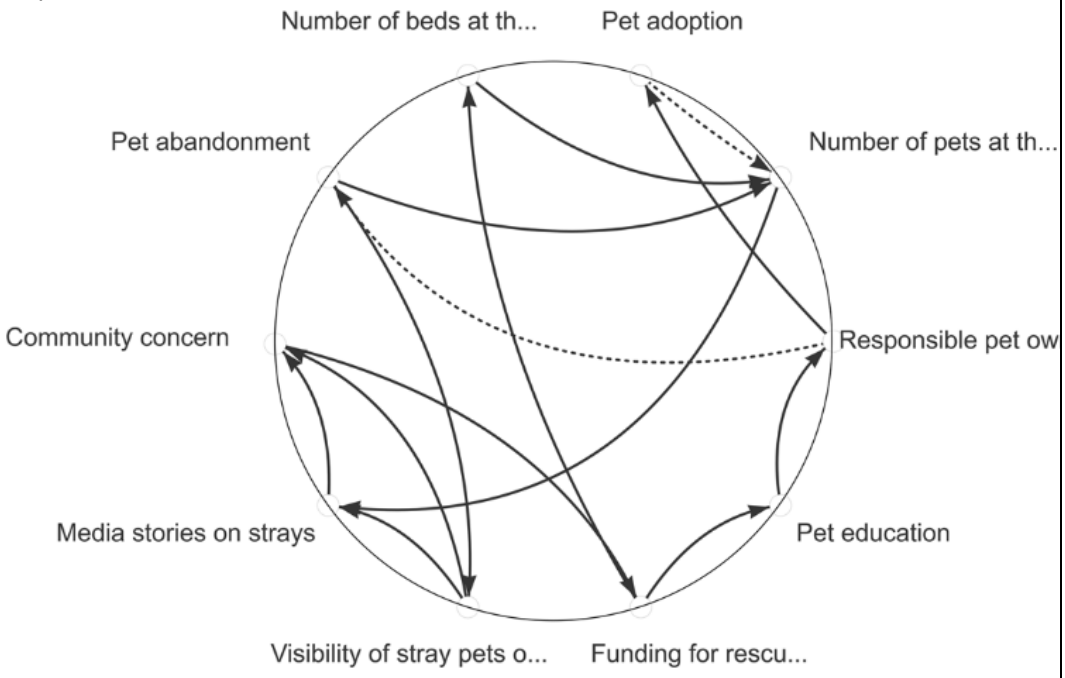
	5. **The modeller** puts the factors into the circle (using STICKE) and shares the screen showing factors in the circle in the STICKE. The modeller, with the help of the facilitator, needs to ensure that the factors on a connection circle are: clear and specific; concise; don't include adjectives that imply increasing/decreasing; when possible, default to the positive/neutral version of the variable. It will help to create meaningful connections between variables in the next exercise. Figure 1 *Example of the Connection Circle from STICKE Software* 

7) Connection Circles and Diagram View in STICKE

Steps	1. **The facilitator** introduces the connection circle script (linking the factors). ***For example:*** "The next task is to link your factors from the 'connection circle' using the STICKE program. The main goal of a connection circle exercise is to find the interrelations between factors that affect consumer choices of alternative protein-based food in your country. In particular, to understand how these factors affect each other."

Figure 2

Example of the Connection Circle



Note. Retrieved from Howard et al. (2020)

2. **The facilitator** explains the directions of the arrows from the STICKE software and how it shows the interrelations between factors. At the same time, **the modeller** shows on the screen the respective examples of positive and negative connections (with corresponding arrows) from the presentation [Slide 6 and Slide 7].

For example: "Before we begin, let me briefly explain how we'll use STICKE to show the connections between the factors you'll identify. We'll link the factors with two types of arrows, depending on the direction of their relationships.

We will use two types of arrows:

-**solid arrow**, showing change in the same direction, we call it a positive connection. It means that if one factor increases then the other factor also increases or if one factor decreases then the other factor also decreases. [respectively when discussing directions, the facilitator shows both thumbs up 👍 👍 or both thumbs down 👎 👎]"

The modeller starts sharing their screen and shows the presentation with an example for the positive association [Slide 6].

The facilitator explains: "Let's use an example to illustrate this. If the factor 'access to the alternative protein-based products' increases, then the factor 'purchase of the alternative protein-based products' also increases [Facilitator demonstrates both thumbs up 👍 👍]

Or if the factor 'access to the alternative protein-based products' decreases, then the factor 'purchase of the alternative protein-based products' also decreases. [Facilitator demonstrates both thumbs down 👎 👎].

So, in both of these cases it shows a change in the same direction: increase-increase [both thumbs up 👍 👍] or decrease-decrease [both thumbs down 👎 👎]. And, as you can see on the printscreen on the slide from our presentation, we used solid arrow to represent this positive association in STICKE"

The modeller stops showing the screen to ensure that the facilitator is visible for stakeholders.

The facilitator says: "On the other hand, **a dashed arrow** shows a change in the opposite direction, we call it a negative connection. It means that if one factor increases then the other factor decreases or if one factor decreases then the other factor increases". (respectively when discussing directions, the facilitator shows one thumb up/down and another one in the opposite direction 👍👎 or 👎👍)."

The modeller shares their screen once again and shows the presentation with an example for the negative association [Slide 7].

The facilitator explains: "Let's demonstrate this by using the same example. So, one of you might say that if the factor 'access to the alternative protein-based products' increases, then the factor 'purchase of the alternative protein-based products' decreases [Facilitator demonstrates one thumb up 👍 and one thumb down 👎]

Or if the factor 'access to the alternative protein-based products' decreases, then the factor 'purchase of the alternative protein-based products' increases [Facilitator demonstrates one thumb down 👎 and thumb up 👍]

So, in both of these cases it shows a change in the opposite direction: increase-decrease [one thumb up 👍 and one thumb down 👎] or decrease-increase [one thumb down 👎 and thumb up 👍]. And, as you can see on the printscreen on the slide from our presentation, we used a dashed arrow to represent this negative association in STICKE.

Is everything clear so far? If you have any questions or if anything is unclear about this exercise, feel free to let me know, and I'll be more than happy to provide further explanations."

3. **The modeller** stops showing the presentation and starts showing the connection circle view from the STICKE.
4. **The facilitator** gives participants 5 minutes to think about connections between the factors presented in the circle. Then, requests each stakeholder to provide their ideas. During this process, the facilitator remembers to ask about the direction of these connections, and the stakeholders indicate the direction using thumbs. The facilitator goes through two rounds of exploring the connections between the factors shown in the circle. However, if needed, the facilitator allows for another round of the discussion for those willing to add more connections. The facilitator ensures that most of the factors receive connections during this task. If there is any factor that doesn't have any connection, and there are no propositions on how to link it, then it can be left unconnected. **The modeller** draws respective arrows in the STICKE.

For example: "You will have 5 minutes to think about connections between factors presented in the connection circle."
After 5 minutes, the facilitator announces:
"Because 5 minutes have passed, let's start sharing your ideas. [Name of the Stakeholder 1], could you begin by identifying two factors that are interrelated? Please use your thumbs to show the direction of the connections between factors."

The tips for the facilitator:

- Take two rounds for sharing examples of the connections. Point to people one by one [Stakeholder 1, Stakeholder 2 Stakeholder 3, ... etc.) to be sure that everyone has spoken
- *Prompting the next examples:*

-“The next person please”;
- “[Stakeholder’s name] it is your turn now. We'd love to hear more from you”;
- “Next connection, please! What do you say, [Stakeholder’s name]?”;
- “[Stakeholder’s name], curious to know if you've spotted any new links between these factors?”;
- “[Stakeholder’s name], do you see any other connections between factors”;
-[Stakeholder’s name], I wonder what your point of view is? Any other connections you'd like to share?”;
- “Could you please add one more connection, [Stakeholder’s name]?”

5. **The facilitator** prompts the next turn of the examples. **The modeller** draws respective arrows in the STICKE.

For example: “To make sure we capture all the connections, let's start a new round of your suggestions. The next turn for providing examples goes to [Name of the Stakeholder 1]. Would you like to share one more connection between two factors?”

6. After the second round of examples, **the facilitator** opens the floor for a discussion, allowing stakeholders to share any additional connections they find important. If there are 1-2 factors that still need to be connected, the facilitator draws participants' attention to those factors and encourages them to make the connections (see "The tips" section for guidance). This ensures that all relevant connections are explored and discussed thoroughly. **The modeller** draws respective arrows.

For example: “We’ve finished the second round of the connections. If anyone wants to share or has discovered another interrelation between factors, please feel free to do so now.”

The tips for the facilitator:

- If the stakeholder doesn’t find a new connection during the next round of discussion the Facilitator switches to the next person: e.g., “[Stakeholder’s name] do you see any more connections? How about you [Stakeholder’s name]? [Stakeholder’s name] it is your turn.”
- Helpful phrases for the facilitator during connection circle exercise:

-paraphrasing/clarifying: “"I understand that you have in mind the situation when (...)”
-asking for the mechanism: "How does it work?”; “How are these factors directed?” “How do these factors affect each other?”
-summarizing: “You proposed to link xx with zz “; “The suggestion is to link xx with zz”;
-ask for the lacking connections: “Which factor might have a connection with factor AA [a factor lacking any connections]?” What about factor XX?”.
-encouraging the discussion: “Thank you, that’s an interesting point.”; “It is valuable connection”; “It’s a great example”; “I see your point of view”; “That's a good addition to the connections we have so far.””

7. Once most of the factors around the connection circle have at least one connection, **the modeller** switches to diagram view, and the picture is rearranged in STICKE. The facilitator explains what is displayed in this view.

For example: “We will now switch from the connection circle into a system map view, making it easier to read and understand how interrelated factors affect consumers’ choices of alternative protein-based food. As you can see,our connection circle has now transformed into a map of the factors. To make it easier to read, we need to rearrange the view of the factors. Let’s take a 15 min

break for map cleaning. See you at xx [note the time when the break ends]"

8. **The modeller** may need to do a bit of additional clean up to clarify the diagram. It means that the modeller: change the font, arrange the factors, shift factors for better view; put unrelated factors in one place on a map; make it easier to read the diagram to show feedback loops and casual chains for the next exercise. **The facilitator** becomes familiar with the map.

9. 15-minute break: Participants take a 15-minute break to refresh themselves while **the facilitator and modeller** work to quickly clarify the map. **The modeller** downloaded it to the .pdf version. **The facilitator and the modeller** should find at least one example of feedback loop and one example of causal chain:

- **casual chains** such as xx→ yy → zz [showing sequence of the links between factors: how one factor affects the other followed by the next factor].

- **feedback loops** such as  [showing that factors form a circle of connections].

The facilitator explains that feedback loops are important because they reveal the interconnectedness and complexity of systems, helping to predict behaviors, and identify intervention points.

10. After the break: **The facilitator** reminds participants that the map created before the break has been revised by the modeller. **The modeller** shows the screen with the map created by stakeholders in the STICKE.

For example: "During the break, the connection circle has been rearranged to present the factors and links as a map of factors. Now, you can see the map that illustrates how the factors you mentioned affect consumers' choices of alternative protein-based foods. Please note that the modeller has not discarded any of your ideas, but rather has visually cleaned up the map, and made some minor improvements to ensure clarity and readability."

11. **The facilitator** asks for additional connections that participants can see in this view. In particular, the **facilitator** emphasizes identifying causal chains and feedback loops, encouraging participants to connect several variables into chains or loops instead of focusing only on single connections. The facilitator remembers to remind participants about directions of associations that dashed or continuous arrows represent. This clarification is important to understand the nature of the relationships between the factors in the system map:

For example: "Your map shows that the factors xx, yy, zz form:
- casual chains such as xx→ yy → zz [explaining one example of a chain of the factors showing how one factor affects the other and so on]. It means that factors are related in sequence, one by one, and

- feedback loops such as [explaining one example of a loop of the factors showing how factors form a circle of connections]. It means that factors form a circle of connections. Feedback

	loops are important because they show how different parts of a system connect and affect each other, helping us to predict behaviors, and identify intervention points." 12. **The modeller** sends a .pdf version of the map to all of the participants. The facilitator informs the participants about this. *For example:* "The modeller has just sent you an email with the map. Please open the message and then we will move on to the next task"

8) Model Review

Steps	1. **The facilitator** invites participants to work individually. Stakeholders are encouraged to review the map which was sent via email. The map review is planned for 10 minutes. During this task, participants have the opportunity to identify and add any new causal linkages they may find, as well as provide any comments or suggestions about the map. Participants should think about meaningful links, especially focusing on causal chains and feedback loops, instead of just randomly connecting factors. Participants may also add any missing factors, but only if they truly believe they are essential. **The modeller** shows the screen with the map from the STICKE. *For example:* "Now, I would like to ask you to take a moment to look at the shared map and work individually. Please focus on how the factors included in the map affect the consumers' choices of the alternative protein-based food. You will have 10 minutes to think and refer to what you find good/interesting in the map, as well as any areas that you believe need improvements. If you want to add any more connections, please focus on causal chains and feedback loops, rather than simply adding connections anywhere. We believe we've included most important determinants in the map, but if you see a crucial factor missing that really should be there, then let's bring it up. Later, each of you will have the opportunity to share and discuss your suggestions with a group. Do you have any questions at this moment?" **The tips for the facilitator:** ● Inform participants about the last 3 minutes remaining for the exercise. Also, provide the update when there is only 1 minute left and a question: "Does anyone need 2 more minutes?", ensuring everyone has sufficient time to complete the exercise. 2. After the 10 minutes have passed, **the facilitator** encourages participants to share their ideas/changes/observations about the map. The facilitator invites any feedback from the stakeholders, fostering an open discussion and exchange of perspectives. **The modeller** shows the screen with the map in the STICKE. **The modeller** is also responsible for adding new connections between factors identified by the stakeholders. *For example:* "The last task is a round-robin type discussion. You will now have a chance to share some of your observations and discuss them with a group. All changes accepted by the group will be incorporated by modeller into the shared map. Please start with sharing your discussion points, and let others know what you want to add or remove from the map? Let's start with the first volunteer."

The tip for the facilitator:

- If nobody is willing to be active the facilitator points to the first person and then asks each participant.
- The facilitator can use following technics:

- summarize: “You proposed to link xx with zz”; “The suggestion is to change xx to zz”; “You want to remove yy”
-paraphrasing/clarifying: “"If I understand correctly, you mean the situation when (...)”
-ask for the mechanism: "How does it work?”; “How are these factors directed?” “Can you explain how these factors affect each other?

3. As **the facilitator** is eliciting new information from the group and guiding the discussion, **the modeler** captures the changes in STICKE, which is being projected on the screen in real time. After each proposition from each stakeholder, the facilitator asks the group about proposed changes. **The facilitator** must ensure that everyone agrees with the changes incorporated into the map.

For example: “What do others think about proposed changes? Do others agree/disagree with new material/removal/ alteration? Does anyone want to suggest any further revisions to the map?”

(If the modeller doesn’t catch the discussed changes, the modeller asks the facilitator for clarification or repetition of the arrangements.)

4. With 5 minutes to go, **the facilitator** alerts the group about the approaching end of the workshop and gives an opportunity for the final discussion. **The modeller** presents the final map.

For example: “We are almost out of time, and we can make two or three quick last-minute changes before we end the workshop. It is time for any final feedback about the map.”

The tips for the facilitator:

- If a person speaks for an extended period, the facilitator uses “the parking lot” method to manage the discussion. For instance, they may say, “Thank you for sharing your thoughts. Please pause for the moment and see what others have to say about this” or “It is a lot of information, could you provide a short summary” or “Thank you for sharing but we need to stop here for now, you can back to this point later [giving opportunity for other stakeholders to share their thoughts]”

5. Individual questionnaire: **The modeller** sends a link with a questionnaire to all participants which includes both sociodemographic questions and questions about stakeholders’ beliefs regarding factors related to consumers' choices of alternative proteins. **The facilitator** informs the participants that the final element of the workshop is to fill out a survey and emphasizes its importance.

For example: “Before we end our workshop I would like to ask you to fill-in the short questionnaire. This questionnaire is a very important complement to the workshop. It concerns potential barriers and factors facilitating a shift in the food system towards alternative protein choices. You should have received an email with it. Please take 5 minutes to complete it before we close the meeting. Thank you!”

	The questionnaire includes the following questions (to be sent as google forms online questionnaire): - 1: Your country (please select from the list of the countries) - 2. Sector and the type of organization (e.g. farming industry, Ingredients Industry, food processor company, marketing, education, retail); (please select from the list) -3. Job title (e.g. sales manager, regional manager, innovations specialist, etc) (please select from the list) - 4. Years of work in a similar position/similar organization) (please select from the list) - 5. Gender (please select from the list) - 6 Age) (please select from the list: 18-25; 25-35, 35-45, 45-55, 55-65, >65) - In your opinion: 7. - *does the map lack any important factors*? If so, please write them down- - Rate the importance of the groups of factors <u>determining an increase of alternative protein choices in your country</u>: (not important at all)-3 -2-1; 0 (neutral) +1+2 +3 (extremely important) Beliefs, knowledge, actions of policy makers -3-2-1 0 +1+2+3 Beliefs, knowledge, actions of producers -3-2-1 0 +1+2+3 Beliefs, knowledge, actions of retail representatives -3-2-1 0 +1+2+3 Beliefs, knowledge, actions of consumers -3-2-1 0 +1+2+3 Food composition policies (e.g. nutrients and sources) -3-2-1 0 +1+2+3 Food Labelling policies -3-2-1 0 +1+2+3 Advertising policies -3-2-1 0 +1+2+3 Food marketing policies (other than advertising)-3-2-1 0 +1+2+3 Public procurement provision policies (food at schools, hospitals, public administration institutions, etc) -3-2-1 0 +1+2+3 Food retail policies (regulating what is available in retail outlets) -3-2-1 0 +1+2+3 Taxation policies -3-2-1 0 +1+2+3 Other fiscal or food prices policies (e.g. subsidies) -3-2-1 0 +1+2+3 Education policies -3-2-1 0 +1+2+3

	Trade and investment agreements -3-2-1 0 +1+2+3 Infrastructure in food production -3-2-1 0 +1+2+3 infrastructure in food processing -3-2-1 0 +1+2+3 Infrastructure in retail -3-2-1 0 +1+2+3 Economic situation of the country (e.g. GDP, national budgets, etc) -3-2-1 0 +1+2+3 Cost of living in the country -3-2-1 0 +1+2+3 Producer/retail costs of introducing novel food -3-2-1 0 +1+2+3 Disposable income/ economic situation of families -3-2-1 0 +1+2+3 Major events that can affect consumers' choices e.g., COVID-19 pandemics, wars in European continent -3-2-1 0 +1+2+3 Political elections in my country -3-2-1 0 +1+2+3 Technology innovation needed for the alternative protein production -3-2-1 0 +1+2+3 Technological innovations and developments in marketing (e.g. Artificial Intelligence) -3-2-1 0 +1+2+3 Climate change -3-2-1 0 +1+2+3 Trends toward more sustainable choices -3-2-1 0 +1+2+3 Local and organic food trends, food ethics (animal welfare) -3-2-1 0 +1+2+3 Note: The questionnaire items are based on -INFORMA food environment monitoring modules https://www.informas.org/modules/ -INFORMA Food Environment Policy index https://www.jpi-pen.eu/images/reports/Food-EPI_EU_FINAL_20210305.pdf -CICI framework for Context and Implementation of Complex Interventions (https://implementationscience.biomedcentral.com/articles/10.1186/s13012-017-0552-5) 0. **The facilitator** closes the workshop. ***For example:*** "Thank you for attending the LIKE-A-PRO workshop. To sum up, we now have the final map of the factors. The map shows how the factors are interrelated and create a system that affects consumer choices of alternative protein-based food. It visually presents the causal loops and chains of the factors that will help the researchers understand the system in which they operate. We are really pleased with the work you've done during the workshop. Please feel free to ask if you have any questions. If not, it is time to say goodbye. Thank you once again for your valuable contributions!"

9) After the workshop

Tasks for the **facilitator** and the **modeller**:

- Based on the discussion during the workshop, the facilitator and the modeller write down the list of factors with their definitions mentioned by stakeholders (immediately after the workshop),
- The modeller **saves the final map created during the workshop in .png and .csv version** (immediately after the workshop),
- **The facilitator or the modeller must send the final map to the LIKE-A-PRO Polish Team (zszczuka@swps.edu.pl or ekulis@swps.edu.pl) in the .png and .csv version (immediately after the workshop)**. The map should be named based on information on page 8 of this manual, e.g., POL_01-09-2023_LIKE-A-PRO.

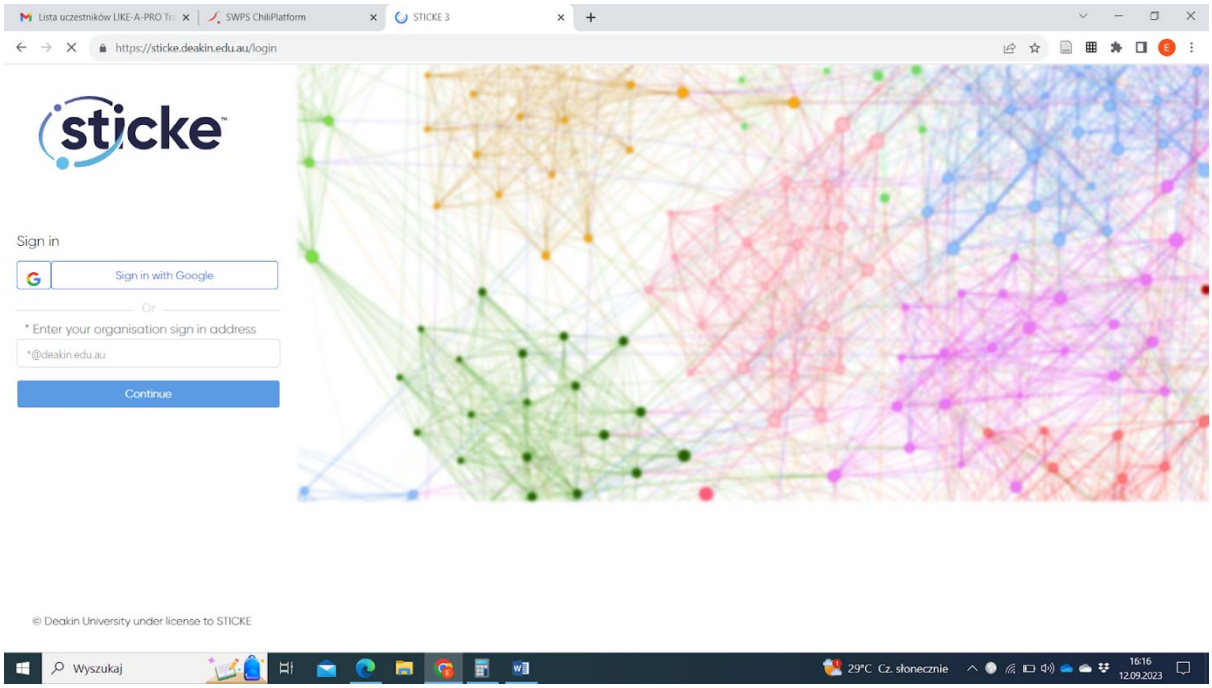
References

Richardson, G. P., & Andersen, D. F. (1995). Teamwork in group model building. System Dynamics Review, 11(2), 113-137.

Savona, N., Macauley, T., Aguiar, A., Banik, A., Boberska, M., Brock, J., Brown, A., Hayward, J., Holbæk, H., Rito, A. I., Mendes, S., Vaaheim, F., van Houten, M., Veltkamp, G., Allender, S., Rutter, H., & Knai, C. (2021). Identifying the views of adolescents in five European countries on the drivers of obesity using group model building. European journal of public health, 31(2), 391–396. https://doi.org/10.1093/eurpub/ckaa251

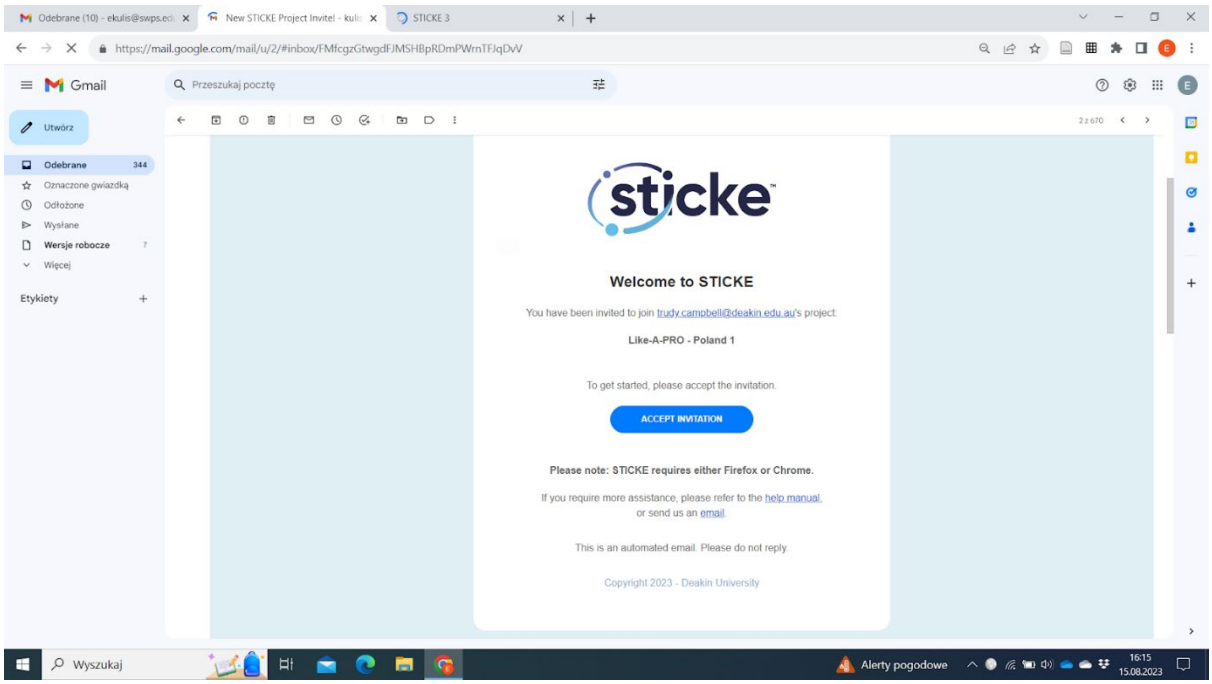
- **Annex VI: How to use the STICKE software: a short manual**

Manual: How to use the STICKE software?

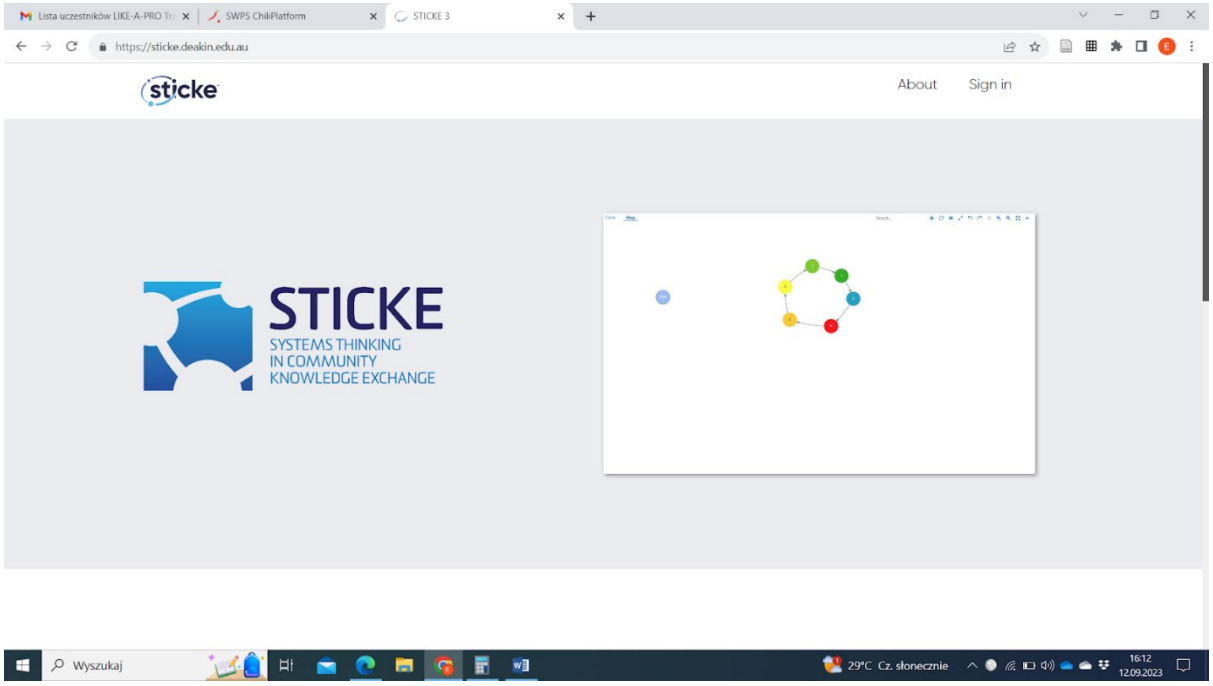


First Step: How to log in to the STICKE?

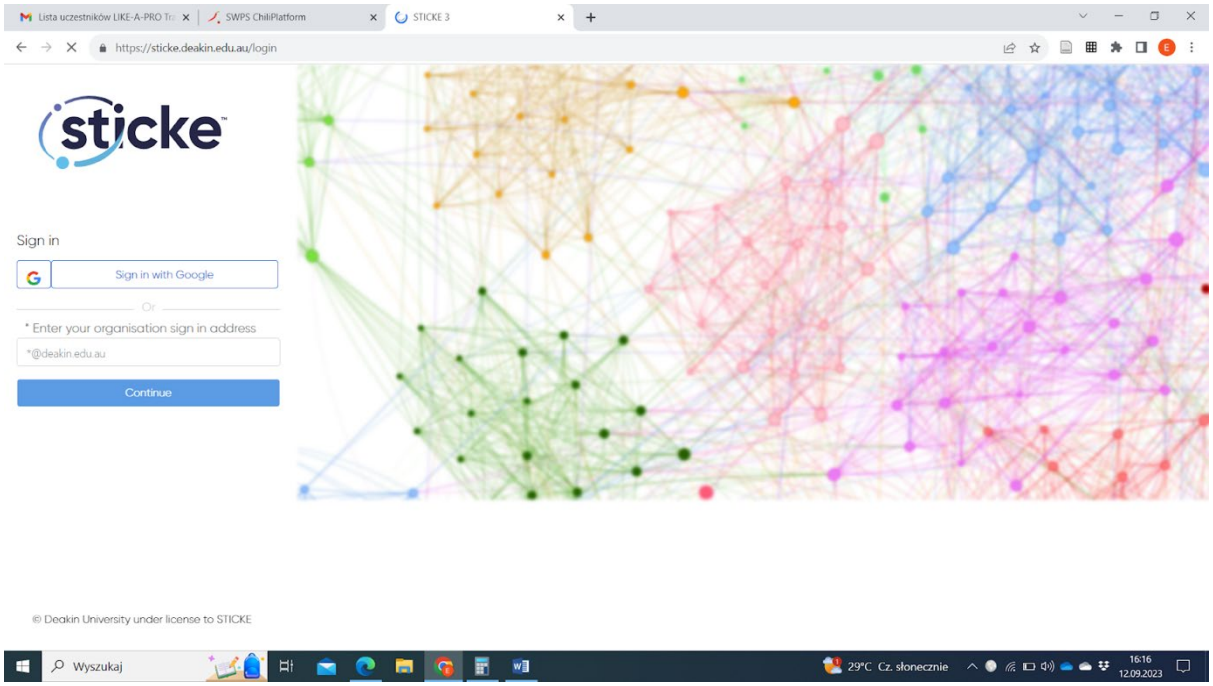
1. **Before you start using the STICKE:** Accept an invitation to the STICKE sent by a Deakin University representative. You should receive it in the email address you indicated for signing in to the STICKE.



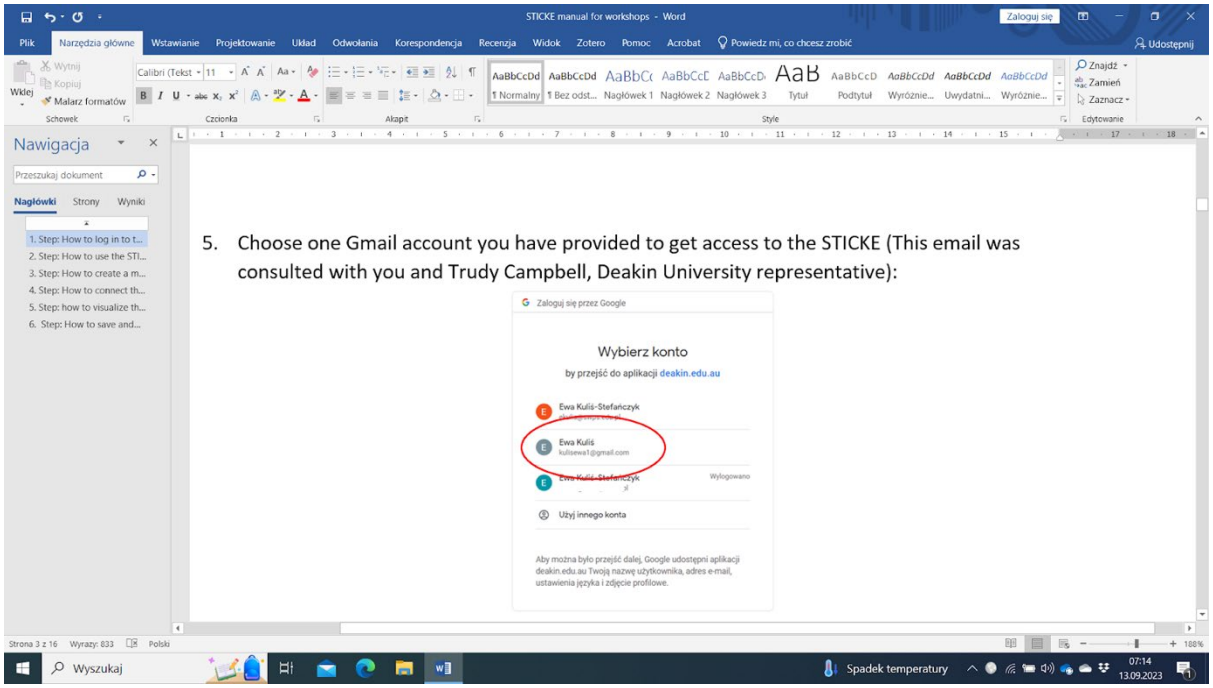
0. Be sure that you are logged in to one Gmail account (please log out from other accounts to be sure that you can get access to the STICKE). **Remember:** The STICKE requires either Firefox or Chrome
0. **In the future:** sign in via the STICKE website: https://sticke.deakin.edu.au/



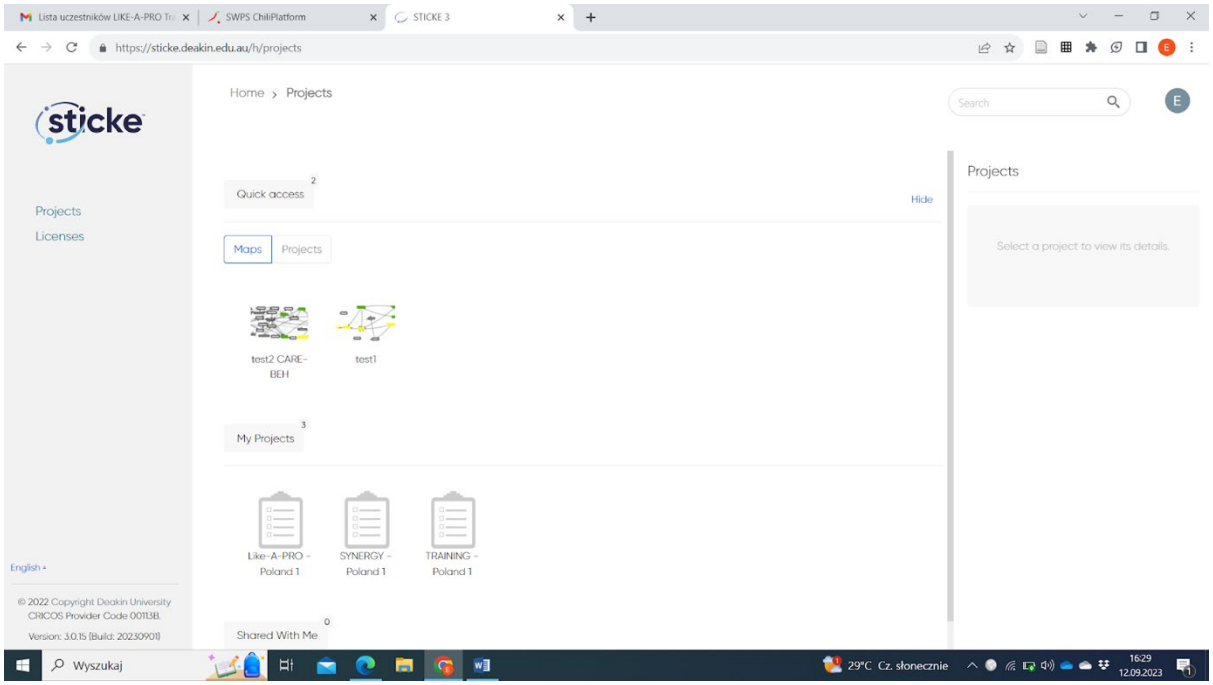
0. Always sign in with your Google account:



0. Choose one Gmail account you have provided to get access to the STICKE (This email address was consulted with you and Trudy Campbell, Deakin University representative):



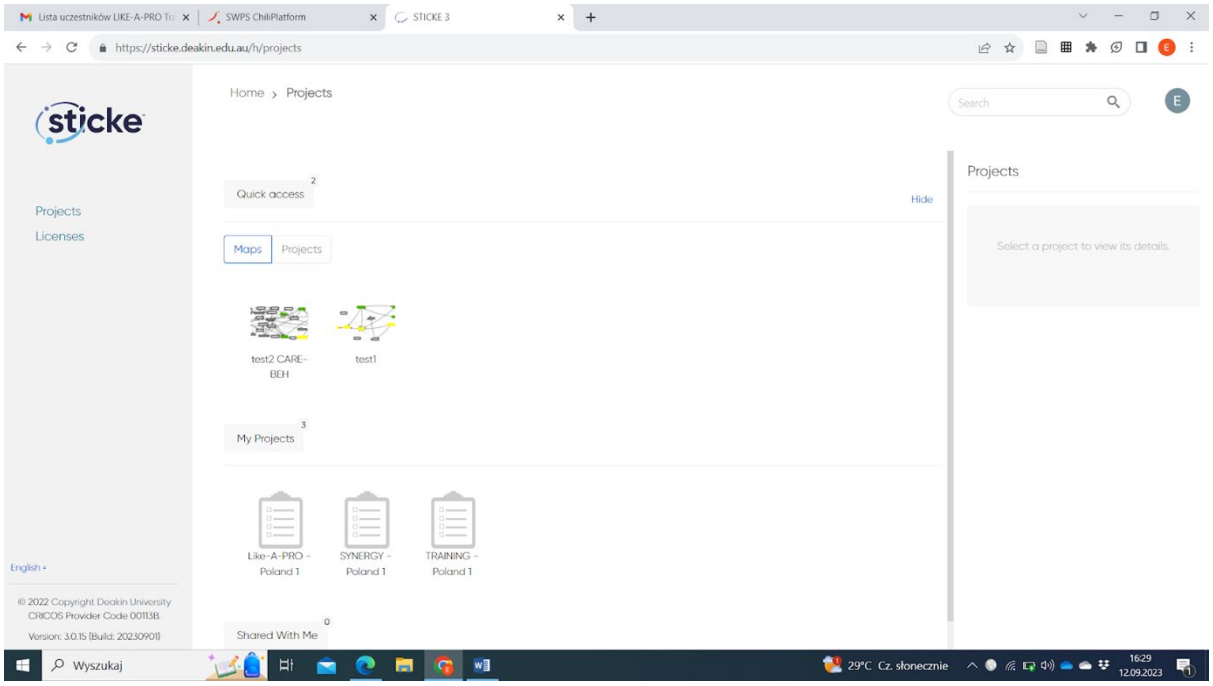
0. If the email address is correct you are automatically forwarded to your STICKE account:



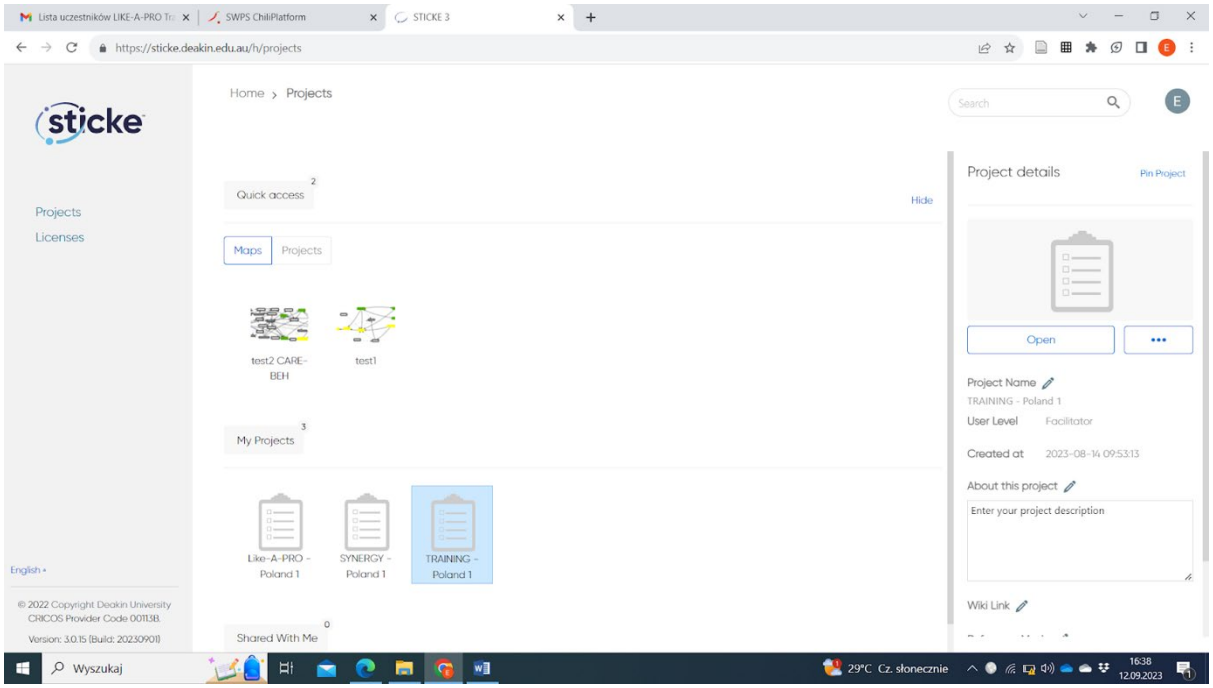
Second step: How to use the STICKE dashboard?

1. **The STICKE dashboard:** You have access to the two projects:

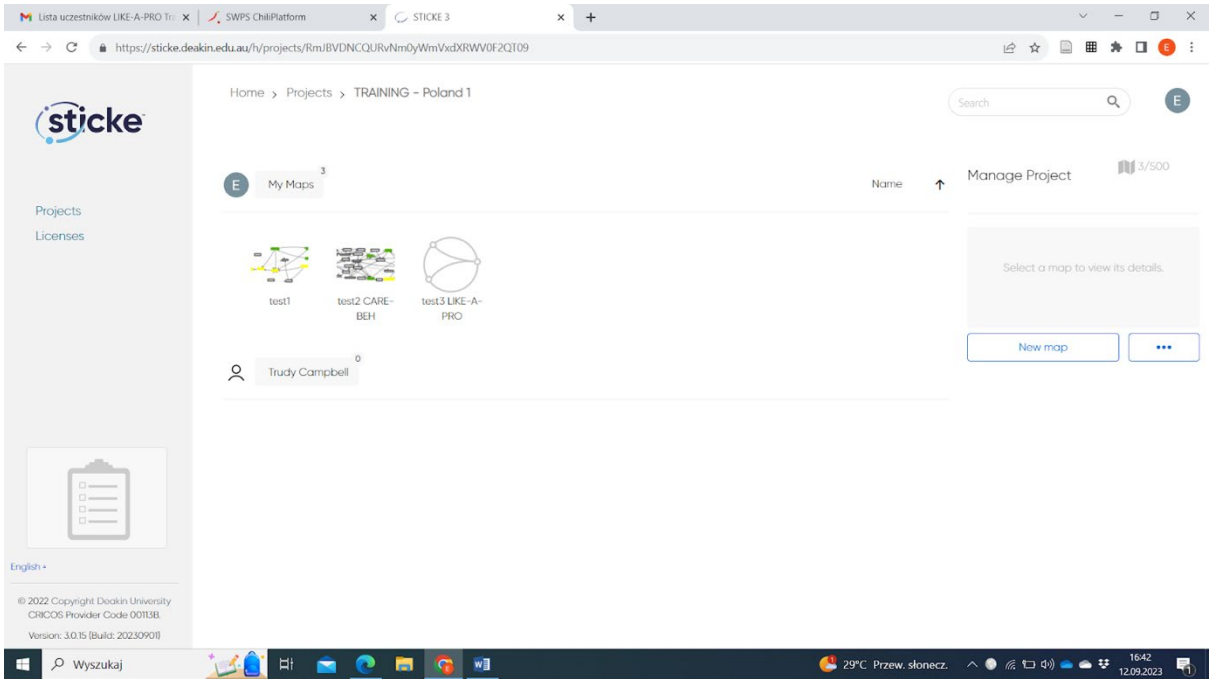
1)**LIKE-A-PRO**: Create a map at the main workshop
2)**TRAINING**: Create maps to learn how to use the STICKE



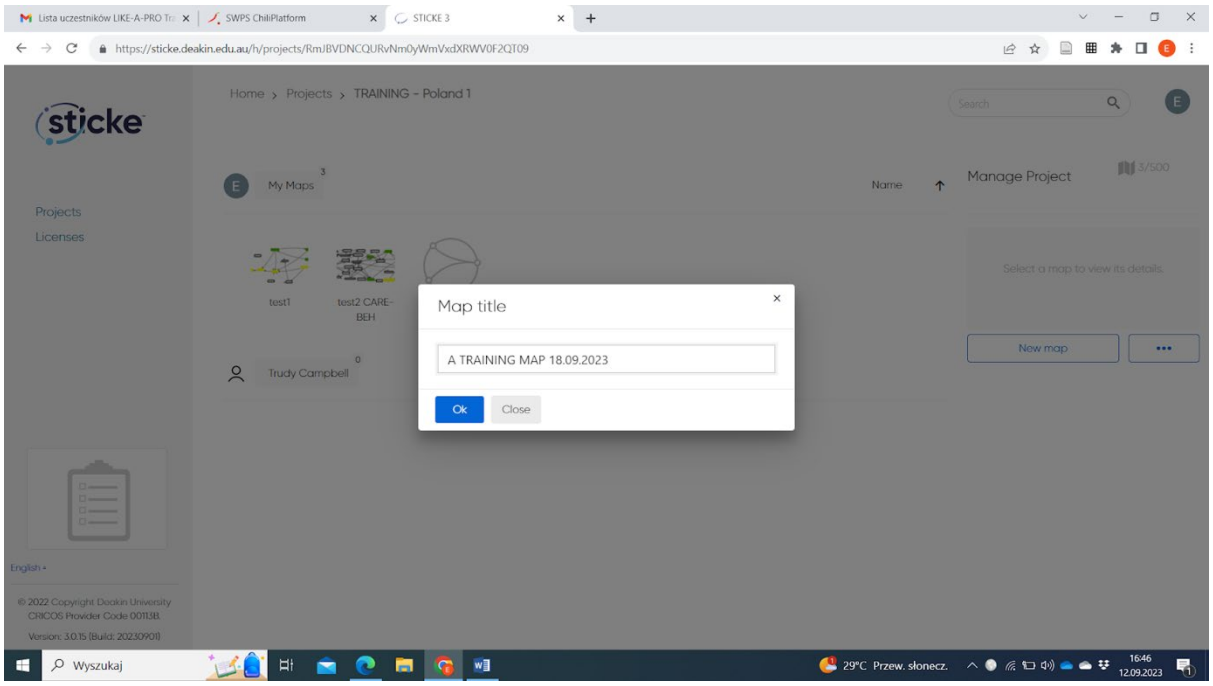
0. Select and open the project that you are interested in:



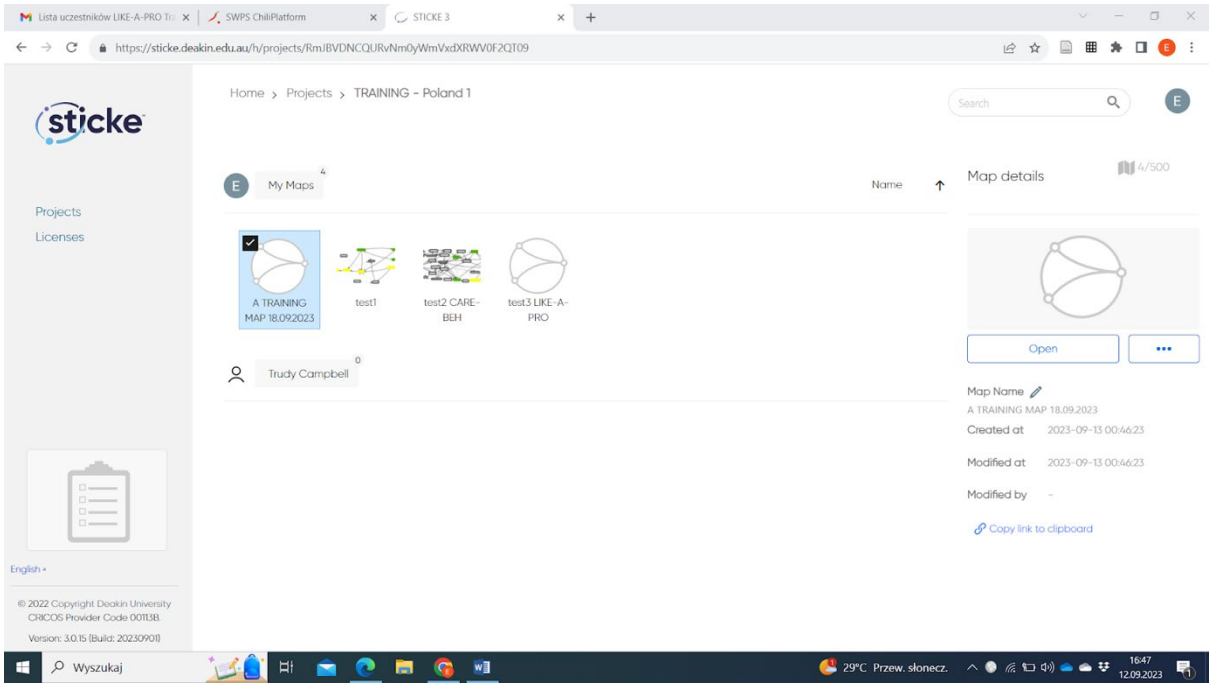
0. Create a new map in the project, e.g., TRAINING:



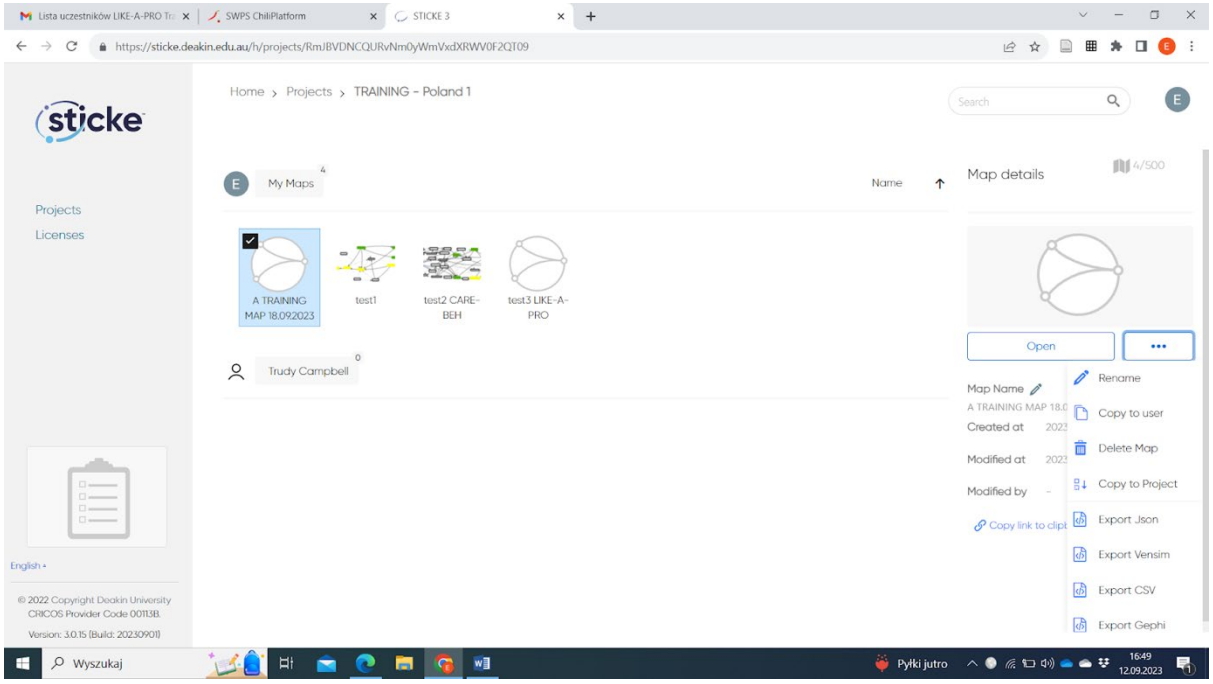
0. Add a map title:



0. Choose your map and open it:

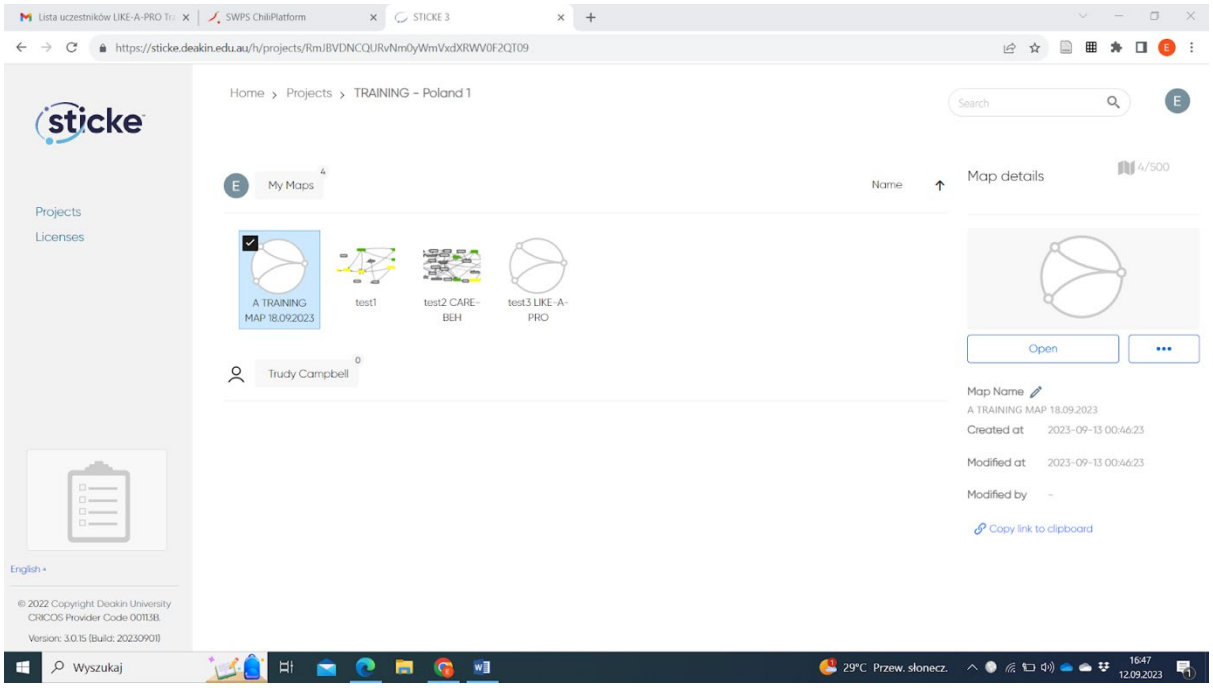


0. **Optional functions:** Delete or Rename the map:

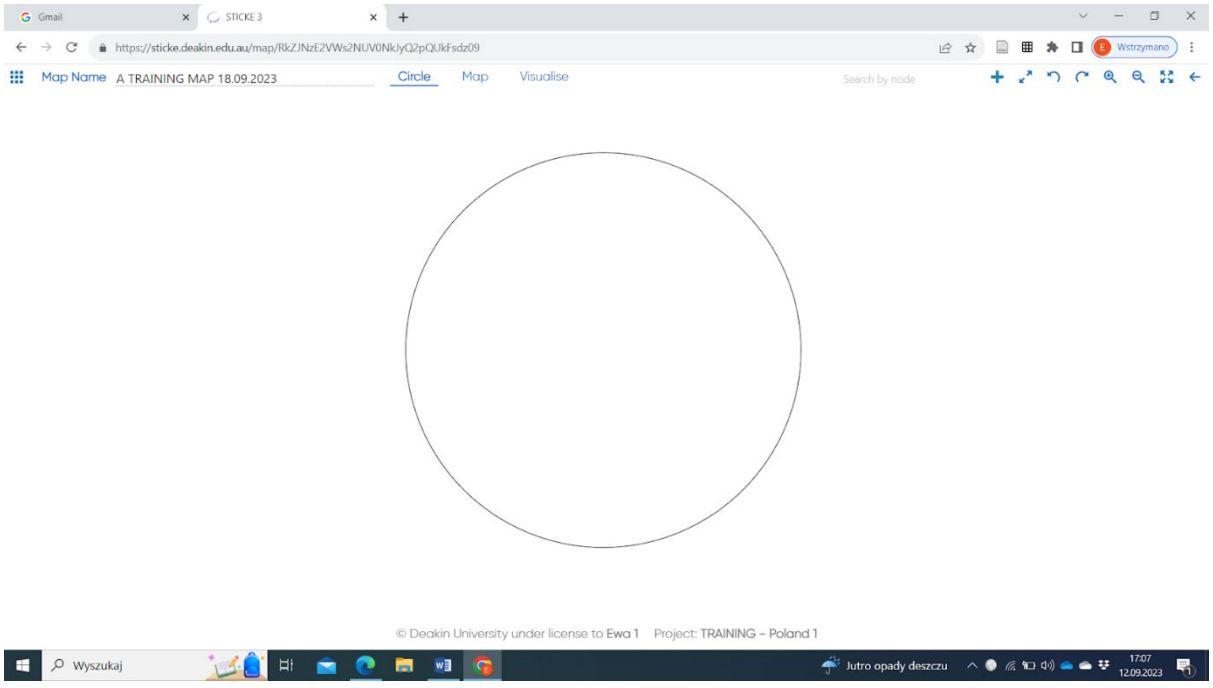


Third step: How to create a map with the key determinants in the STICKE?

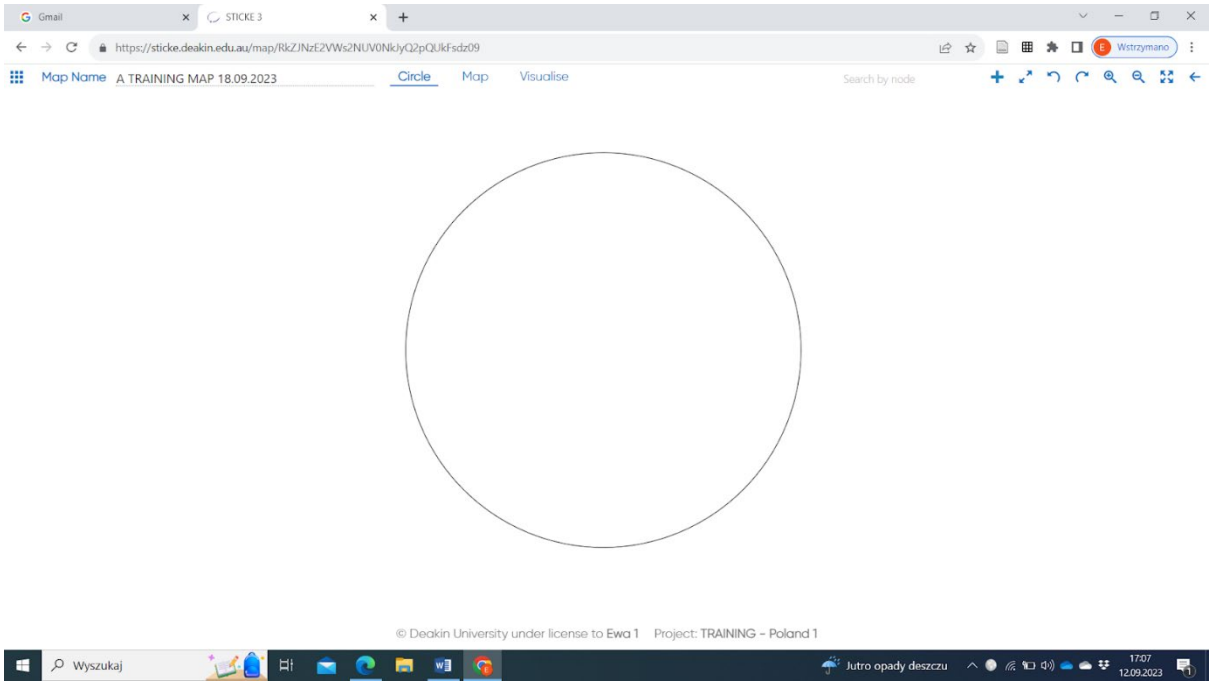
1. Open the map you want to work with:



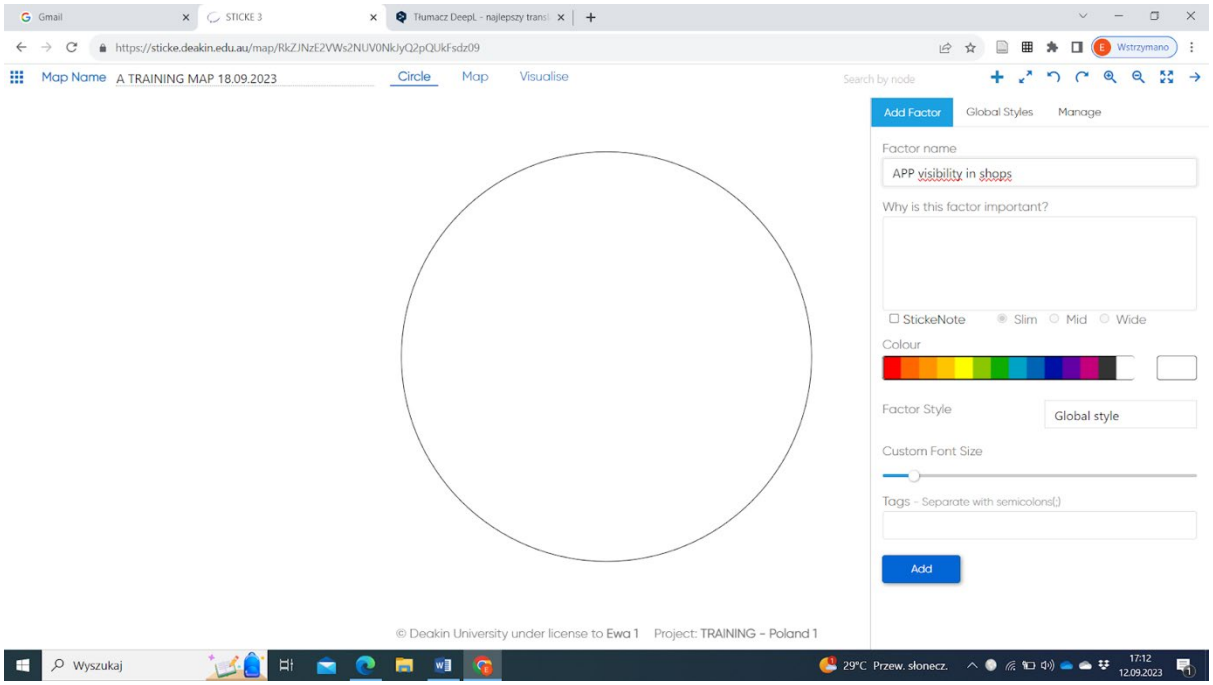
0. A circle dashboard view:



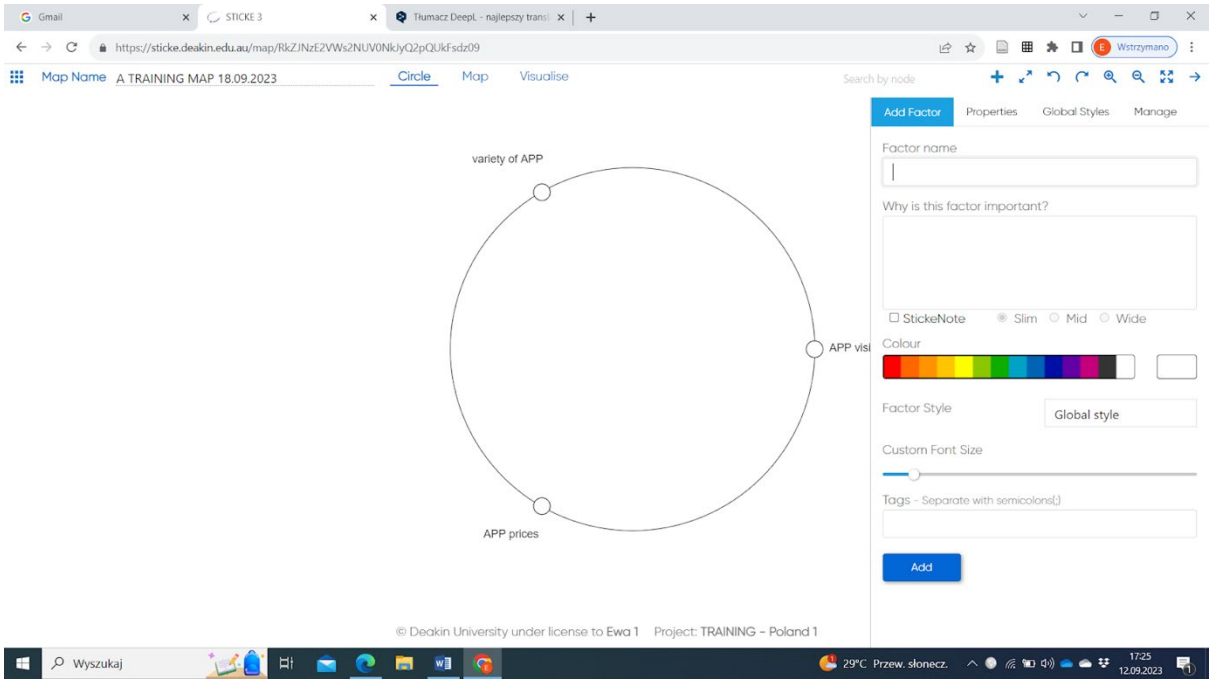
0. Add a factor:



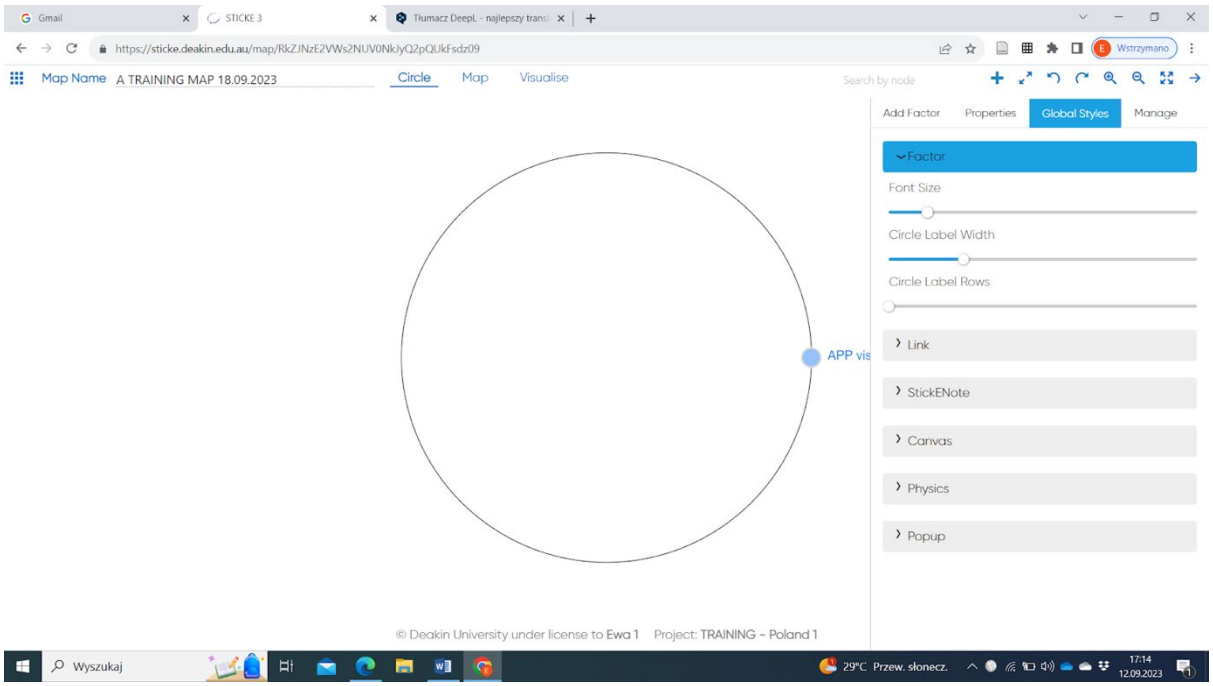
4. Name and add a factor to the circle:



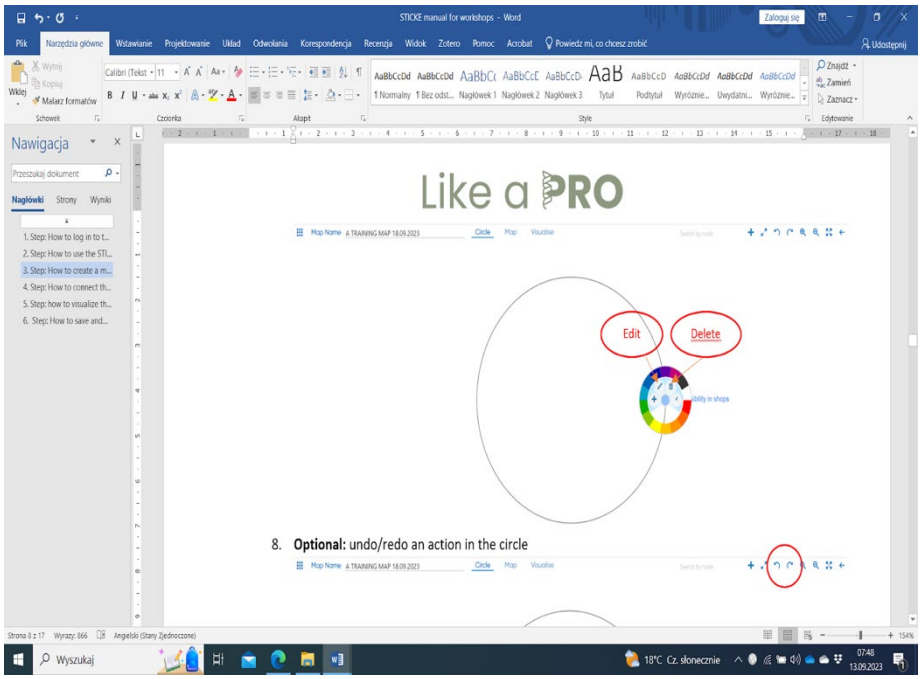
0. Add as many factors as you want:



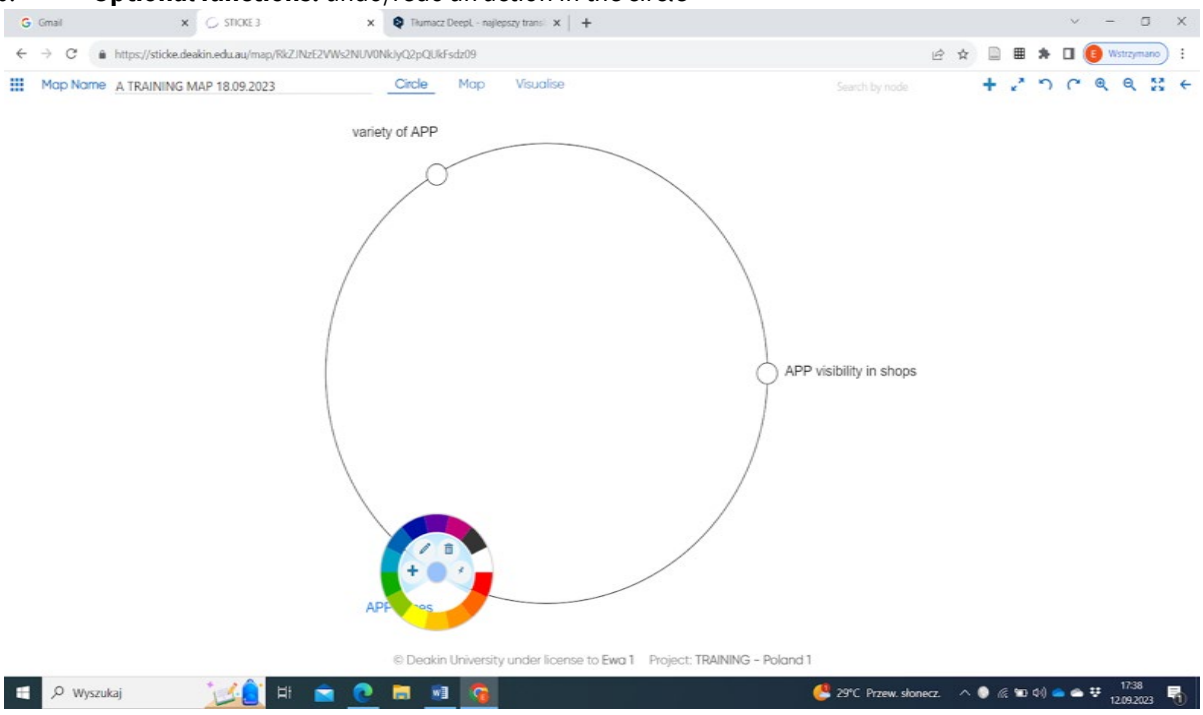
0. **Optional functions:** Change a font size:

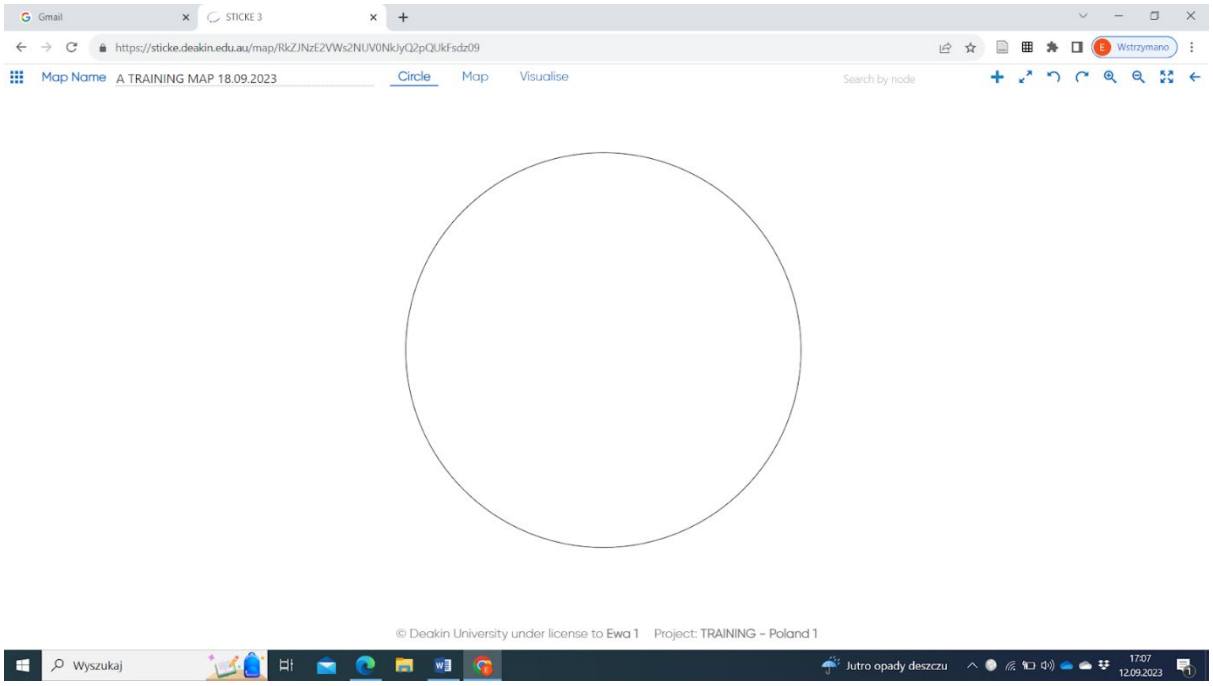


0. **Optional functions:** Edit or remove a factor: 1) press the point next to the factor and 2) choose the intended action (Edit function: you can rename a factor or change a font size and

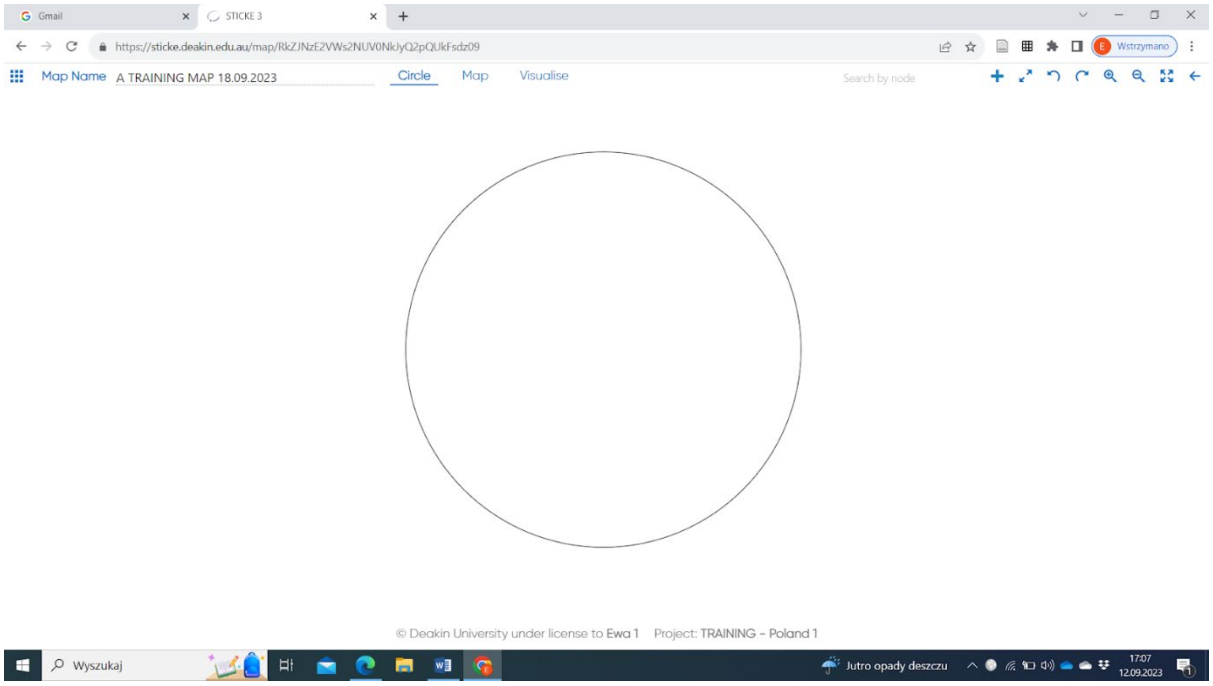


0. **Optional functions:** undo/redo an action in the circle



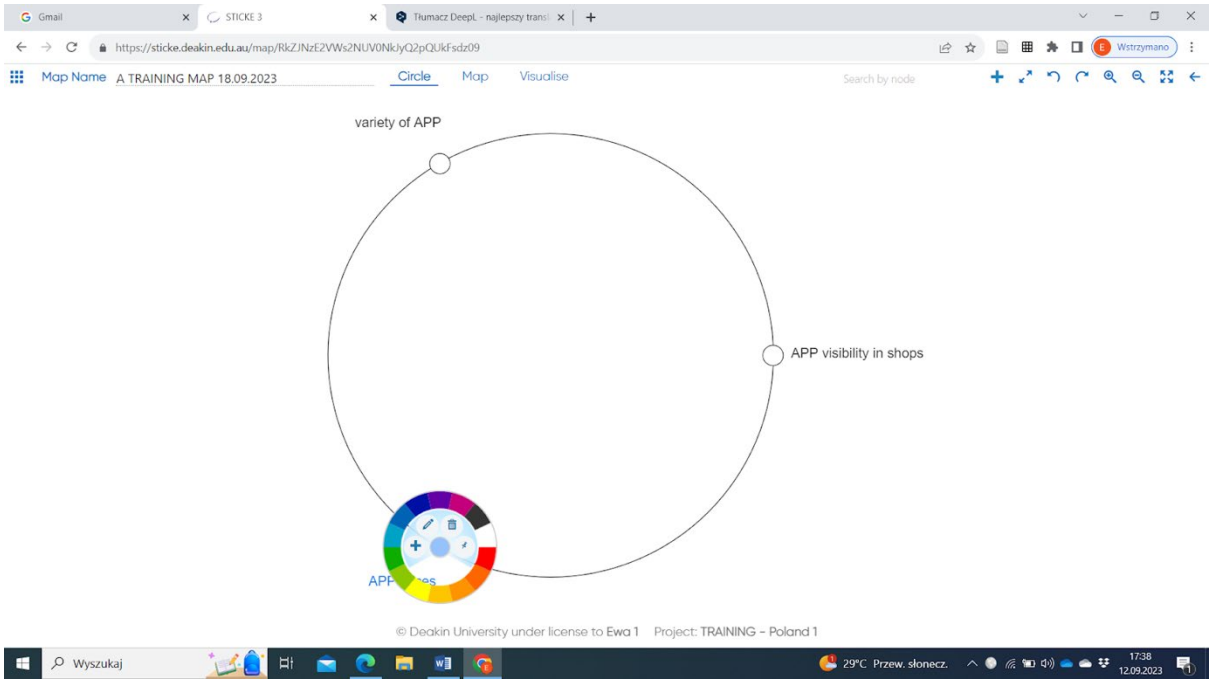


0. **Optional functions:** zoom in/zoom out a view of the circle

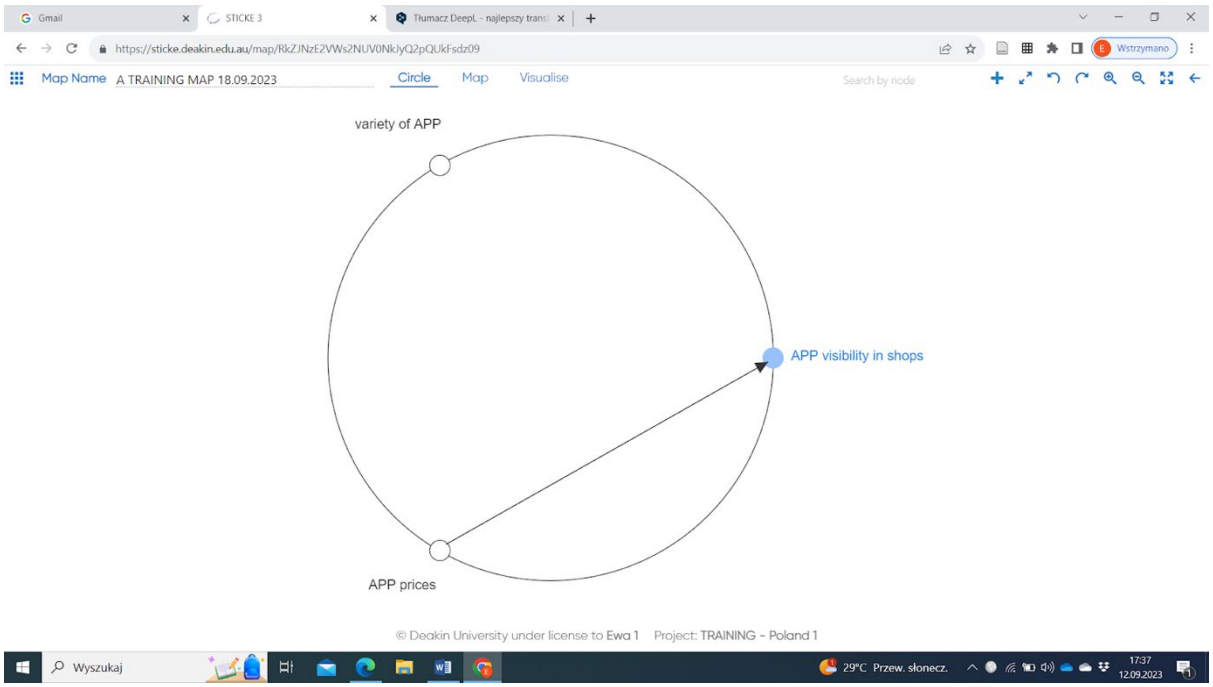


Fourth step: How to connect the factors in the circle?

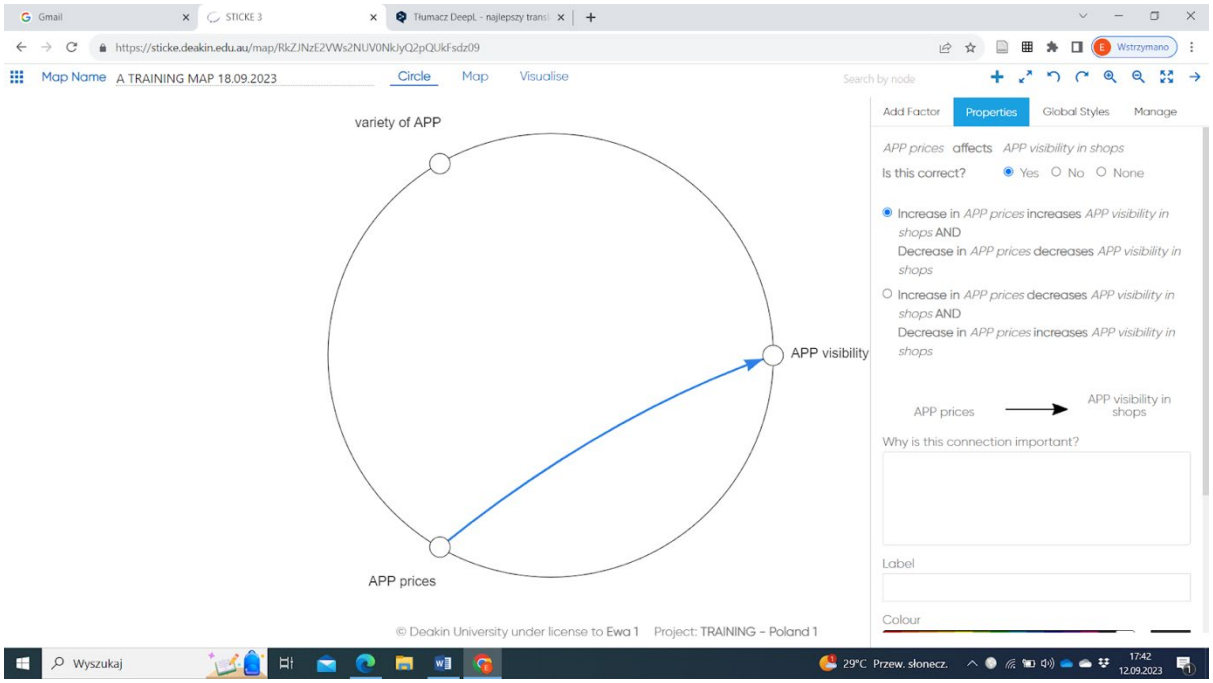
1. Connection of two factors: 1) Press the point next to the factor and 2) choose the function "connect":



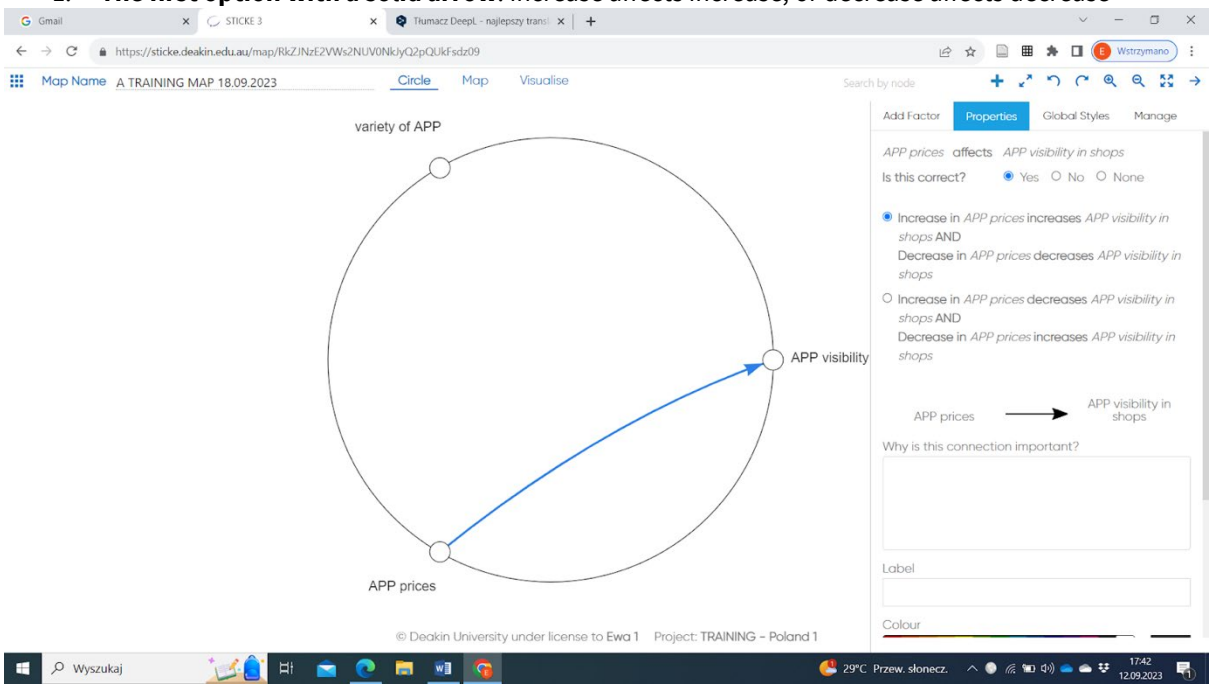
0. Connection of two factors: direct the cursor according to the intended connection- pull the cursor from one factor towards the other factor:



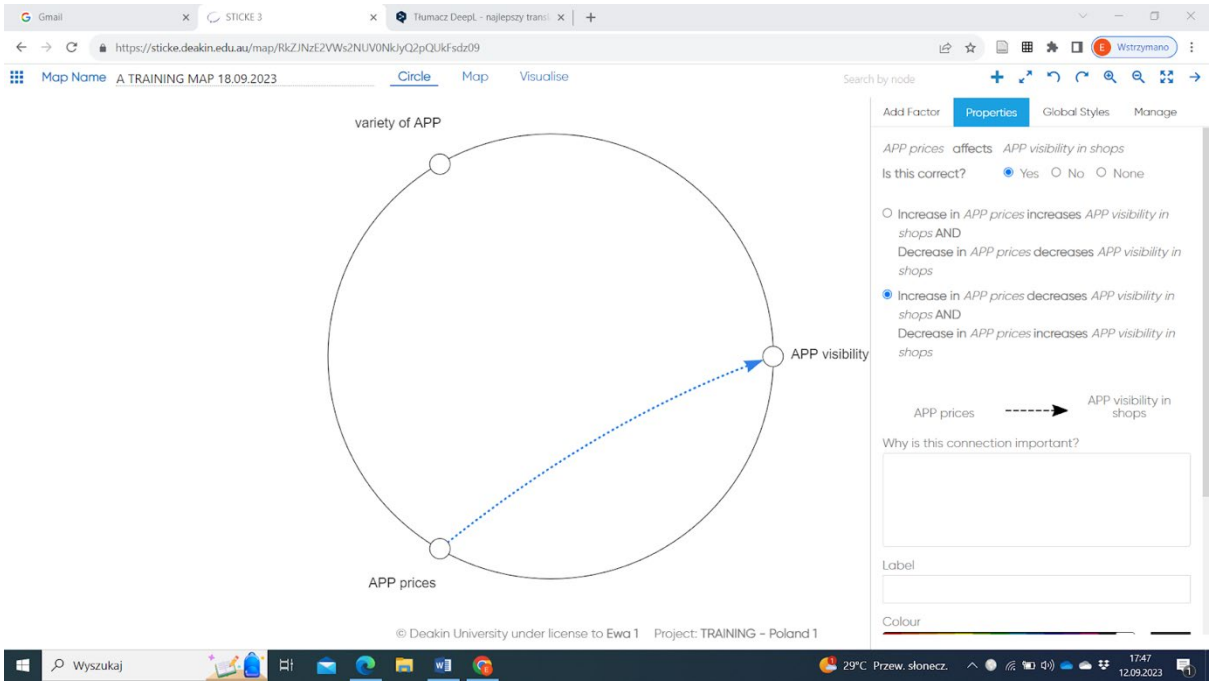
0. Connection of two factors: Choose a proper connection on how one factor affects the other factor (a dashboard opens automatically):



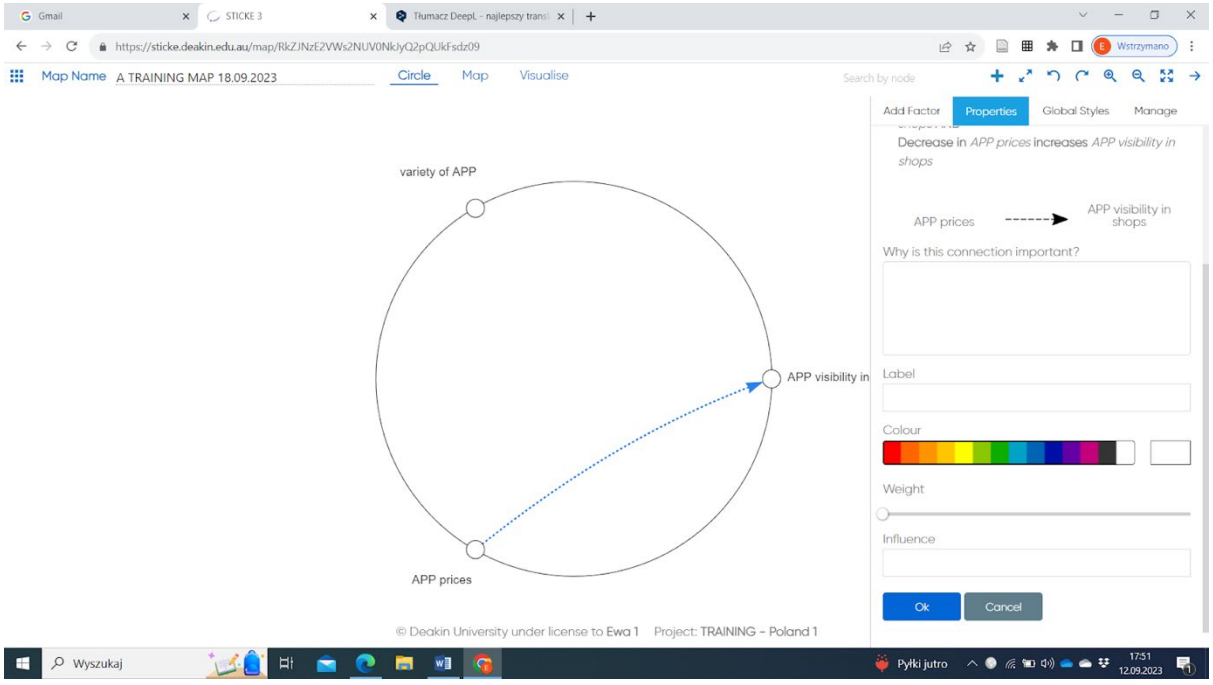
1. **The first option with a solid arrow**: increase affects increase, or decrease affects decrease



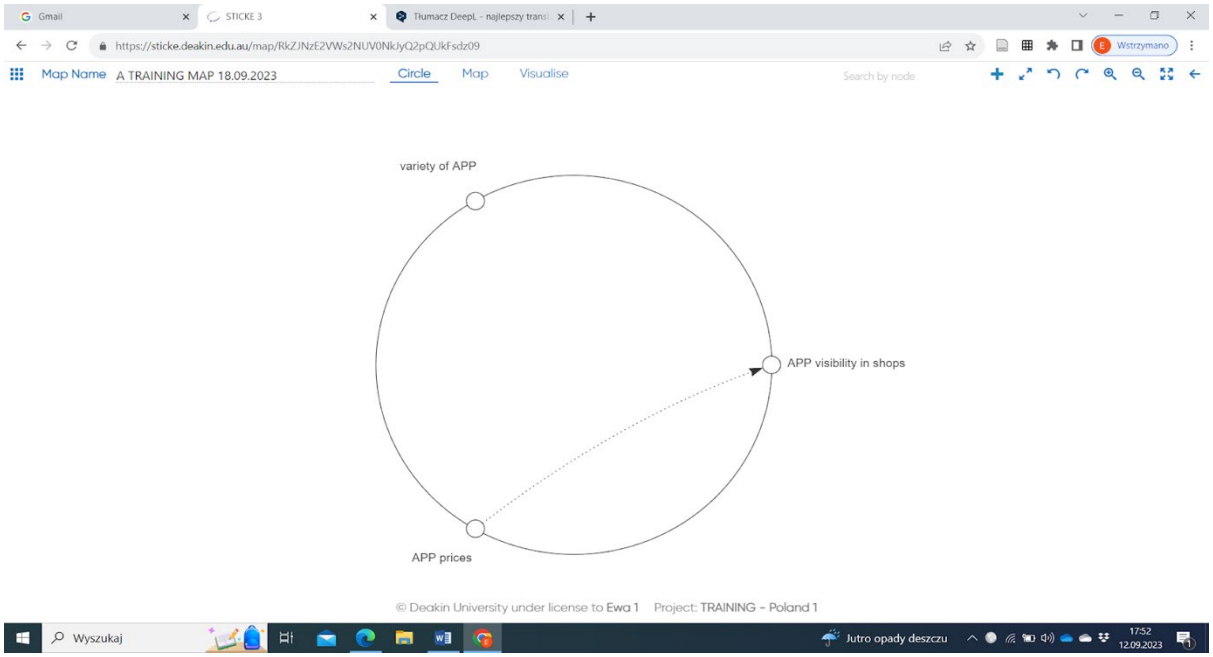
0. **The second option with a dashed arrow**: increase affects decrease, or decrease affects increase



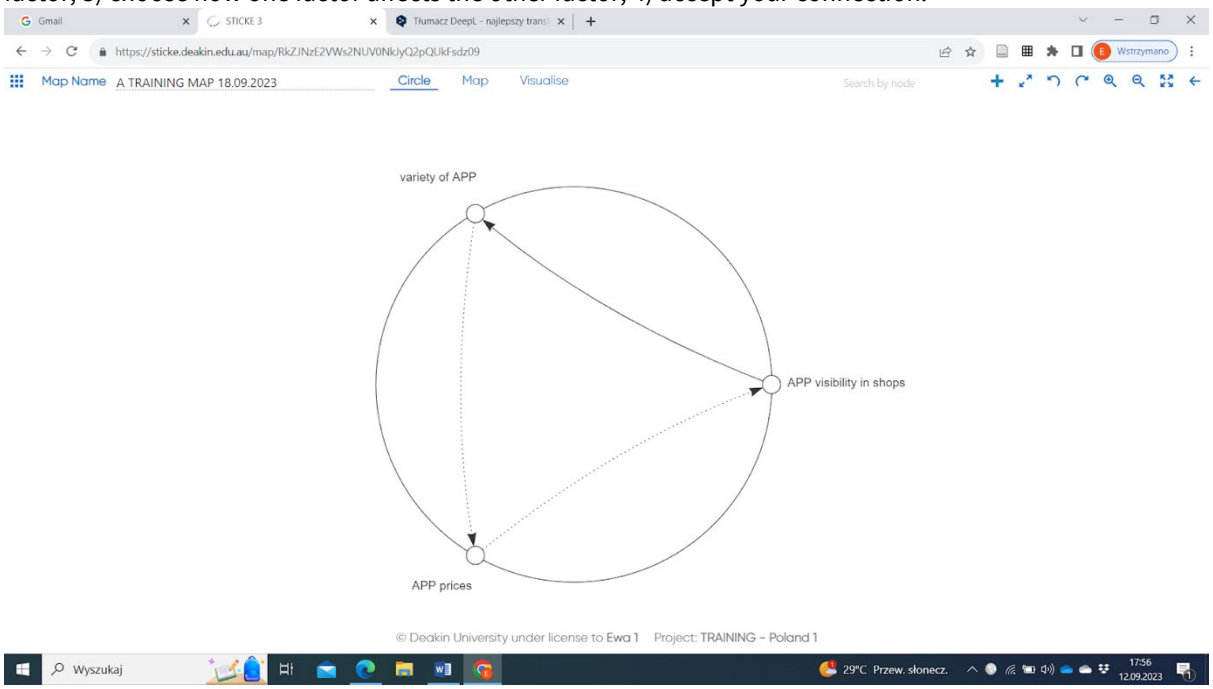
0. At the end: accept or cancel your action:



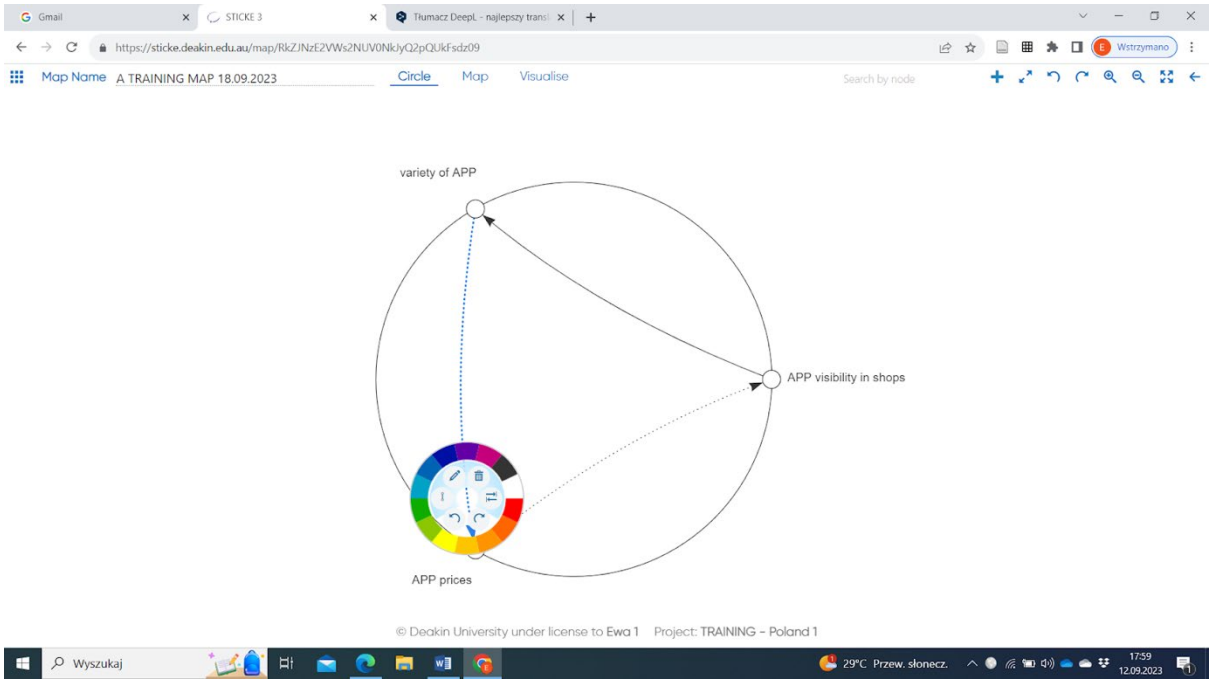
0. How the circle looks after first acceptance of the connection:



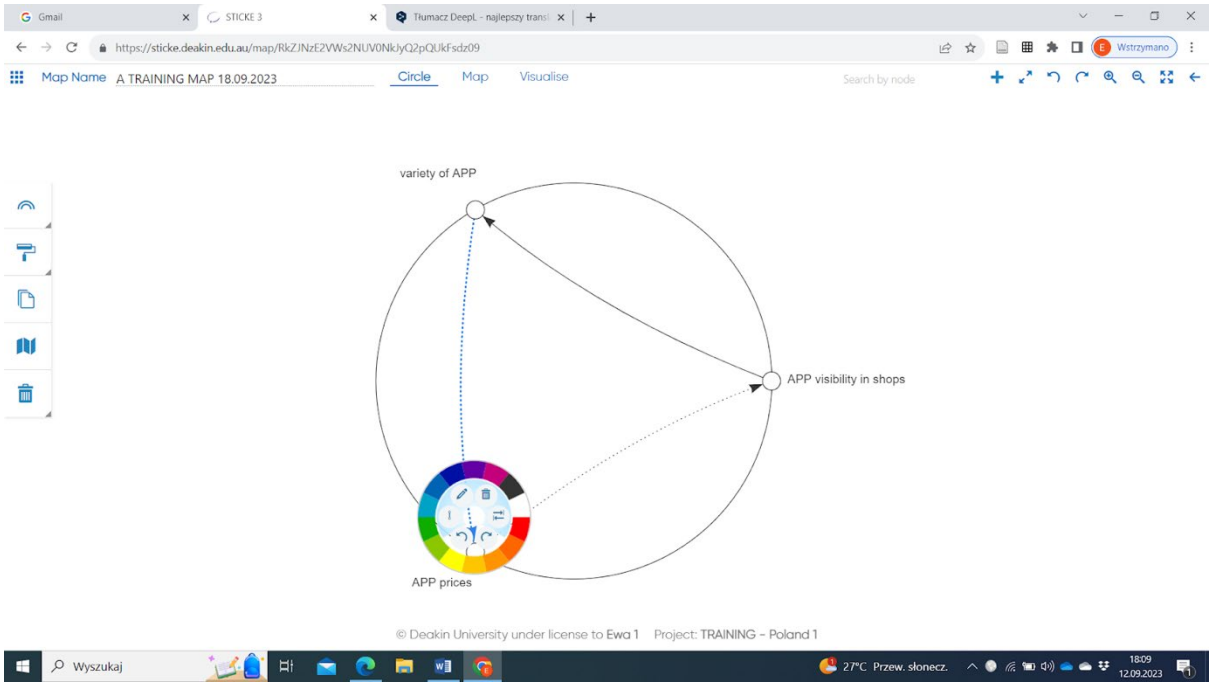
0. Add more connections between the next two factors following the same steps (points 1 to 4): 1) press the point next to the one factor and choose the function “connect”, 2) pull the cursor towards the next factor, 3) choose how one factor affects the other factor, 4) accept your connection:



0. **Optional functions:** reverse, delete, polarity (change dashed arrow to solid arrow or solid arrow to dashed arrow) or edit (e.g., links function in “global style”, e.g., change color and size of the arrow) arrow: 1) point cursor to the arrow (arrow highlights to blue color); 2) press the arrow; 3) choose the intended action

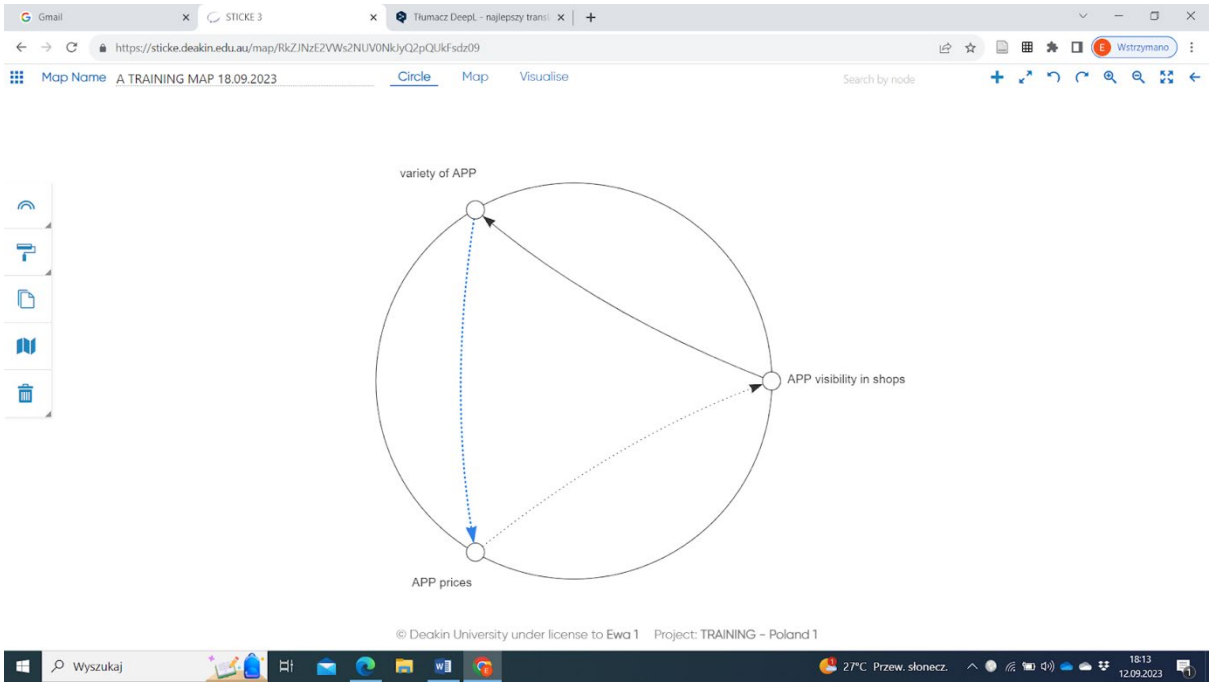


0. **Optional functions:** change a shape of the arrow using the “curve” function:

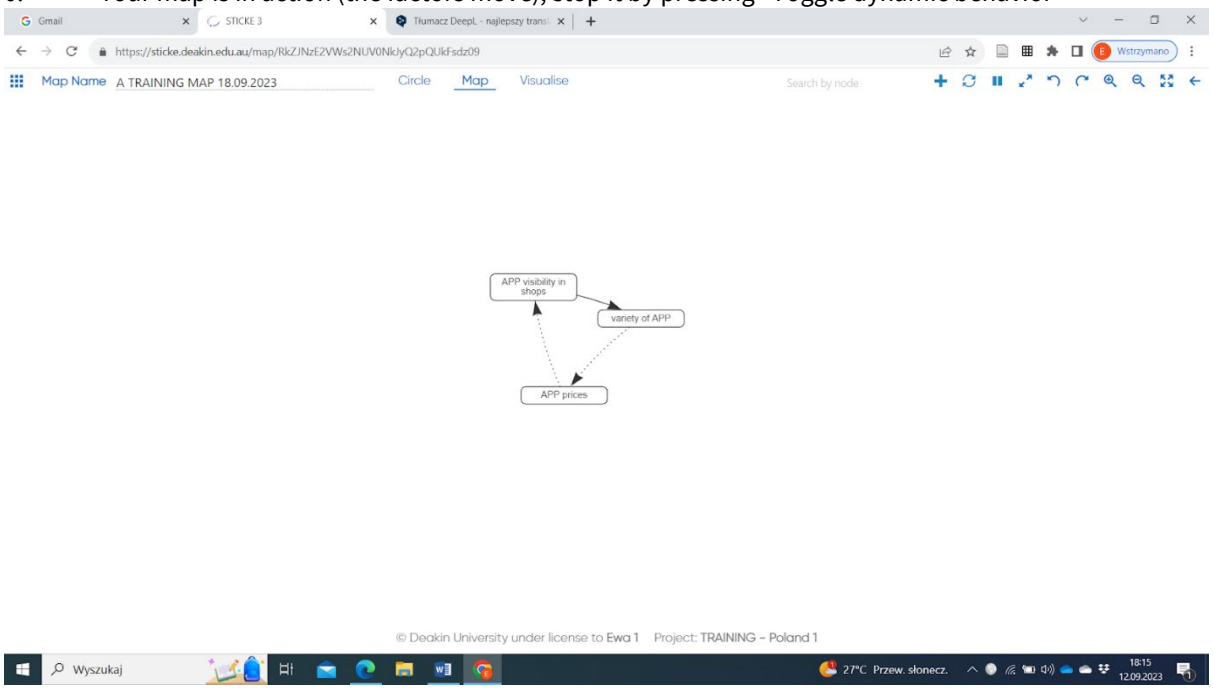


Fifth step: How to visualize the map with the factors and connections?

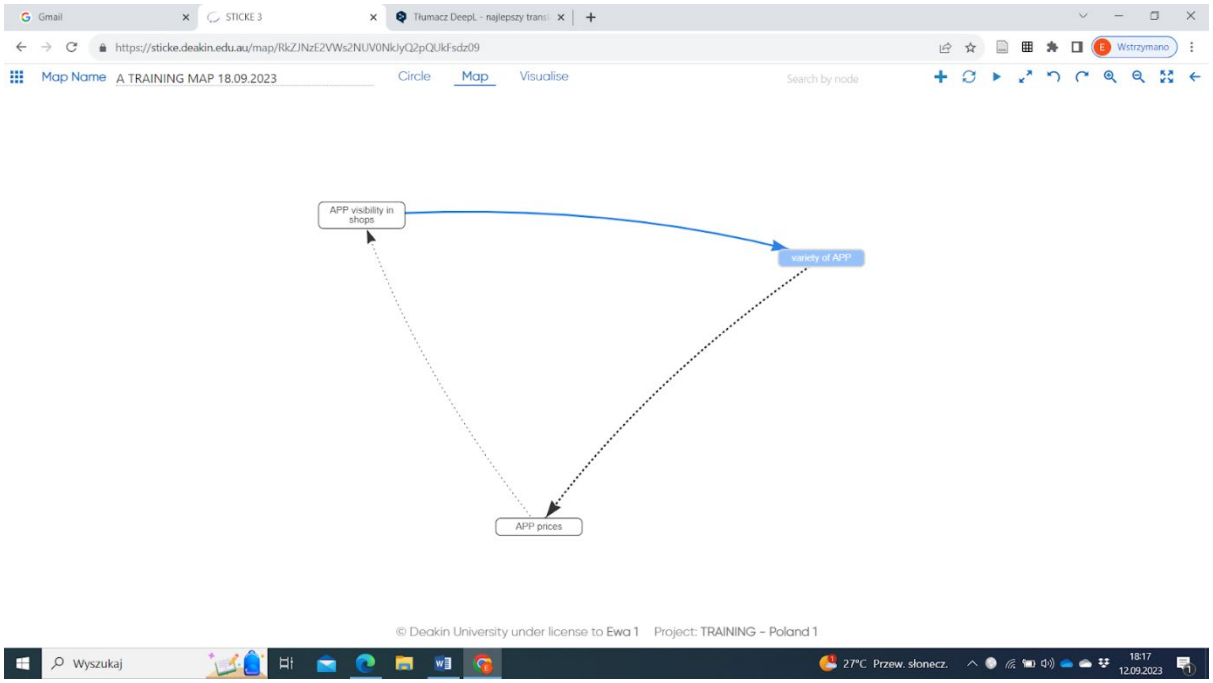
1. Change a view from a circle view to a map view



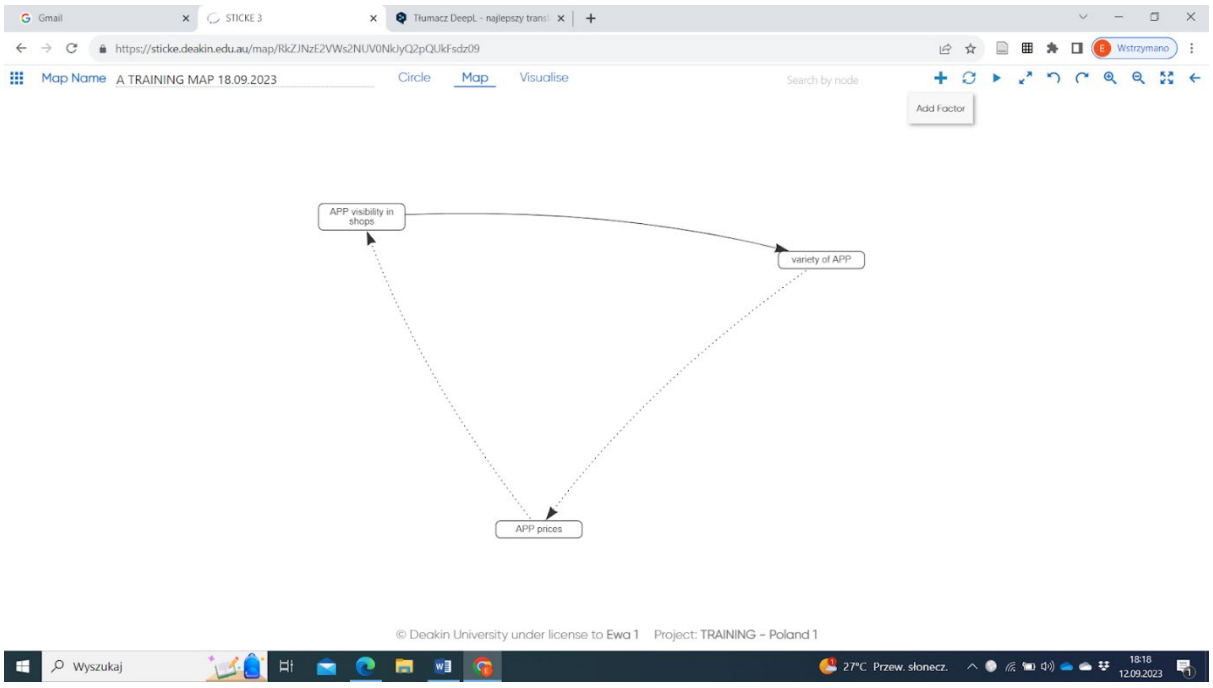
0. Your map is in action (the factors move), stop it by pressing “Toggle dynamic behavior”



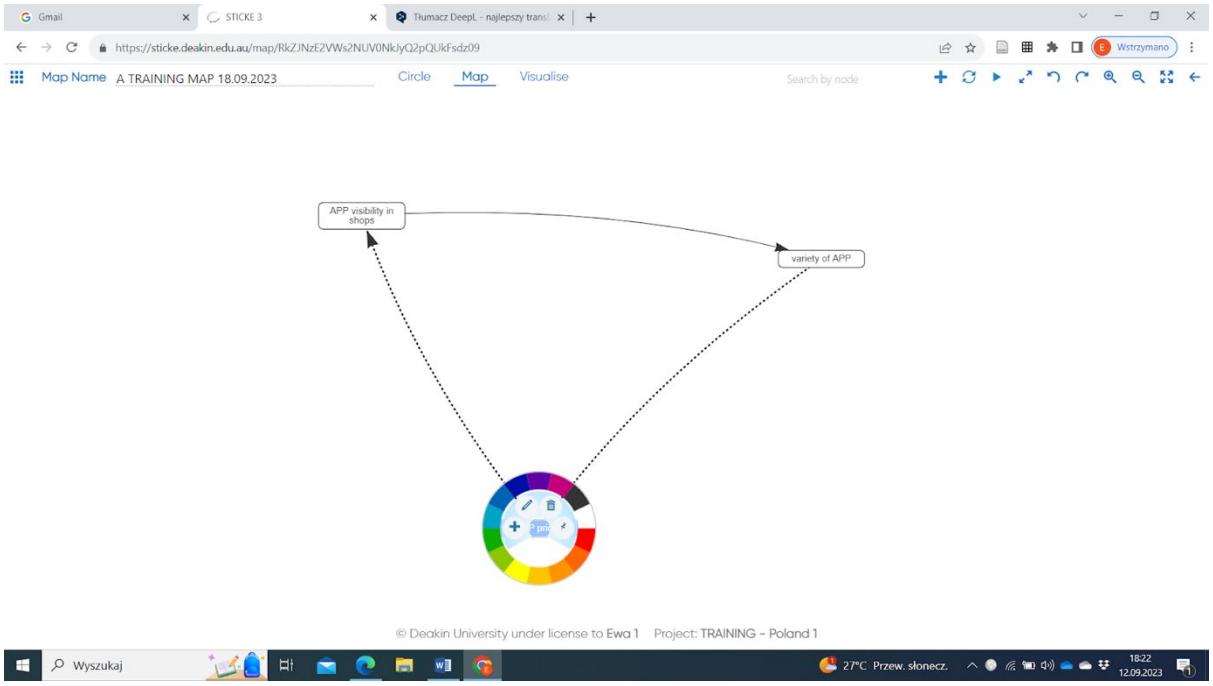
0. Change a map shape: By pressing the factor you can change the location of the factors and the view of your map:



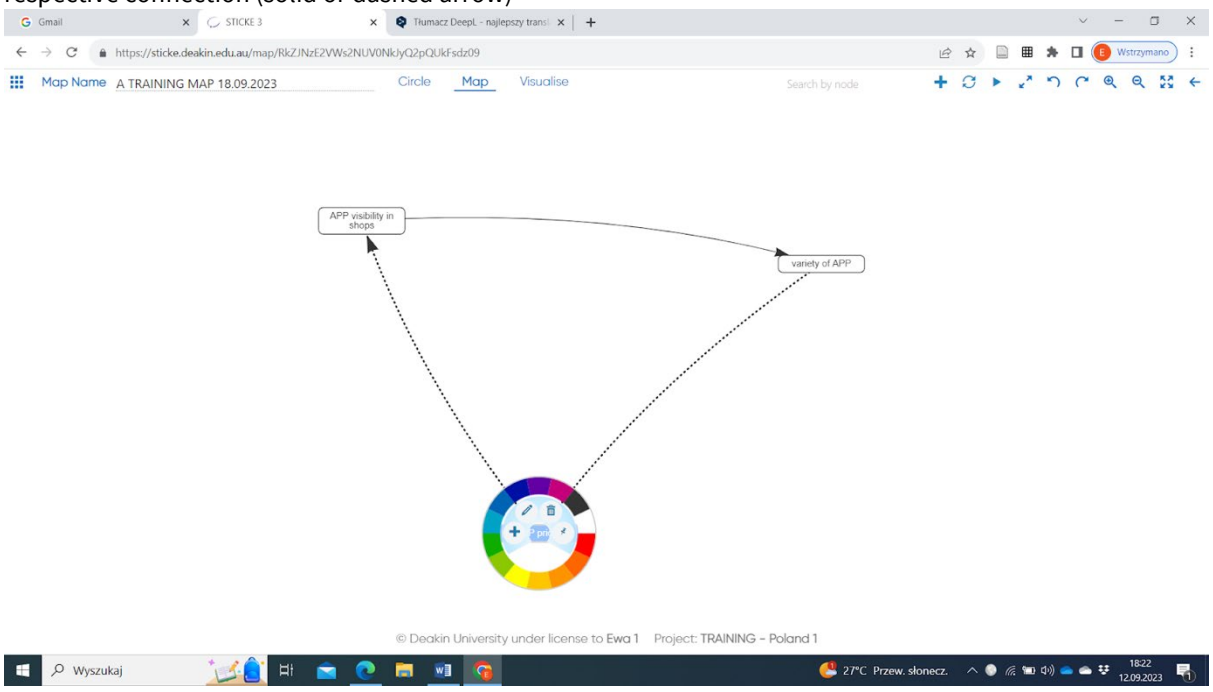
0. At a map view you can:
   1. Add a factor: select “add factor” in a dashboard:



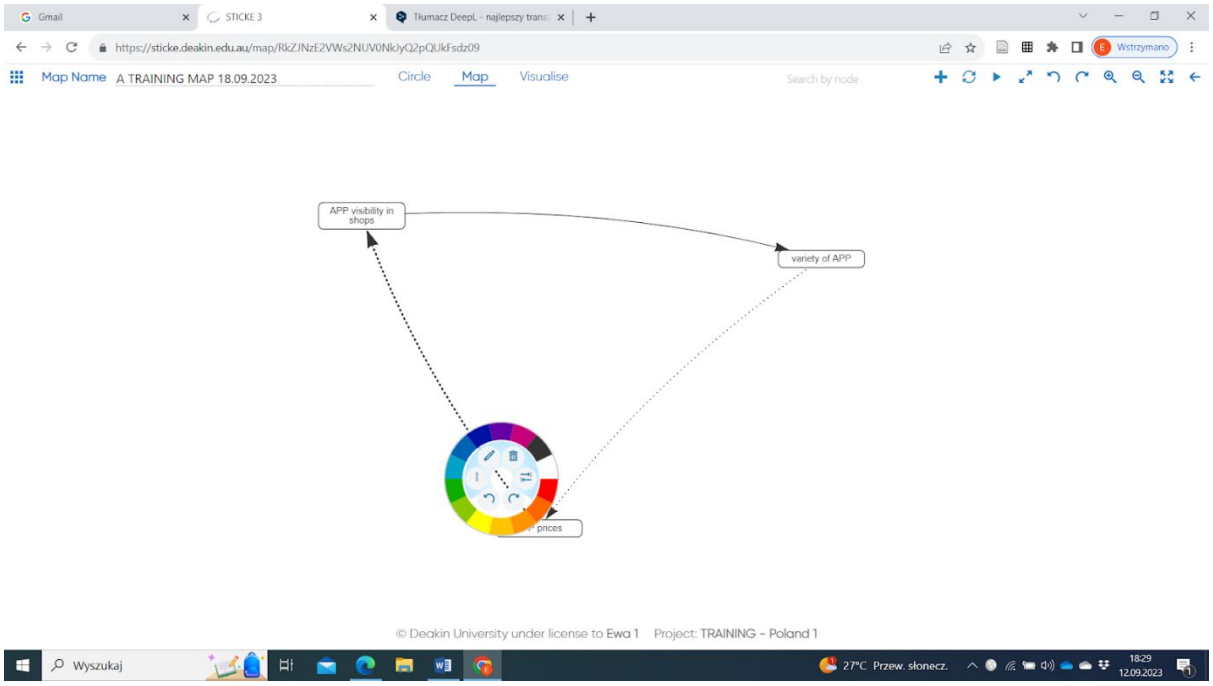
0. Edit or remove the factor: select and press the respective factor, next choose: edit (e.g., rename, change a font size or color) or delete a factor with arrows connected to the factor



0. Add a new connection with the factor (new arrow): 1) select and press the respective factor, 2) next, choose the function “connect”, 3) point the cursor from the factor towards the other factor, 4) choose the respective connection (solid or dashed arrow)



0. Edit, Delete, Reverse, Polarity or Curve of the arrows: 1) select and press the respective arrow, 2) next choose the respective action

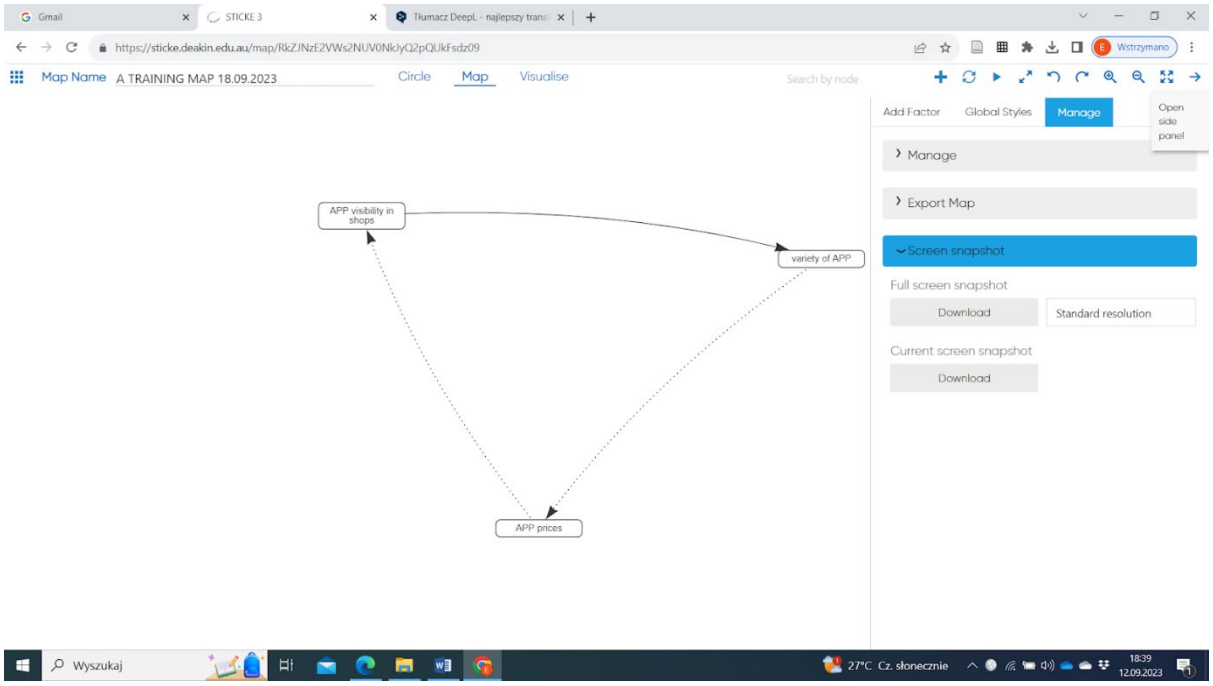


Sixth step: How to save and download your map?

1. **Save the map**: When you are online the STICKE saves your map automatically. If your internet connection is not stable, the STICKE pops up an information. In such a situation, your map can't be saved. Be sure that you have a good internet connection.

2. **Download the map to .png file**: select the following steps

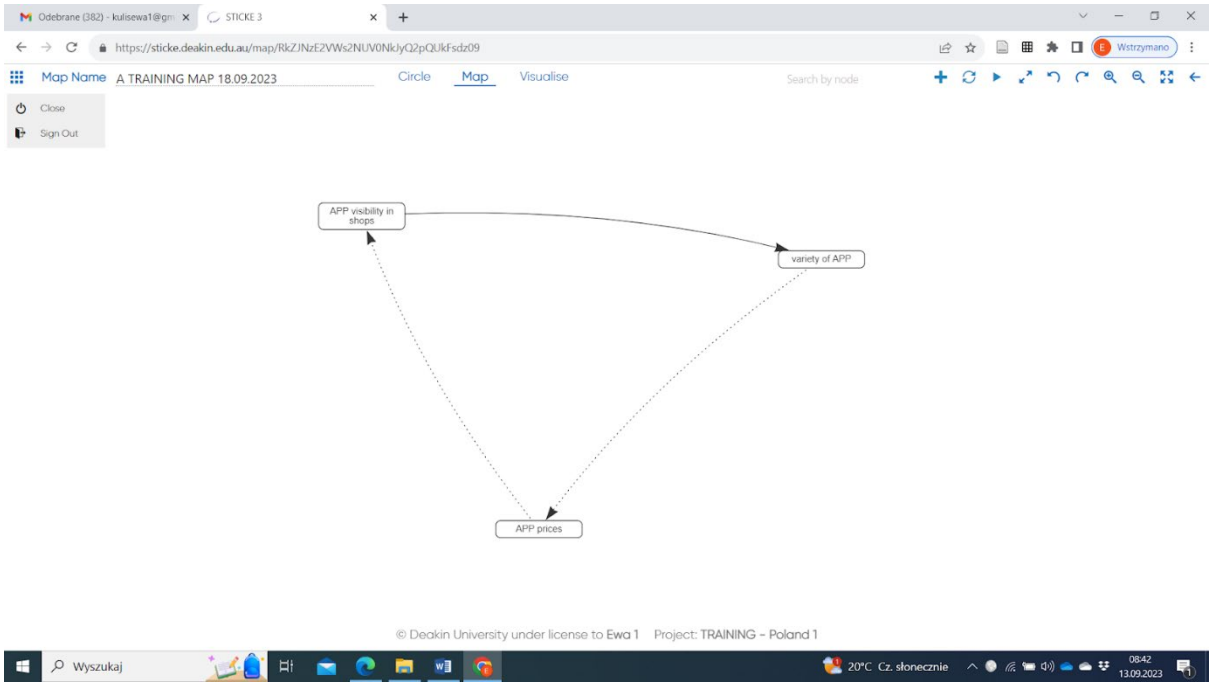
1) Open side panel
2) Manage
3) Screen snapshot
4) Download a full screen snapshot (your map can despair for a few seconds but then it must be visible again. Be sure that you do not lose your map: Additionally, please make a "print screen" of your screen view by the "print screen" option on your computer beforehand and save it on your computer).



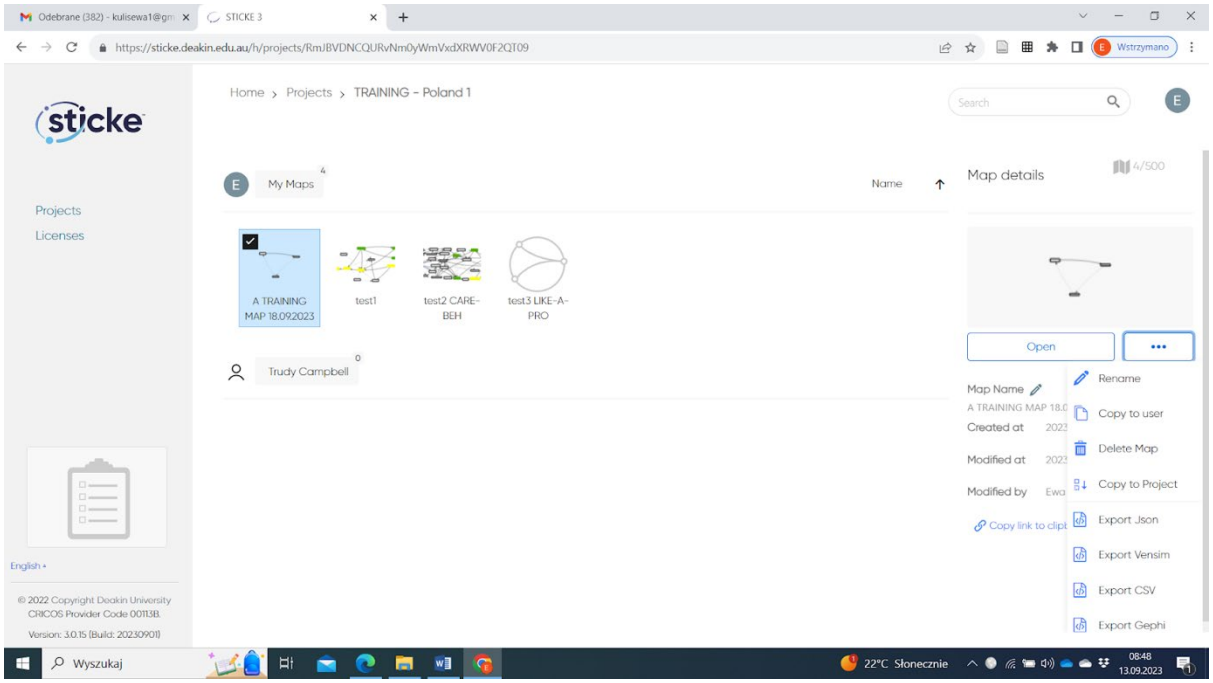
To download the map like an image, these steps should help you out:
https://scribehow.com/shared/How_to_Take_a_Screen_Snapshot_of_a_Map__mnHvBsbySk2WtEdqI0Tp4w

Seventh step: Close the map and export the data

1. Close the map. You will automatically be taken to the STICKE dashboard:



2. In the STICKE dashboard: download the data from your map to the Excel file:



Remember:
Save and send TWO files to: ekulis@swps.edu.pl and zszczuka@swps.edu.pl

1. **the map (.png file)**
2. **data (a CSV file)**

○ Annex VII: Questionnaire for the workshop participants

The questionnaire includes the following questions (sent as google forms online questionnaire):

- 1: Your country (please select from the list of the countries)

- 2. Sector and the type of organization (e.g. farming industry, Ingredients Industry, food processor company, marketing, education, retail); (please select from the list)

-3. Job title (e.g. sales manager, regional manager, innovations specialist, etc) (please select from the list)

- 4. Years of work in a similar position/similar organization) (please select from the list)

- 5. Gender (please select from the list)

- 6. Age (please select from the list: 18-25; 25-35, 35-45, 45-55, 55-65, >65)

- In your opinion:

7. - *does the map lack any important factors*? If so, please write them down- -

Rate the importance of the groups of factors <u>determining an increase of alternative protein choices in your country</u>:

(not important at all)-3 -2-1; 0 (neutral) +1+2 +3 (extremely important)

Beliefs, knowledge, actions of policy makers -3-2-1 0 +1+2+3

Beliefs, knowledge, actions of producers -3-2-1 0 +1+2+3

Beliefs, knowledge, actions of retail representatives -3-2-1 0 +1+2+3

Beliefs, knowledge, actions of consumers -3-2-1 0 +1+2+3

Food composition policies (e.g. nutrients and sources) -3-2-1 0 +1+2+3

Food Labelling policies -3-2-1 0 +1+2+3

Advertising policies -3-2-1 0 +1+2+3

Food marketing policies (other than advertising)-3-2-1 0 +1+2+3

Public procurement provision policies (food at schools, hospitals, public administration institutions, etc) -3-2-1 0 +1+2+3

Food retail policies (regulating what is available in retail outlets) -3-2-1 0 +1+2+3

Taxation policies -3-2-1 0 +1+2+3

Other fiscal or food prices policies (e.g. subsidies) -3-2-1 0 +1+2+3

Education policies -3-2-1 0 +1+2+3

Trade and investment agreements -3-2-1 0 +1+2+3

Infrastructure in food production -3-2-1 0 +1+2+3

infrastructure in food processing -3-2-1 0 +1+2+3

Infrastructure in retail -3-2-1 0 +1+2+3

Economic situation of the country (e.g. GDP, national budgets, etc) -3-2-1 0 +1+2+3

Cost of living in the country -3-2-1 0 +1+2+3

Producer/retail costs of introducing novel food -3-2-1 0 +1+2+3

Disposable income/ economic situation of families -3-2-1 0 +1+2+3

Major events that can affect consumers' choices e.g. COVID-19 pandemics, wars in European continent -3-2-1 0 +1+2+3

Political elections in my country -3-2-1 0 +1+2+3

Technology innovation needed for the alternative protein production -3-2-1 0 +1+2+3

Technological innovations and developments in marketing (e.g. Artificial Intelligence) -3-2-1 0 +1+2+3

Climate change -3-2-1 0 +1+2+3

Trends toward more sustainable choices -3-2-1 0 +1+2+3

Local and organic food trends, food ethics (animal welfare) -3-2-1 0 +1+2+3

○ Annex VIII: List of 28 determinants of alternative protein intake included in the questionnaire

1. Beliefs, knowledge, actions of policy makers
2. Beliefs, knowledge, actions of producers
3. Beliefs, knowledge, actions of retail representatives
4. Beliefs, knowledge, actions of consumers
5. Food composition policies (e.g. nutrients and sources)
6. Food Labelling policies
7. Advertising policies
8. Food marketing policies (other than advertising)
9. Public procurement provision policies (food at schools, hospitals, public administration institutions, etc)
10. Food retail policies (regulating what is available in retail outlets)
11. Taxation policies
12. Other fiscal or food prices policies (e.g. subsidies)
13. Education policies
14. Trade and investment agreements
15. Infrastructure in food production
16. Infrastructure in food processing
17. Infrastructure in retail
18. Economic situation of the country (e.g. GDP, national budgets, etc.)
19. Cost of living in the country
20. Producer/retail costs of introducing novel food
21. Disposable income/ economic situation of families
22. Major events that can affect consumers' choices e.g. COVID-19 pandemics, wars in European continent
23. Political elections in my country
24. Technology innovation needed for the alternative protein production
25. Technological innovations and developments in marketing (e.g. Artificial Intelligence)
26. Climate change
27. Trends toward more sustainable choices
28. Local and organic food trends, food ethics (animal welfare)