The Evolution of Personalised Nutrition: Personalised Nutrition market and business models

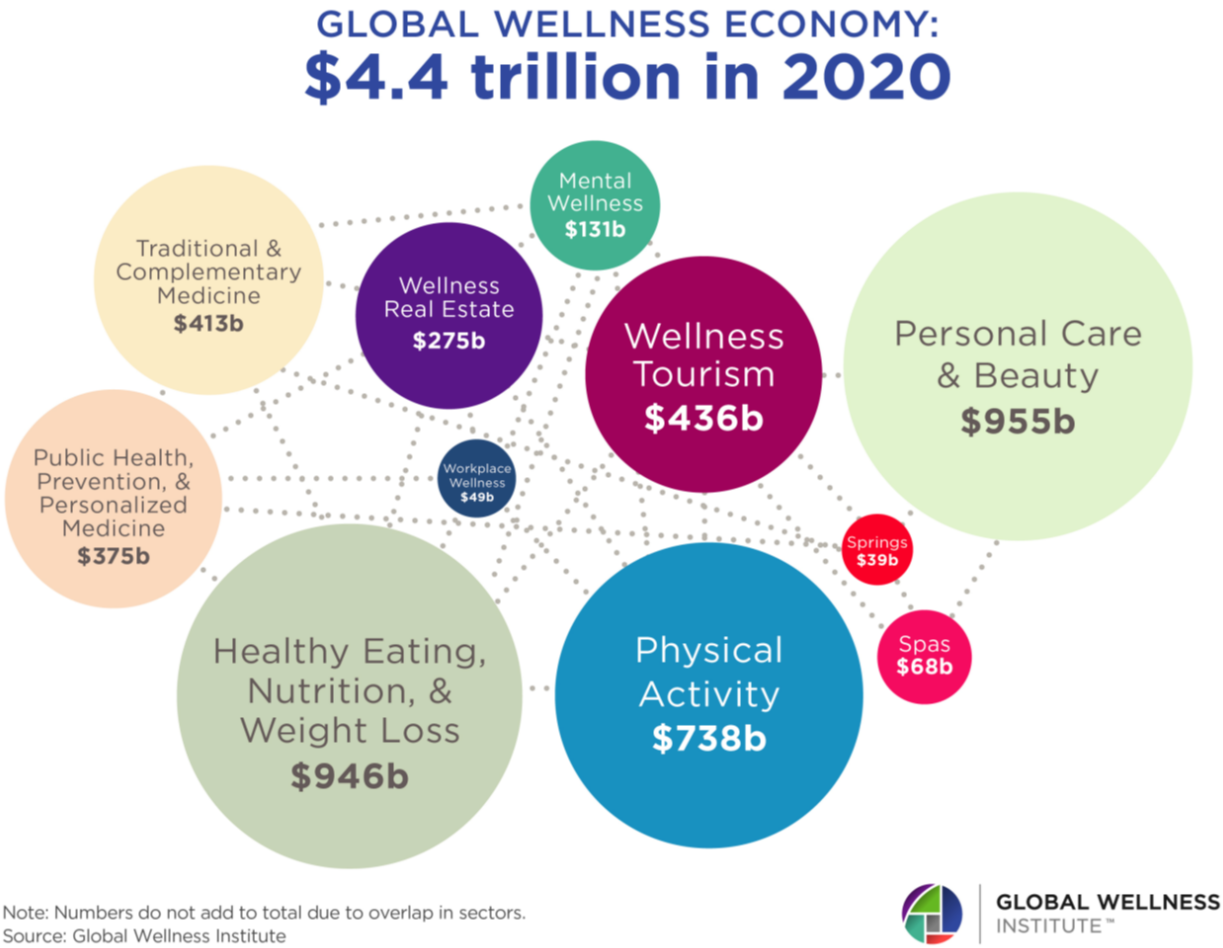
Health and wellness market overview

As most PN providers position themselves within the health and wellness market, a look at the overall global wellness economy and how the wellness industry itself assesses the nutrition segment might give some indication of growth potential of PN services.

The Global Wellness Institute estimates the global wellness economy in 2020 was worth $4.4 trillion, growing at a rate of 6.6% per annum. Within this, the estimated global market segment for “healthy eating, nutrition and weight loss” is the second largest segment at $946 billion, after “personal care and beauty” at $955 billion (see Figure 6) (The Global Wellness Institute, 2021, 2022). These priorities are the same across most of the world, and consumer spending on wellness sectors is tightly correlated with GDP. More indicative than absolute market size estimates for the “healthy eating, nutrition and weight loss” category however might be its modest growth forecast of only 5.1% within the next five years, only half of the expected growth of the “physical activity” market segment (10.2%). This is in contrast to growth of other sectors of the wellness industry, such as, “wellness tourism” (growth of 20.9%), “spas” (growth of 17.2%), or “wellness real estate” (growth of 16.1%) (The Global Wellness Institute, 2021). This estimate is based on the combined projected growth of foods and beverages free from gluten, dairy, lactose, and meat as well as foods and beverages targeting weight management, which are growing rapidly, indicating that PN seen as part of a wellness offering might be currently perceived as a service with low growth potential.

Nevertheless, Callaghan et al. (2021) suggests that within the wellness market, better nutrition has always been important, and is increasingly recognised as a key to accomplishing all other wellness goals such as better health, fitness, appearance, sleep and mindfulness. As a result, consumer interest is growing in personal nutrition apps, diet programmes, subscription food services, and so on. Moreover, there is a strong trend towards personalisation in every consumer sector, and hence demand for personalised wellbeing solutions and personalised nutrition services is anticipated to become increasingly important in the future. The Covid-19 pandemic has brought health and wellbeing to the fore for many, further stimulating demand in the sector.

Figure 6 Global wellness economy in 2020



Source: The Global Wellness Institute (2022)

Global wellness economy totals $4.4 trillion in 2020:

- personal care and beauty $955 billion
- healthy eating, nutrition and weight loss $946 billion
- physical activity $738 billion
- wellness tourism $436 billion
- traditional and complementary medicine $413 billion
- public health, prevention and personalised medicine $375 billion
- wellness real estate $275 billion
- mental wellness $131 billion
- spas $68 billion
- workplace wellness $49 billion
- springs $39 billion

Personalised Nutrition market

Companies offering personalised genomics and other biomarker testing services at an affordable price in combination with personalised behavioural change advice and feedback have created a personalised nutrition market catering to consumers who wish to tailor their nutritional intake to their physiology and disease predispositions in order to achieve health benefits and prevent disease. However, when looking into available market data there appears to still be a large discrepancy between forecast figures of the market potential for personalised nutrition and the number of companies active in this space. From an estimate in December 2020 the global market size for personalised nutrition was claimed to be worth $3.7 billion in 2019 with a forecast to grow

to $16.6 billion by 2027 with a compound annual growth rate (CAGR) of 17%. This growth was predicted to be driven by consumer trends such as increasing health awareness, increasing NCDs, such as diabetes, and CVD among others. Findings, such as that in a 2017 survey of US adult consumers where 76% stated they would take dietary supplements, are interpreted as “indirect” evidence for the potential of personalised nutrition offerings.

In 2019 the US was leading the PN market with 44.56% of global market share and is predicted to be the region of major growth until 2027, while Europe in 2019 captured 27% of the market with an anticipated growth of 3% until 2027 (ResearchAndMarkets, 2020). These figures would make Europe a theoretical total addressable market of around $1billion. However, these estimates assume a homogenous market population with respect to consumer acceptance of PN across Europe, which several studies have shown is not the case. For example consumers in Greece, Ireland, Poland, Portugal and Spain, rated the general benefits of personalised nutrition highest, while in Spain and Germany respondents in a 2016 study had most reservations against commercial PN services due to low trust in data protection; even among some of the most accepting countries, such as Poland and Portugal, data protection was considered a precondition (B. J. Stewart-Knox et al., 2016). This means that within Europe the addressable market might be much smaller than estimated.

Difficulties generating realistic market data are not only due to the fact that the commercial PN sector has so far been small and slowly evolving with bigger private investments only in the past five years, but also due to its unclear positioning between health/wellness and food/nutrition. From reporting in various health/wellness and food technology media it seems that from within these industries PN is currently perceived as being more closely associated with the health/wellness sector, rather than the food sector. For example, Forward Fooding, a food technology and innovation news platform publishes a yearly ranking of top FoodTech 500 companies in the food innovation sector including many small start-ups as well as more mature players. In their ranking of 2021 only four companies to some extent within the PN sector were included: these were Eagle Genomics, UK, a genomics services provider, ranked 59th, foodsmart, US, a personalised dietary advice business offering personalised meal plans without using bio-specimen data, ranked 61st, lifesum, Sweden, a personalised weight loss platform, ranked 95th, and Nourished, UK, offering 3D printed personalised functional ingredients and vitamins using only questionnaire data, ranked 124th.

Not only does this reflect the small number of active companies in this space, but also the fact that from a food technology innovation perspective their impact on the global food system is perceived as rather modest from within the industry, compared for example to alternative protein producers, plant-based, or lab-grown meat companies, of which some rank among the top ten and several are represented in each category throughout the ranking table.

Personalised Nutrition examples

A study surveying genomics-based nutrition companies worldwide has found around 45 active companies in 2020, with around 20 in the US and Europe respectively and a handful in Australia and Asia (Floris et al 2020). Table 1 presents a sample of some of the companies active in the PN market, from some of the newest start-ups, to long-established market leaders. In Appendix A we present a further list of PN providers currently operating in the UK market specifically, indicating the scope and scale of their operations and specific functional areas of expertise. The appendix indicates the type of business models employed, which are discussed in the following sub-section.

Table 1 Examples of companies in Personalised Nutrition

Company	Description

Healthify Founded 2012, Singapore, Funding $100 million	Mobile-based application for tracking diet and meal planning. Offers food suggestions based on the nutritional deficiencies in the food consumption entry by the user. It also offers workout plans and expert-led guidance.
Persona Founded 2017, US, Funding $4 million (acquired by Nestlé in 2019)	Provider of personalized dietary supplements, containing herbal extracts, minerals, vitamins, amino acids, probiotics, etc. The company provides supplements based on questionnaire and suggestions from nutritionists.
Care/of Founded 2016, US, Funding: $84 million	Provider of multi-category dietary supplements, such as vitamins, probiotics, herbs, minerals, and others. Allows subscribers to select the supplements they wish to receive, with filters available for supplements developed for the brain, energy, eyes, stress, heart, immunity, joints, skin, prenatal, digestion, and bones.
Clear health Founded 2021, Netherlands Funding €780,000	Participants wear a glucose monitoring patch, and log their lifestyle patterns including food, mood, exercise and sleep. The service offers its recommendations with a consultation.
Lumen Founded 2020, US	Provide a breathalyser device to analyse metabolic status from exhaled air and gives users a tailored recommended diet based on the analysis.
Orig3n Founded 2014, US Funding $62 million	Provider of personalized supplements based on a genetic test. Using DNA test kits for fitness, nutrition, and performance that provide genetic data to improve health and weight. Also provides recipes, vitamins, and supplements based on DNA test.
Zoe Founded 2017, US Funding $53 million	Based on the results of ZOE's at-home gut health (microbiome), blood sugar and blood fat tests, the company creates a personalized dietary plan for its users.

Business models and types of PN services based on types of consumer data collected

PN providers differentiate themselves by their use of a limited number of scientific methods and data collection and analysis tools, which are an essential part of their business model. The exact combination for any given provider may determine whether its services would fall potentially under the FSA's remit or not. This should enable the FSA to analyse service offerings for their underlying scientific basis and types of personal data involved, as well as their relevance for the food system. Currently most providers employ five primary types of data collection and testing tools as summarised in Figure 7.

Figure 7 Five types of phenotype testing tools used for personalised nutrition applications

Source: Based on DigitalFoodLab (2021)

These tools are generally applied in the following four categories of commercial offerings (Gibney & Walsh, 2013; Ordovas et al., 2018).

A) Approaches collecting various kinds of personal information (longest on the market) concerning lifestyle factors, dietary habits, demographic information, and phenotypic specifics, for example, age, sex, allergen status or physical activity etc. Information is collected via self-reported questionnaires and web interfaces. All that is provided by the consumer is personal data/information. This information then serves as input for analysis performed by the provider, presumed to be based on scientific literature or expert knowledge. Nutritional intervention advice is usually given with a nutritional goal in mind, such as weight reduction, health improvement or enhancing athletic performance among others. These forms of advice are very similar to classic dietary advice given by dieticians or nutritionists. However, most of the offerings are currently built around information and data technologies. This involves internet-based self-reporting tools, various tracker devices (fitbits, smart watches, etc.) combined with smart phone apps to generate either static or dynamic input data. To analyse these data, and to build the individualised science base applicable for individual users, the provider uses among others machine-learning and text semantics algorithms to browse vast amounts of scientific literature to automatically generate science-based advice output. Many companies in this space offer additional online support via dieticians and nutritionists, or some other form of virtual “coaching” using bots. A detailed analysis of this segment of PN services is outside the scope of this report.

B) Approaches that use physical bio-specimen samples from customers to measure and/or quantify aspects of their phenotype. These can be based on blood, saliva, urine, or faecal samples, or breath, among others, to assess biochemical makers for nutritional status, or clinical parameters of health or disease risk (for example, glucose levels, cholesterol levels, metabolic enzymes, among others). Blood samples are usually collected with a certified consumer test kit method, such as Dried Blood Spot Sampling (DBS), or a microfluidic device, which do not require a nurse or phlebotomist to collect blood (fingertip prick). Direct-to-consumer DBS kits are reasonably robust, but obtainable data quality varies between manufacturers (Trifonova et al., 2019). Most consumer blood sampling kits allow only certain blood parameters to be identified, as many either would require greater blood volumes, or specific forms of blood preservation for their detection. Some of the molecules detected in blood allow classification of users into different "health/risk categories" based on clinical literature. Included in this category are offerings of continuous measurement of glucose via a D2C monitoring device that produces dynamic time-course data (well established for diabetics), which is then analysed via the provider's software. Stool samples for the assessment of the gut microbiome fall also within this category (as they are for detecting DNA of the gut microbes and not the person's DNA). Though variable for most people over time, a combination of a number of such phenotypic parameters can sufficiently identify a person's identity.

C) Approaches using personal DNA information of customers. DNA samples are usually collected via a consumer test kit that is sent out by the PN provider to the customer. These contain tools to swab some cells into a collection tube that is then sent back to the PN provider. (The risks of loss of personal DNA in the process are rarely discussed in the PN sector). The provider then sends the sample to a laboratory for extracting DNA and performing DNA sequencing, returning DNA sequence information to the provider. For quality assurance, ideally the laboratory is ISO 17025 certified and accredited with a body that complies with ISO/IEC 17011. Most providers test only for a very limited number of genes, or gene variants (10-30), usually the ones with a long scientific publication history and confirmed causality for disease risk or metabolic function proven to some degree at population level.

D) Approaches that use any of A, B, C, and sell a physical product (often described as "functional food", "personalised supplement" or similar) A number of companies in the PN space offer services as described in A-C, and in addition offer branded products tailored to the results of the customer's phenotypic and genotypic data analysis results. These products often are supplements similar to "functional ingredients", "personalised vitamins", or "sports nutrition" in the form of a powder mix to be diluted and consumed as a "meal shake" (for example: NGX or foodspring), bars, amino acid mixes, snacks etc. Others specialise on more traditional personalised supplements, such as personalised vitamin mixtures, including single supplements such as collagen (for example: Personalised Co or vitl).

These service categories are not mutually exclusive but have historically evolved because some companies have built their offering around one novel sample analysis technology, in particular when they hold IP in that space, while more recently with reducing costs of D2C testing technologies more companies can offer increasingly a combination of these approaches. In particular, from a consumer data perspective, these categories are a good representation of how the sector is structured.

Implementation of these approaches to PN can take many forms, (Ronteltap et al., 2013) propose a categorisation of nine business model archetypes for PN:

1. Employee lifestyle guidance. Business-to-business (B2B) service where the PN provider partners with an employer to offer services to their employees.
2. "Standing strong together". Community-level groups, including possibly NHS-funded initiatives that offer support to participants in following a PN-based programme.
3. Health club model where participants pay a membership fee that includes PN services.

4. App based self-monitoring of dietary intake using smart-devices, fitbits, web-based applications, etc.
5. “Do-it-yourself” model. After initial PN tests and guidance the participant is then left on their own to follow a dietary programme.
6. “Step-in step-out”. This model includes initial test and guidance, and then a level of optional feedback based on on-going testing and monitored progress.
7. All-in lifestyle guidance covering all aspects of health and wellbeing.
8. Traditional face-to-face dietitian advisory services.
9. Mass-media communications model – public education and awareness raising initiatives.

Business models for Personalised Food

The personalised nutrition market is primarily concerned with providing advisory services, and as discussed above, may include provision of vitamins and supplements to support a personalised diet. This is distinct from the separate category of “personalised food” businesses that offer personalisation or customisation of food, personalised food businesses already exist, albeit most are not currently based on science and PN, and in the future they could become part of a supportive ecosystem of services and hence impact or even drive the evolution and uptake of PN. For example, the PN provider tells the consumer what to eat, and the personalised food provider delivers what the consumer should be eating. Personalised food providers are likely to be the most relevant area of focus for FSA as they will fall directly within the FSA’s regulatory remit.

Personalised foods can be either pre-packaged (ready-meals, ingredient boxes, processed foods, etc), or food services (restaurants, take-aways, etc), and can be with mass-customised offering stratified product groups, or personalised for the individual consumer (Sagentia Innovation, 2021).

The literature and the start-up scene identify several potential business models offering varying degrees of personalised foods (as shown in Table 2), and new business models can be expected to emerge as the industry evolves and leverages digitization and rapid delivery services, among other things. Figure 8 illustrates a potential schematic for an integrated personalised food system. Successful business models will need to address the following factors (Boland et al., 2019):

1. A completely connected PN/Personalised food platform, and a nutrition profile standard to create a complete value chain.
2. Retaining the emotional aspect of food as customers mostly eat to enjoy the sensations food can bring.
3. Consumers need to be persuaded to actively engage long-term with PN, i.e., the industry needs to create a compelling mechanism/offering to engage consumers.
4. Consumers must have confidence that their personal genomics and other information is handled appropriately and transparently.
5. An economically viable business model based on subscription services, or other revenue streams.

Table 2 Business models for personalised foods

Source: based on Tischer et al. (2021)

Business model	Description	Advantages	Challenges
Personalised eGrocery	Builds on existing ecommerce solutions and rapid food delivery services to offer self-segmentation. Gluten-free, organic, and so on, with potential for segments to target metabolic types, cholesterol levels, biomarkers, etc.	• Ease of use • Integrates with existing consumer routines • Consumer controls personal data • Opportunity to expose consumers to new products without significant behaviour change	• Not true personalisation • Need for consumer self-evaluation to choose products • Unsupervised health impacts • No holistic value chain – depends on consumer to do the work.

Business model	Description	Advantages	Challenges
Gastronomy	Eat-in and take-away restaurants offering meal options based on pre-defined criteria. Leverages digital technologies for menu and ordering processes, tech for in-kitchen preparation, 3D food printing, dark kitchens. Already partially seen in health-food fast-food eateries such as personalised smoothies.	• Convenience and consumer familiarity • Potentially low complexity, depending on implementation • Expand on existing fast-food franchises • Opportunity to gather data on consumer habits, needs, etc. for targeted promotion and product development	• Fragmented • Additional overhead burden for restauranteur, and runs counter to standardisation of most fast-food operations • May reduce flexibility for restaurateurs as meals must be exactly as described • Consumers may be unwilling to adopt rational PN concept in place of social aspects of dining.
Personalised nutrition platform	Two-sided marketplace, connecting consumers (and their personalised data) with retailers and restaurateurs. Revenue streams potentially related to advertising, use of consumer data for targeted offerings and for product development.	• Personalised recommendations from a wider range of retailers/ manufacturers/ restaurants • Based on full PN profiling, not just self-selected categories • Convenience • Potential lock-in with consumers	• Significant investment required to build and market and establish consumer base • Data privacy concerns over how data will be used/ shared/ sold
Subscription-based personalised meal service	Offers boxed, frozen ready to eat meals, or ingredient boxes for home preparation. These already exist, but new solutions might build on, or be closely integrated with personalised nutrition platform to provide highly tailored offerings.	• Convenience for consumer • High potential impact as PN is fully integrated into diet • Extension of existing subscription services • Commitment/lock-in to subscription ensures ongoing engagement	• Variety may be challenging, and consumers may demand more choice • Depending on modularity/options may be expensive to deliver and scale • Freshness is a challenge for pre-made meals • Requires nutrition profile service

Figure 8 Schematic of a personalised food system

Source: Boland et al. (2019)

Business eco-system for personalised nutrition and personalised foods

The personalised nutrition and personalised foods business models discussed above could be vertically integrated business entities but given the specialist and diverse aspects of their operations, are much more likely to emerge through the collaboration of multiple value-chain partners. Figure 9 illustrates the potential range of actors in the eco-system, with a coordinating role for PN service integrators. The figure illustrates only PN provision, but an additional layer of personalised food providers could be added.

Figure 9 Eco-system integration of business actors and activities

Source: developed from Goossens (2015)

Growth opportunities in personalised nutrition

With rising awareness of the impact of food on our health the market potential for personalised nutrition is huge, and there are already businesses emerging offering personalised microbiome-based nutritional testing. The global nutrigenomics market size was valued at $252.20 million in 2017 and is projected to expand at a CAGR of 16.48% from 2018 to 2025. Increasing awareness among consumers along with the increased prevalence of obesity and related ailments is expected to be a key factor driving the market (Grand View Research, 2019). Epigenetic testing is still a long way off from a mass application, as epigenetics methods are still much more expensive and scientifically less proven than genomics methods. But in the same manner companies offer a complete genome analysis for a few hundred dollars, similar is expected with epigenomics in the longer-term future.

Key challenges for development of the sector are the high costs and long timeframes for conducting randomised control trials to develop the underlying scientific nutrition standards to support PN. This acts as a significant barrier to entrepreneurs and investors in the sector. To address this issue, grants and incentives to support and accelerate development of PN are available in the EU and the US. For example, the European Commission is currently offering grants to support research into microbiome composition and how this can be affected by diet, for a value of €1m per project. The Horizon Europe programme provides funding towards a molecular and neurobiological understanding of mental health and mental illness, with a budget of €10million per project (Deloitte, 2021). Tapping into these resources offers a potentially viable business model to enable new start-ups to subsidise consumer engagement in the initial phase, until such time as costs reduce and interest reaches a threshold for a sustainable economic enterprise.

Drivers and challenges for personalised nutrition

Given that PN in its current scientific understanding has been around for some decades, one might wonder why it has still not gained more traction already, either as an accessible market offering for consumers, or as a publicly supported technology for achieving public health goals. The reasons for its current state of evolution can be found in the rather complex interactions between a number of long-term input trends that have been defining PN in the past, and more recent trends of the past 5-10 years. In addition, its ill-defined position between the food and healthcare sectors will make it subordinate to trends in both these areas and their respective regulatory developments, hence it appears very unlikely that the complexity in this regard will reduce in the near future.

In order for FSA to build an analytical framework for understanding past and future evolution of PN we provide in the following chapters 4-7 an overview of important drivers and challenges that have been and will be shaping PN. It will be necessary to monitor closely this ecosystem of trends to gain some prognostic insights into likely developments of the PN industry in order to be able to design regulation proactively. We have grouped relevant trends into four categories, namely science and medicine, technology and commercial players, consumers and society, and regulation (see Figure 10). This separate grouping of trend areas may be somewhat artificial, as it is understood that these areas interact and influence each other, impacting mutually the evolution of certain trends that manifest in any given category. For the purpose of this report, we use these categories solely as a framework to support clarity of presentation of findings, and present each separately in the following chapters 4 -7.

Figure 10 Input trends shaping personalised nutrition