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Digital opportunities for demand-side policies to improve consumer health and the sustainability of food systems

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DIGITAL OPPORTUNITIES FOR DEMAND-SIDE POLICIES TO IMPROVE CONSUMER HEALTH AND THE SUSTAINABILITY OF FOOD SYSTEMS

Tom Baragwanath

Digital tools and technologies can assist governments to improve consumer health and the sustainability of food systems. These tools can be used to encourage consumers to buy healthy and nutritious foods and foods produced through sustainable farming practices, as well as to reduce asymmetries of food labelling schemes. They also contribute to more effective food data collection systems that can inform policy decisions, including by combining commercial sales information with national dietary intake survey data. Given the diverse approaches to adopting these digital tools, there is scope for cross-country learning. Current use of digital technologies by some governments – from national dietary guideline websites to dedicated mobile apps – can serve as references for other countries that seek to develop their own digital programmes. While these tools offer useful mechanisms for advancing policy objectives, they will need to be carefully designed to maximize their effectiveness and regularly evaluated to avoid excess cost and duplication

Key words: Obesity, behavioral insights, food waste labelling, dietary intake surveys

JEL Codes: I18, M38, O38, Q18

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Table of contents

1. Introduction	5
2. Role of demand-side policies in consumer health and food system sustainability	6
3. Digital technologies	7
4. Digital tools for demand-side policies	11
4.1. Demand-side public interventions	12
4.2. Working with industry at the supply-demand interface	13
4.3. Regulations to align private incentives with public incentives	16
4.4. Fiscal measures	19
5. Digital tools for food data collection	19
5.1. Practical examples: The United States, Portugal, Finland, Australia, and Canada	21
5.2. Common challenges and limitations in food data collection	23
6. Practical obstacles to delivering demand-side policies via digital tools	25
6.1. The capability and capacity of governments to adopt digital tools is mixed	25
6.2. User capacity to adopt digital tools is also mixed	26
6.3. Data cost and complexity can be prohibitive	26
6.4. Digital tools require targeting to address specific policy problems	26
6.5. Digital tools might offer no improvement over existing tools	27
7. Digital tools and platforms as potential solutions	28
7.1. Policy evaluation using digital technologies	29
8. Conclusion	30
Annex A. Overview of existing digital instruments that deliver consumer health and environmental sustainability initiatives	32
References	35

Tables

Table 1. Digital technologies for agriculture and food	8
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Boxes

Box 1. The use of digital technologies in response to the COVID-19 pandemic	10
Box 2. United States' food data system: Key trends and observations	24

Key messages

What is the issue and why is it important?

- In pursuing consumer health and food system sustainability goals, countries are searching for ways to implement and evaluate demand-side policies using digital tools and technologies.
- These initiatives include behavioural nudges delivered via mobile apps, reducing consumer-supplier information asymmetries via labelling schemes, and integrating food data systems by combining commercial sales information with national survey data.

What did we learn?

- Countries use a variety of digital technologies from business-as-usual tools, such as dietary guideline websites, to dedicated mobile apps. However, the use of digital tools is not widespread. There are opportunities to do much more, in particular as a means to assist in swiftly responding to crisis situations (e.g. COVID-19).
- The extent to which governments are using digital technologies to influence dietary habits (for example, through providing food assistance, nutritional information or protection from harmful advertising) depends in part on the degree to which these habits are recognised by governments as having wider public impact, or whether they are considered a matter of personal choice.
- Digital tools require careful design to create behavioural nudges and to address specific issues, such as reducing the consumption of food and beverages that are energy-dense and nutrient-poor. Tools should match the target population's communication preferences. Countries need clear business cases for the use of digital technologies, and need to monitor and evaluate projects.
- A few countries currently use digital tools to encourage consumer awareness on the sustainability of food systems, and some countries have shown progress in addressing food loss and waste with these tools. Many private sustainability initiatives use digital tools.
- Countries face several shared obstacles in the use of digital tools and technologies, including the prohibitive cost of data access, limited capacity to design and adopt these tools, scarcity of specialised digital expertise, and fragmented data systems.

Key recommendations

- It is recommended that discussion continues on opportunities for collaboration on the use of digital tools in pursuing demand-side food system health and sustainability policies. This includes focussing on designing tools to address specific issues, sharing models for best practice, and analysing their long-term effectiveness in modifying consumer behaviour.
- Countries should examine successful examples of food data systems and consider adapting these for their own objectives, as well as seeking opportunities to partner with universities, research institutes, and the private sector to develop their own expertise in food systems data aggregation and analysis.

1. Introduction

Food consumption patterns have implications for the health of people as well as the environment. Improving the environmental sustainability of food systems is an important policy focus for OECD countries.¹ This includes policy interventions to shift consumer eating preferences and choices to minimize environmental impacts and food loss and waste. In addition, healthy diets are a critical part of resilient and sustainable food systems by, for example, reducing the burden of disease and malnourishment. (OECD, 2008^[1]).

The seriousness of the threats posed by unhealthy diets is well-documented. The Global Burden of Disease Study estimates that poor diets were responsible for 11 million deaths worldwide in 2017 (Afshin et al., 2019^[2]). Unhealthy diets are contributing to the global rise in overweight and obesity: about 39% of adults were categorised as either overweight or obese in 2016 globally (FAO, IFAD, UNICEF, WFP and WHO, 2019^[3]). More than half of the adult population is overweight in 34 of the 36 OECD countries. One in four adults in OECD countries is obese (OECD, 2019^[4]). These trends are shortening lifespans and reducing quality of life, in addition to imposing significant economic costs via higher health care expenditures and lower economic output. Yet while overweight and obesity are increasing, critically, there are still an estimated two billion people (or 25.9% of the global population) who had irregular or insufficient access to nutritious food in 2019 (FAO, IFAD, UNICEF, WFP, and WHO, 2020^[5]). Addressing the tragic and lifelong consequences of hunger and childhood malnutrition remains a vitally important global challenge.

The climate and environmental impacts of the global food system are also significant. Total current GHG emissions from the global food system may contribute between 21% to 37% when all emissions from manufacturing of fertilisers, food processing, transport, retail, and food consumption as well as emissions from agriculture and land use are taken into account (IPCC, 2019^[6]). Countries are pursuing a range of policies to manage these impacts, including technological innovation, the strategic use of economic incentives, new forms of governance, and behavioural changes (UN DESA, 2019^[7]).

Digital technologies – including the Internet, mobile technologies and connected devices – have the potential to assist countries to deliver demand-side policies that aim to improve consumer health and the sustainability of food systems. These technologies also have the potential to satisfy consumer demand for health and sustainability information relating to food purchases through the provision of nutritional information.

Giner and Brooks (2019^[8]) outlined a four-track approach for policies to encourage healthier dietary choices in a way that is consistent with the wider objectives for the food and agriculture sector, including those related to ensuring the adequate supply of safe, affordable and nutritious food, environmental sustainability, and the livelihoods of agents along the food chain. This four-track approach consists of:

- demand-side public interventions (such as the provision of public information and education, e.g. dietary advice and counselling)
- working with industry at the supply-demand interface (e.g. in product reformulation or standardised labelling regimes)
- regulations to align private incentives with public incentives (e.g. a consumption levy internalising the external costs of product consumption)
- fiscal measures (e.g. a soft drink tax).

Digital technologies can be used to improve the generation, collection, exchange, aggregation, combination, analysis, access, discoverability, and presentation of digital content. Data on consumer preferences, food purchasing, and consumption decisions over time can enable policy makers to develop policies and evaluate their effectiveness. At present, efforts to collect and analyse food systems data are often disjointed and focus on single issues (e.g. evaluating the performance of nutrition subsidies).

¹ See, for example, the 2016 OECD Agricultural Ministers Declaration ([OECD Committee for Agriculture, 2016](#)); G20 Agriculture Ministers' Declaration 2017 ([G20 Agriculture Ministers, 2017](#)); and the [Global Forum for Food and Agriculture 2019 Ministerial Communiqué](#) (2019).

This paper explores the potential for digital tools to facilitate demand-side policies that affect consumer choices with respect to dietary health and nutrition, and the environmental sustainability of food systems (here understood to include climate change, water quality and use, soil health, and resource intensity). Specifically, it explores how digital technologies can help overcome common obstacles (such as information asymmetries between producers and consumers of food) and provide the delivery mechanisms and data necessary for policy design and evaluation.

Sections 2 and 3 offer an overview of the role of demand-side policies in this area, and of the opportunities to use digital tools and technologies to deliver these policies. Section 3 examines the use of digital tools in global responses to the COVID-19 pandemic. Section 4 outlines several existing country efforts to employ digital instruments in consumer health and food system sustainability interventions, and highlights lessons from these experiences.² Section 5 then examines the potential uses of digital tools in food data collection, including trends and challenges.

Specific obstacles to the use of these digital instruments identified from a literature review are discussed in Section 6, followed by a presentation of potential solutions in Section 7. The paper concludes by noting the key trends in this area, and providing several recommendations for further country co-operation and involvement.

2. Role of demand-side policies in consumer health and food system sustainability

In the areas of food system sustainability and consumer health, demand-side policies influence the preferences of consumers towards food products, consumer incomes, or the prices paid by consumers for food commodities (Okawa, 2015^[9]). These policies can increase the demand for goods produced in a sustainable fashion (Caviglia-Harris, Kahn and Green, 2003^[10]), as well as improving food security and sustainable consumption by reducing waste and changing consumption patterns (Aljamal and Bagnied, 2012^[11]).

Specifically, demand-side policies improve the sustainability of food systems by:

- internalising environmental costs in the price paid by consumers (taking existing preferences as a given), and
- helping customers to act on asserted preferences for sustainability by:
 - incentivising customers to bridge the “value-action gap”³
 - transmitting reliable, trusted, and easy to understand information on products and processes, and production methods to consumers to reduce information asymmetries, and
 - influencing consumer preferences towards sustainable products.

Common demand-side nutrition policies in OECD countries include campaigns that seek to increase the consumption of fruits and vegetables, improve dietary education, and provide dietary information through front-of-pack labelling.

OECD analysis shows that socio-economic and demographic factors such as age, income, education, or employment status influence food choices (Placzek, 2021^[12]). For example, consumer education programmes and food labelling regimes may be less effective in influencing the behaviour of households with a low degree of educational attainment. Additionally, individuals in low-resource contexts can experience cognitive burdens, as well as systemic barriers, making it more difficult to deliberate and make rational dietary and nutritional choices, especially as they relate to long-term health (World Bank, 2014^[13]).

² This environmental overview uses information from country responses to questions sent by the OECD in early February 2020. Responses were received from Australia, Canada, Denmark, Finland, Ireland, New Zealand, and the United States.

³ The “value-action gap” is a concept of behavioural economics, which refers to an inconsistency between the attitudes or stated preferences of individuals and their everyday behaviour and actions.

The design of demand-side policies to promote healthier dietary choices must therefore take socio-economic and demographic determinants, as well as availability and architecture of choice, into account. Policies must be capable of responding to these determinants with targeted interventions or be able to shape the availability structure in which dietary choices are made. This paper recommends that countries monitor and share information on the effectiveness of demand-side policies that target defined groups and address unhealthy and unsustainable dietary behaviour.

Several demand-side policy options may be employed individually or together to influence and improve poor health and dietary decisions and encourage sustainable food choices. This paper examines the potential uses of digital tools and technology in implementing demand-side policies, including the following specific initiatives:

- Policies designed to “nudge” consumers⁴ towards healthy and/or sustainable consumption; for example, apps that help users track product origin information or their own consumption.
- Policies that increase traceability and transparency within food systems by improving the information available to consumers. Examples include labelling schemes (whether mandatory or voluntary), apps providing product information, assisting industry actors to develop assurance systems, or regulations that mandate the supply of product information.
- Policy incentives for actors in the food system to act more sustainably. For example, France’s use of tax credits to encourage farmers to reduce food loss by donating excess produce to community organisations through initiatives such as the SOLAAL scheme.
- Demand-side policies that incorporate environmental externalities into the price of food products; e.g. consumption taxes delivered alongside digitally-delivered information.
- Policies that help shape consumer preferences or expand available information and evolve social norms towards health and sustainability. Examples include the development of educational apps or information campaigns that are delivered digitally in order to shift social norms towards healthier dietary choices.

This paper focuses primarily on demand-side policies delivered via digital instruments, but supply-side policies can complement the long-term effectiveness of these policies. Unless demand-side policies (e.g. public interventions that educate consumers on healthy dietary purchasing decisions) are coupled with supportive and relevant supply-side policies (e.g. public-private partnerships for the reformulation of food to lower saturated fats and sodium content), they are likely to be significantly less effective at achieving health and sustainability objectives.

3. Digital technologies

In order to effectively influence consumer (and, by extension, food systems actors) behaviour, demand-side policy measures need access to timely, clear, and comprehensive information, and must be delivered via convenient and dependable mechanisms. These policies have high data requirements and rely on the quick transfer of information to multiple stakeholders at low cost.

In light of the increasing digitalisation of food systems, and considering the shared policy objective of promoting healthier and more sustainable diets in many countries, it is timely to examine the role of digital technologies in delivering better demand-side policies.

⁴ In the context of behavioural insights, a “nudge” refers to the use of positive reinforcement to subtly influence or guide individuals or institutions in their decision-making processes. The nudge theory assumes individuals often make mental shortcuts that do not necessarily have beneficial outcomes. Nudging presents choices in a way that influences individuals to make better decisions without inhibiting their freedom of choice (OECD, 2017^[20]). One example is front-of-pack labelling that identifies a food product as high in saturated fat or sodium content.

In the context of this paper, digital technologies are defined as “Information Communication Technologies, including the Internet, mobile technologies and devices, as well as data analytics used to improve the generation, collection, exchange, aggregation, combination, analysis, access, searchability, and presentation of digital content, including for the development of services and apps” (OECD, 2019^[14]).

Digital technologies can help build integrated food data systems that operate by collecting and sharing data about consumer food preferences, costs, purchasing, and consumption decisions. They can provide targeted, reliable, and salient information to consumers and other food system actors (including farmers, food processors, and supply chain actors), using appropriate and convenient timing and delivery methods. These technologies also assist in the monitoring and evaluation of demand-side policies, and can support a greater degree of international and cross-border co-operation and policy alignment in food systems.

These technologies also offer a useful means to minimise the factors that typically hamper the implementation of demand-side food system policies, including gaps and delays in information, information asymmetries between consumers and producers, transaction costs, and non-aligned interests. Digital technologies can help to create a comprehensive and integrated system of data exchange, empowering consumers to make informed decisions and minimising the opportunities for public-private interests to diverge. For example, if food production companies share information regarding GHG emissions associated with specific products, companies and consumers are each empowered to make informed decisions.

At the same time, digital technologies can assist in delivering policies to address overweight and obesity (OECD, 2019^[4]). Policies involving a combination of nutritional advice, social media engagement, and regular communication with individuals have a higher rate of effectiveness in changing long-term behaviours (OECD, 2019^[4]). Digital platforms such as mobile-based nutritional applications offer a way to match these demands with appropriate interventions.

In addition, consumers are increasingly demanding a higher degree of responsiveness, integration, and customisation in the provision of products that relate to nutritional and dietary health (Euromonitor, 2020^[15]). In this context, countries need to match this demand with quality instruments that offer a high degree of convenience and timely and accurate information. This can be more easily achieved with digital tools.

Many countries have developed a range of active demand-side policy initiatives and interventions that use digital instruments, including smartphone apps rewarding fitness activity, databases of food nutrient information that can be downloaded, and online infrastructures that support the efficient use of waste or excess food (Giner and Brooks, 2019^[8]). These instruments are discussed in Section 4, and are summarised in Annex A.

Table 1 lists the digital technologies that facilitate the collection, analysis and transfer of data relevant to successful food system policy delivery.

Table 1. Digital technologies for agriculture and food

Technology purpose	Category	Sub-category
Data collection technologies	Remote sensing	Satellite-mounted data acquisition / monitoring systems
		UAV / drone-mounted data acquisition / monitoring systems
		Manned aircraft data acquisition / monitoring systems
	In situ sensing	Water quantity meters
		Water quality sensors, air quality sensors
		In situ meteorological sensors
		In situ soil monitors
		In situ biodiversity, invasive species or pest monitors
		Crop monitors
		Livestock monitors
		Data from precision agricultural machinery
	Crowdsourcing data collection	“Serious games” for gathering agri-environmental data
		Citizen science
	Online surveys / censuses	Data collection portals (e.g. online census)

Technology purpose	Category	Sub-category
Data analysis technologies	Financial / market data collection	Retail scanner data
		Business software for recording financial or market information (e.g. database entry systems)
	GIS-based and sensor-based analytical tools	Digital Elevation Modelling
		Land Use-Land Cover mapping
		Watershed modelling
		Soil mapping
		Landscape modelling
		Software (programmes, apps) for translating sensor and other farm data into actionable information
		Software for automating agricultural machinery which uses sensor or other farm data as input
		Software for measuring and grading agricultural outputs (e.g. carcass grading software)
	Crowdsourcing data analysis	Crowdsourcing applications for data sorting / labelling
	Deep learning / AI	Data cleaning algorithms
		Big data analysis algorithms
		Machine learning
		Predictive analytics
Data storage technologies	Secure and accessible data storage	Cloud storage
		Confidential computing
		Virtual data centres
Data management technologies	Data management technologies	Distributed ledger technologies (e.g. Blockchain)
		Interoperability programmes and apps
Data transfer and sharing: Digital communications; trading, payment and service delivery platforms	Digital communication technologies	Digital data visualisation technologies
		Social Media
		Web-based video conferencing
		Machine-assisted communication (e.g. chatbots, natural language generation algorithms)
	Online platforms - property rights, payments, services and markets	Online property rights and permits registries
		Online trading platforms
		Platform-based crowdfunding for agriculture and agri-ecosystem services
		Online payment platforms (for public programs)
		Service delivery platforms

Source: OECD (2019_[14]).

Although Table 1 includes a comprehensive list of the digital technologies to deliver, monitor, and evaluate food system policies, the digital tools most commonly used to shape the daily food practices of consumers are the following (Mu, Spaargaren and Oude Lansink, 2019_[16]):

- *Social media connectivity*, allowing consumers to share and interact with each other with respect to their food choices and preferences, and to source information from known (and trusted) contacts.
- *QR codes*⁵ offering fast and dependable information for consumers with respect to nutritional values, the traceability of ingredients, menu availability, and other relevant factors.
- *Gamification of food choices*, for example nutritional platforms allowing users to earn points for positive eating behaviours and compete against others.
- *Artificial intelligence* providing personal recommendations based on the health attributes and personal preferences of individual users

⁵ QR refers to quick response two-dimensional or matrix bar codes.

- *Virtual reality technology* in mobile applications replacing or augmenting textual information or explanations
- *Internet of Things technology* connecting objects to digital platforms that provide integrated consumption information (e.g. food experiences connecting tableware to digital platforms to monitor the speed of eating).

In addition to these tools, a 2019 review of the most common digital instruments featured in 2 000 academic papers also noted the use of (Hedin et al., 2019^[17]):

- *Public interactive schemes* utilising digital platforms
- *Internet-connected “smartbins”*⁶ that log the food choices of digital study participants
- *Food inventory systems* linked to users’ social media profiles; and
- *Webpages that visualise users’ food purchase data* for health and sustainability outcomes.

Box 1. The use of digital technologies in response to the COVID-19 pandemic

The use of digital technologies to respond to the COVID-19 pandemic offers a useful and timely illustration of the advantages associated with these technologies, and demonstrates the opportunities to apply them more widely within demand-side food system policies.

The COVID-19 pandemic has had a significant impact on food systems, specifically on the livelihood of farmers and food chain actors, and on the capacity to supply enough food to safeguard the nutritional security of vulnerable populations. Countries have taken quick action to address the short-term risks to the food system, including significant sector-wide emergency financial assistance packages and making use of digital technologies.

In this context, e-commerce and delivery companies have a key logistical role to play. Many supermarkets and wholesale suppliers, as well as individual food brands, are switching to digital platforms to support the sale, processing, and delivery of food items to households.

The following examples offer a snapshot of how countries and private organisations are putting digital tools to work in response to this pandemic.

- The USDA has established a dedicated COVID-19 website to provide information on food assistance packages to which families could be entitled, and has linked this to the [MyPlate](#) website to help users on a restricted budget prepare nutritious food at home (e.g. guidance on good preparation, recipes).¹ The WHO has also developed a webpage to promote healthy diets during self-quarantine.²
- The United States Families First Coronavirus Response Act 2020³ enables the issuance of electronic benefits transfer cards to participants of nutritional assistance programmes so as to minimise disruptions in the delivery of this support. Additionally, USDA has expanded the option of online food purchasing to cover over 90% of SNAP recipients.⁴
- Weekly online Household Pulse Surveys are being run in the United States to collect timely information on the social and economic impacts of the pandemic including on households’ food insecurity (OECD, 2020^[18]).
- The United Kingdom is making digital supermarket vouchers available to families whose children would usually receive free meals at schools, but who are unable to do so due to closures.⁵

⁶ “Smart bins” refer to a digital waste management system that involve physical trash or rubbish bins fitted with electronic sensors. These rubbish bins transmit real time data about the level of rubbish contained (or “fill-level”) to a cloud-based monitoring and analytics platform, thereby enabling more efficient waste management.

- Supermarkets in the United Kingdom are drawing from government data⁶ to assist delivering the 1.5 million food parcels to clinically vulnerable people committed to by the government.
- Web scraping techniques combined with data provided by food retailers and producers is being used in the United Kingdom to establish real time understanding of the food supply chain situation in order to anticipate shocks (OECD, 2020^[18]).
- The New Zealand Salvation Army is using a digital food bank (the [Foodbank Project](#)) whereby donors purchase specific grocery orders prepared by local supermarkets and delivered directly to the nearest food bank for families and individuals in need.⁷
- The Irish Food Board (Bord Bia) has numerous resources on its [COVID-19 Hub](#) including podcasts, webinars and indicator reports which are updated daily to inform the Irish food sector about market developments and observed consumer trends to support the sector's business decisions and risk mitigation strategies.⁸
- In Israel, classes are being taught online by nutritionists to school children about the importance of healthy eating (OECD, 2020^[18]).

These examples highlight the advantages of using digital tools and technologies within food systems. These technologies not only allow for the instantaneous exchange of information, but enable food system actors to distribute resources quickly and efficiently.

Digital technologies assist all kinds of businesses to adapt to changing circumstances, and as a result make systems for the supply and delivery of food items more resilient. Integrating multiple sources of data (e.g. referencing supermarket customer databases against government data concerning vulnerable people) allows for the rapid provision of food.

1. See <https://www.fns.usda.gov/disaster/pandemic/covid-19>
2. See <http://www.euro.who.int/en/health-topics/health-emergencies/coronavirus-covid-19/novel-coronavirus-2019-ncov-technical-guidance/food-and-nutrition-tips-during-self-quarantine>.
3. See <https://www.congress.gov/bills/116th-congress/house-bill/6201/text>.
4. See <https://www.usda.gov/media/press-releases/2020/05/20/snap-online-purchasing-cover-90-households>.
5. See <https://www.gov.uk/government/publications/covid-19-free-school-meals-guidance/covid-19-free-school-meals-guidance-for-schools>
6. See <https://www.itv.com/news/2020-03-27/supermarkets-to-use-government-data-to-get-supplies-to-most-vulnerable/>.
7. See <https://www.salvationarmy.org.nz/research-media/media-centre/business-news/online-foodbank-first>.
8. See <https://www.bordbia.ie/industry/covid-19/>.

4. Digital tools for demand-side policies

As noted above, a four-track policy approach can be used to deliver policies that encourage healthier dietary choices (Giner and Brooks, 2019^[8]). The first three of these tracks focus on providing information to individual consumers and on changing individual preference structures through behavioural nudges. The fourth approach includes direct interventions on prices and incomes. While this four-track approach was developed by the authors in the context of food nutrition and health, they can be applied to food system sustainability.

Each of these four demand-side policy tracks has the potential to be delivered more efficiently and effectively with the use of digital instruments. This is particularly the case for public education and the flow of timely and accurate information concerning the health and sustainability profile of food purchases and consumption behaviours.

The use of behavioural insights interventions such as nudges, feedback loops to consumers, and education campaigns is considered primarily in the context of the first track of demand-side policies. There is also scope to apply these techniques to the supply-demand interface (second track), to regulatory interventions that align private and public incentives (third track), and to fiscal measures (fourth track). For

example, behavioural insights could be applied in the implementation of voluntary or regulatory food labelling schemes, or to the testing and design process of fiscal interventions such as food taxes. Behavioural insight techniques should also be employed to develop and evaluate policy interventions, including monitoring and enforcement, as these techniques can help gain a better understanding of individual behaviour as well as pre-test the effectiveness of policy solutions before their implementation on a large scale (OECD, 2019^[19]). Case studies on the use of behavioural insights in relevant public policy interventions suggest there is significant potential in this area, particularly with respect to consumer-focused interventions (OECD, 2017^[20]).

Digital technologies also have the potential to empower citizens to play a more active role in the development and delivery of demand-side policies relating to consumer nutrition and food system sustainability. For example, digital technologies can facilitate citizen participation in the design of education tools such as websites and mobile apps.

4.1. Demand-side public interventions

The first track involves addressing unhealthy and unsustainable dietary choices via demand-side public interventions, such as the provision of public information, counselling, and advice. These interventions aim to improve the information on which individuals and households base their consumption choices. There are significant opportunities for the use of digital tools to foster the use of behavioural approaches in public policy as they offer tailored and convenient communication channels with individuals (OECD, 2017^[20]). OECD countries have a wide range of such digital initiatives that are either underway or under development (Annex A).

Dietary guidance distributed via digital platforms

OECD countries generally offer dietary guidance and strategies to consumers through the use digital tools such as websites or social media.⁷ For example, the Department of Agriculture and Department of Health and Human Services in the United States releases dietary guidelines every five years. This involves scientific panels examining new findings in nutrition research and turning these findings into actionable advice for consumers. This advice is then presented via the MyPlate website, which offers tailored menu suggestions for individuals and households, as well as budgetary advice, shopping lists, and cooking tutorials. Tailored features convey food purchasing and preparation knowledge that target recipients of food assistance programmes who may have low culinary skills (Placzek, 2021^[12]). Eating recommendations, recipes, videos and tips to help Canadians apply dietary guidance in their daily lives are included on [Canada's Food Guide](#) website. These sets of dietary guidance are more extensive than that of most countries, and are a significant resource for consumer education. Countries could adopt aspects of these approaches to deliver their own dietary guidelines.

The majority of countries use social media platforms such as Twitter, Facebook, Instagram and YouTube to engage individuals with tailored messages concerning nutritional guidance. Examples include the United Kingdom's Eatwell Guide, Denmark's Strategy for Food, Meals, and Health, and the New Zealand/Australian Health Star Ratings system. These social media platforms offer targeted channels to communicate with marginalised and hard-to-reach groups, and have the potential to offer a more agile, iterative, and responsive public service delivery (OECD, 2014^[21]). Their analysis shows the importance of measuring the impact of social media strategies, including setting specific metrics or indicators for engagement (OECD, 2014^[21]).

Most countries monitor engagement with these social media platforms. However, evaluations of their effectiveness in changing individual behaviour are not always available. While countries monitor figures relating to page views and information download rates, using this information to review content and improve usability studies concerning long-term changes in behaviour are less common. This could be a future objective.

⁷ The FAO notes over 100 countries worldwide have developed food-based dietary guidelines and made these available to the public, including through public websites (<http://www.fao.org/nutrition/education/food-dietary-guidelines/home/en/>).

Tailored digital applications and platforms

Many countries have developed tailored digital applications and/or platforms that offer tailored nutritional guidance and advice to individuals. Examples include Ireland's Weight-Mate app, Finland's Fineli database, Hong Kong, China's NuCal nutritional calculator, the United States' MyPlate app, Canada's Carrot Rewards app (currently being redeveloped for release in mid-2020), and Australia's VegEze app. These apps offer access to tailored nutritional information and many allow users to set health goals (e.g. increased vegetable consumption or weight loss) according to personal circumstances; results can also be shared with friends and family.

The provision of public advice and guidance concerning the sustainability aspects of food consumption – either via general advice or tailored digital platforms – is less common, but under active consideration by several countries. For example, the United Kingdom is considering options to embed sustainability in its public Eatwell Guide, and within wider UK food policy (Medact, 2017^[22]). The United States has developed its FoodKeeper app, which offers tailored advice concerning the proper storage and consumption of food in an effort to limit household food waste. [Tips](#) on Canada's Food Guide cover minimising food waste and food choices to reduce negative environmental impacts in terms of water and land use.

The use of digital instruments in public nutrition and food sustainability education must remain cognisant of the potential for consumers to access conflicting and erroneous information online. In the context of an increasing number of individuals accessing health and nutrition advice from sources such as social media influencers, countries must ensure the availability of clear and unambiguous government-approved guidelines (Pilgrim and Bohnet-Joschko, 2019^[23]). They may also need to consider committing to media literacy campaigns regarding online content (Funke and Flamini, 2020^[24]).

Behavioural nudging delivered via digital tools

Food system policies within the first track of public education initiatives can involve behavioural “nudging”. The use of big data technologies means more data concerning food products and individual food choices is becoming available. For example, the availability of food composition databases enables consumers to learn the composition of almost any product, and smartphone applications allow users to easily access this information. Combining this technology with behavioural algorithms would allow users to review their potential food choices and receive prompts for healthier dietary options. Similar technology is being utilised in many mobile dietary applications, for example the US's MyPlate app, and Hong Kong, China's NuCal app. These applications have the potential to feature games that aim to incentivise positive behavioural changes by introducing elements of competition that keep users engaged.

There is significant potential to involve a range of other behavioural insights techniques in the use of digital tools. This includes wider public education campaigns and guidelines that frame public understanding, the use of opinion leaders to disseminate information via social media platforms and other technologies, and the creation and reinforcement of new social norms via digital communication tools (OECD, 2019^[19]). Digital tools that simplify meal planning (e.g. the US's MyPlate app) could also harness behavioural insight techniques, including interfaces designed to encourage healthier purchases through default settings, recommended options, pre-set grocery lists, and recipes based on official dietary guidelines. Digital tools have the potential to provide efficient feedback loops to consumers on the sustainability or health aspects of their shopping cart, and could incentivise behavioural shifts through the use of reward systems that offer points in recognition of healthy or sustainable purchases within the context of national guidelines and definitions.

While countries have a range of policies either underway or in development utilising digital instruments in the delivery of healthier and more sustainable dietary choices, there is insufficient shared understanding regarding which digital instruments are the most effective in creating meaningful and lasting changes. This is because the majority of demand-side policies are poorly evaluated, and because selected participants are not studied over sufficiently long timeframes (Hedin et al., 2019^[17]).

4.2. Working with industry at the supply-demand interface

The second demand-side policy track involves working with food industry actors at the supply-demand interface where private incentives align with public ones, e.g. in voluntary product reformulation or the introduction of voluntary testing and labelling schemes. Supporting the development of assurance systems

can help to increase the adoption of these voluntary schemes, and can influence expectations for transparency from both the supply and the demand side. These measures also aim to augment and improve the information on food products made available to consumers at the time they make their purchasing decisions. Behavioural Insights research shows that the quality of information (including style, complexity, and framing) plays a central role in shaping individual decision-making (OECD, 2016^[25]). Measures to provide information to consumers should reflect the Behavioural Insights principles of making positive decisions as easy and timely as possible for individuals (consistent with the Easy, Attractive, Social and Timely (EAST) Framework (Behavioural Insights Team, 2015^[26])) and solving problems by enhancing consumer attention through choice architecture (OECD, 2019^[19]).

In cases where voluntary demand-side instruments reflect an alignment of public-private incentives, governments can develop policies that support, frame, or provide information (among other functions) rather than impose specific actions via incentives or punitive measures. This may take the form of government assistance in establishing industry co-operative groups, or using government platforms to promote voluntary certification schemes, such as Ireland's Origin Green or New Zealand's FernMark scheme. OECD analysis has highlighted a range of roles for governments in relation to environmental labelling and information schemes, including as a supplier and/or user of labelling schemes, as a supporting institution, or as an inventorying institution providing guidance to users of the schemes (Gruère, 2013^[27]).

Voluntary industry partnerships with a digital focus

A promising set of voluntary measures at the supply-demand interface involves the establishment of voluntary public-private industry partnerships that focus on improving the information available to consumers through digital tools and platforms.

An example is Australia's Healthy Food Partnership, established in 2015, which is a joint initiative between government, food industry groups, and public health groups that focuses on enabling people to make healthier dietary choices by increasing their nutrition and health knowledge. This includes promoting and communicating information on appropriate portion sizes that align with Australian Dietary Guidelines, and voluntary food reformulation activities that optimise the appropriate balance of nutrients and ingredients in manufactured foods. Each of these activities includes a focus on increasing the availability of food information to consumers. Since its establishment, the partnership has implemented voluntary reformulation targets for sodium and saturated fats in 27 sub-categories of food (Australian Healthy Food Partnership, 2018^[28]).⁸

Voluntary digital standards and labelling regimes

Another set of voluntary demand-side measures involves the creation of voluntary labelling regimes that convey nutritional or sustainability information to consumers and other food system actors. In this context, digital instruments can serve to certify compliance or provide information to consumers. Several countries have established such regimes, including Ireland's Origin Green initiative (and, more specifically, its Sustainable Beef and Lamb Assurance Scheme (SBLAS)) and New Zealand's FernMark programme. These credence-labelling regimes assure consumers that the product was produced according to sustainable farming practices.⁹ Many of these regimes offer convenient sources of information via technology such as QR codes scanned by mobile devices.

For example, studies suggest online grocery shopping sites could achieve positive health outcomes for users by automatically suggesting healthier alternatives to products that have high salt or sugar content (Hartmann-Boyce et al., 2018^[29]). Here, private and public interests are aligned as individuals benefit from healthier dietary choices, and grocery retailers do not face any reduction in sales. Countries could consider collaborating with online food retailers on similar initiatives.

Evidence suggests some consumers are willing to pay additional premiums for food considered to be more nutritious or sustainable according to industry-led or government-mandated labelling regimes (e.g. food

⁸ See also <https://www1.health.gov.au/internet/main/publishing.nsf/Content/reformulation-targets>.

⁹ Credence refers to claims about how a product was produced or attributes embodied in a product rather than the physical attributes of a final product i.e. animal welfare, food safety, and organic (Fernqvist and Ekelund, 2014^[76]).

items marketed as being certified organic products) (Carlson and Jaenicke, 2016^[30]). Studies suggest a majority of EU consumers already factor sustainability concerns into their food purchasing habits, although consumers in different markets associate a varying range of attributes with the use of the term “sustainable food”. In this context, consumers may be interested in attributes related to lower environmental impacts, avoided use of GMOs and pesticides, reliance on local supply chains, revenue-sharing practices, animal welfare commitments, or minimal processing (BEUC, 2020^[31]). In response to this demand for healthier and more sustainable dietary choices, private nutritional and sustainability standards and labelling regimes have emerged worldwide, some of which are now using digital technologies to provide their consumers with detailed origin and production information to justify price premiums. One example is Atkins Ranch, a US brand that markets grass-fed New Zealand lamb using social media and geolocation tools.

Voluntary and regulatory supply-demand measures offer particular promise in relation to the use of Digital Traceability Systems (DTS). These systems can provide food system actors and consumers with access to dependable and consistent information concerning the health and sustainability aspects of dietary purchases (e.g. QR codes certifying that exported shark products are processed in accordance with all relevant national and international regulations (UN ECE, 2016^[32])). DTS technology is increasingly used to connect supply-chain actors and speed up the production, transport, and consumption of food products, with a specific focus on food safety, transparency, reducing food waste, and preventing food fraud (Internet of Food Things, 2019^[33]). The increasing spread and reliance on DTS technology offers new avenues for voluntary food sustainability instruments in the supply-demand interface, such as voluntary labelling regimes for credence goods and assurances concerning product sustainability. Given the potential benefits for consumers and suppliers, there is increasing interest by governments in the use of DTS technology.

However, while these labelling regimes can provide consumers with valuable information, the multiplication of claims within voluntary labelling schemes and the incentives of food suppliers to frame these labels in ways that generate demand for their products, means that consumers do not always have clear and accurate information (Kuchler et al., 2017^[34]). For example, a 2013 European Commission study found that about 40% of consumers expressed confusion concerning the meaning of certain food labels (at the time of the study, there were over 900 such labels used in the European Union) (European Commission, 2013^[35]). Consumers also expressed confusion concerning labels regarding “natural” and “organic” standards in the United States (Kuchler et al., 2018^[36]). OECD analysis has found evidence that, in some instances, label competition has led to harmonisation and market-driven convergence in standards over time, notably amongst regional ecolabels (e.g. the EU Ecolabel) and forest sustainability certification (Prag, Lyon and Russillo, 2016^[37]). However, the reverse has also been observed. For instance, an OECD study of 544 labelling schemes in 2013 found a significant degree of overlap and inconsistency among regimes, a lack of clear and objectively validated information, and concerns regarding scheme transparency (OECD, 2016^[38]). It noted that market competition in labelling does not necessarily lead to better information for consumers (OECD, 2016^[38]).

Consumer confusion regarding the meaning of food labels can also have an adverse effect on the operation of the market for healthy or more sustainable dietary choices, as consumers become sceptical about labelling claims and may not be willing to pay the premium that compensates producers and retailers for incurring additional production costs. This risk is equally valid for labels delivered via digital tools, such as systems involving QR codes scanned to mobile devices. OECD analysis has identified the potential for countries to collaborate on providing trusted sources of comparable information across different labelling schemes (OECD, 2016^[38]).

At the same time, these voluntary credence labelling regimes provide the opportunity for food system actors to gather data concerning their customer base and to evaluate the operation of the labelling schemes. For example, in the case of New Zealand’s FernMark programme, the licensing body overseeing the use of the label is able to track consumer engagement with QR codes and can determine the location of consumers accessing this information.

Governments can help address these issues by monitoring or standardising schemes that prevent fraud, reduce transaction costs, facilitate market access for all producers, and ensure food markets are functioning (i.e. observing that credence goods are attracting price premiums) (Rousset et al., 2015^[39]). In the context of rising consumer expectations regarding nutrition and sustainability, governments can facilitate the flow of information (including via digital tools) and endorse private standards by recognising regulatory equivalence and monitoring compliance (Rousset et al., 2015^[39]). At present, there is a gap in country efforts to encourage consumer awareness of food system sustainability via digital tools.

The UN Codex Alimentarius Committee on Food Labelling (CCFL) determines the minimum acceptable standards relating to international labelling. In 2019, the CCFL requested input from countries regarding their approaches to the digital presentation of information (“labelling”) to consumers. The CCFL is trying to determine where information that is not directly attached to food, i.e. provided virtually, is captured by existing CCFL’s definitions of labelling or whether these definitions need to be revised (UN FAO Codex, 2020^[40]). Discussions on this topic are ongoing.

Voluntary schemes and technologies addressing food waste

Another key element of demand-side food system sustainability measures is the emergence of voluntary schemes and technologies that address food loss and waste. As consumer awareness of the threat posed by food waste to the sustainability of food systems has increased, several voluntary food loss and waste avoidance schemes have been developed. These schemes offer incentives for food system actors (including farmers, processors, retailers, and consumers) to avoid generating food loss, and to put excess or unwanted food to use in productive ways. Recently, the use of digital technology has allowed these schemes to make significant steps forward, attracting new participants and boosting avoided food waste.

An example of a voluntary food loss avoidance programme is France’s SOLAAL scheme. Established in 2013, this private scheme connects farmers and other food system actors to community organisations to facilitate food donations. Since February 2019, the scheme’s integrated mobile application has allowed farmers to communicate the availability of excess food to nearby groups, set a date and time for pickup, and calculate the financial value and impact of each donation (both in terms of food weight and standard meal numbers). Those donating food are then eligible for annual tax credit, and have the opportunity to demonstrate their participation in the scheme to consumers through use of the SOLAAL brand. According to its own reporting, SOLAAL has facilitated the delivery of 14 000 tonnes of donated food, representing about 28 million meals and 2 500 tonnes of avoided CO₂ emissions (SOLAAL, 2019^[41]).

This example highlights the potential for voluntary measures at the supply-demand interface to improve the sustainability of food systems, especially through the use of digital delivery methods. SOLAAL succeeds in its objectives because it enables the fast transfer of information between parties interested in solving the problem of food loss in the supply chain, and the use of fiscal incentives in the form of tax credits for donating parties creates a greater incentive for participation. The incentives for participation in such schemes in France have been strengthened by the introduction of regulations in 2016 mandating the donation of quality excess food (Mourad and Finn, 2019^[42]).

In addition to government-supported schemes, other private food waste avoidance schemes have emerged using digital technologies to connect donors and recipients of unwanted food. This includes surplus food market places such as Too Good to Go, as well as waste avoidance apps such as Meal Prep Mate and Winnow. These digital services involve geolocation and predictive algorithms based on user behaviours, creating efficiencies in food systems. While these are not government initiatives, they are examples of digital instruments that countries could use in implementing demand-side sustainability policies. They are a way to avoid excess waste and packaging, and to allow food needs to be met in novel ways (Strubenhoff, 2018^[43]). Although information concerning their effectiveness and long-term changes in user behaviour is patchy, data suggests these apps are contributing meaningfully to reducing food waste (van der Haar and Zeinstra, 2019^[44]).

4.3. Regulations to align private incentives with public incentives

Where private and public incentives do not fully align, countries need to take firmer measures to regulate the behaviour of food system actors such as food processors and retailers. These measures can include regulations on the promotion of certain foods to certain population groups, e.g. restricting advertisements of foods with low nutritional quality that are aimed at children,¹⁰ or involve hard regulations, e.g. limit sodium content. Regulatory measures can help address inconsistencies and gaps between voluntary product labelling or reformulation schemes (Rousset et al., 2015^[39]).

¹⁰ A French study published in June 2020 found that televised food advertisements seen by children and adolescents are mostly for products with a Nutri-Score rating of D and E. This study highlights the case for restricting the marketing of foods with low nutritional quality (Escalon, Serry and Resche, 2020^[77]).

There is significant potential for the use of Behavioural Insights techniques to develop and implement these regulatory measures. This includes simplifying the information provided to consumers, adopting positive default and convenience policies (e.g. making it mandatory for online food suppliers to present healthy alternatives as the default dietary selection), and making certain information more salient to individuals (e.g. mandating the prominent display of sodium or saturated fat content on food packaging) (Lunn, 2014^[45]).

Countries could also employ a blend of second and third-track policies (i.e. a mixture of voluntary and regulatory measures) to encourage consumers and food system actors to improve food system health and sustainability. For example, regulatory requirements concerning nutritional labelling could be combined with voluntary commitments to food reformulation, or voluntary national codes for production practices could be developed.

As with the voluntary measures detailed above, the delivery of this third track of regulatory demand-side food system policies can be enhanced through the use of digital tools and technologies.

Labels mandating product information

Many countries mandate the provision of nutritional information on food products, most notably nutrient lists on packaged foods (EUFIC, 2018^[46]). Increasingly, these labelling regimes are delivered via digital tools and instruments such as QR codes and product websites that list more extensively nutritional information for consumers. These tools assist in the fast and reliable provision of product information and offer suppliers a way to highlight the quality and origin of their products.

Food suppliers have a financial incentive to provide consumers with the product attribute information they believe will sway consumers to buy their products. There is no incentive to voluntarily provide negative information regarding nutrition or sustainability information, e.g. the amount of sodium where sodium levels are higher than physicians recommend, or the use of palm oil associated with deforestation. To address these incentives, governments pass regulations that require food suppliers to provide this information.

Countries have a long history of attempting to provide nutritional information in simplified and standardised formats to support wider consumer understanding. For example, the United States Nutrition Education and Labelling Act of 1990 required food suppliers to provide clear and standardised information about micro and macro-nutrients, calories, and the wider health implications of food products. More recently, Chile introduced simplified front-of-pack labelling regulations that require all packaged products containing high levels of salt, sugar, and/or saturated fats to display warnings for consumers (OECD, 2021^[47]). A helpful summary of simplified approaches to nutrition labelling across OECD countries is outlined in *Policies for Encouraging Healthier Food Choices* (Giner and Brooks, 2019^[8]).

Despite efforts to regulate for the provision of standardised and easily understood nutritional labelling (e.g. France's front-of-pack NutriScore scheme), studies suggest nutritional label information is not widely used by consumers as it is often too complex to understand (Leek, Szmigin and Baker, 2015^[48]).¹¹ Some governments have developed programmes to assist consumers in reading and interpreting the mandatory elements of food labels on pre-packaged food in order to make healthier food purchasing decisions. For example, Health Canada and the Canadian Food Inspection Agency have developed websites and interactive web-based tools (i.e. Understanding [food labels](#) generally and [a food label specifically](#)).

Given the widespread use of smartphone technology, there is considerable potential for governments to direct consumers to web-based services (such as France's Open Food Facts database, or the new GS1 digital product identification initiative CodeOnline Food¹²) that provide nutritional information in an easily understood format. These services often use Universal Product Codes (UPC).¹³ Given the proportion of

¹¹ The pan-European FLABEL study conducted from 2008-2011 found that although consumers demonstrate a broad capacity to interpret and understand nutritional labels, the average person examines these labels for a mere 25 to 100 milliseconds (EUFIC, 2012^[78]).

¹² See <https://fr.openfoodfacts.org/> and <https://www.gs1.fr/Notre-offre/CodeOnline-Food>.

¹³ Universal Product Code (UPC) is a type of printed code used on retail product packaging in the United States and Canada to aid in identifying items. It consists of a machine-readable barcode and a 12-digit number beneath it. The UPC scheme is administered by the Global Standards Organisation, formerly known as the Uniform Code Council. The European Article Number (EAN) system is used for barcode schemes outside of the United States and Canada.

consumers in OECD countries that have access to smartphones, these approaches would have potential to shift consumption behaviours, including in ways that contribute to health and sustainability goals.

As consumer awareness regarding sustainability implications of food purchases increases, countries will look to regulatory options mandating the inclusion of food sustainability attributes on labels, including aspects such as GHG emissions, water use, and soil health. Given the historic confusion around the use of terms such as “organic” and “natural” (Kuchler et al., 2018^[36]), government intervention will most likely be required to offer clear and consistent terms on labels, including those delivered via digital tools. Notably, the European Union is currently examining proposals for standardised environmental impact labelling (European Commission, 2011^[49]) and has recently announced its intention to introduce a harmonised mandatory front-of-pack nutrition labelling scheme and to prepare a legislative proposal in line with the objectives of its Farm to Fork Strategy (European Commission, 2020^[50]).

Given that lack of comprehension of nutritional information is a major barrier to the success of labelling policies in shifting consumer choices, these policies should also identify and target subsets of the population that need support in understanding labels correctly. Digital tools such as mobile dietary applications offer novel ways to provide such targeted assistance, e.g. the United States’ MyPlate app.

There is an emerging evidence base that demand-side policies such as labelling regimes, whether voluntary or mandatory, are effective in contributing to the health and sustainability aspects of the food system. These policies can also indirectly stimulate product reformulation, as seen in the example of the New Zealand Health Star Rating system.

The success of labelling schemes depends on specific design features, most notably simplified labelling schemes with a high degree of information consistency between producers and retailers. As shown in several studies concerning the French NutriScore system and comparable schemes, the presentation of different front-of-pack labelling (including the format of digital information) significantly influences the effectiveness of these schemes in encouraging consumers to make healthier dietary purchasing choices (Julia et al., 2017^[51]). The development of effective front-of-pack labelling schemes requires significant experimentation and testing to ensure that labels reflect behavioural biases and local cultural and communication contexts.

Integrated digital technologies offer possibilities for speed, convenience, and reliability of labelling schemes, and have the potential to reduce the risk of food fraud by making it easier for consumers to access food origin information. These technologies also have the potential to enable easier collection of empirical evidence on how labelling schemes benefit food system actors (specifically farmers) and could therefore create more demand for such schemes.

Regulating digital food promotion to vulnerable audiences

An important aspect of demand-side food system policies relates to the ability of food suppliers to advertise products to consumers. While the swift evolution in digital tools and technology has allowed countries to deliver food health and sustainability information more effectively and efficiently, it has also offered new ways for food manufacturers to promote food and beverages that are energy-dense and nutrient-poor to vulnerable audiences, including children. Marketing these foods to children can have significant consequences, given the influence children’s food preferences have on household purchasing habits, especially in lower-income households where children have higher average hours of screen-time per day (Placzek, 2021^[12]).

WHO analysis notes that targeted digital advertising that uses big data has the potential to amplify the effectiveness of food advertising compared to traditional sources of media. Furthermore, the use of online or in-app advertisements for energy-dense and nutrient-poor foods can quickly reach vulnerable audiences, and are increasingly challenging for guardians and caretakers to monitor and prevent (WHO, 2016^[52]).

Policy analysis on efforts to curb childhood obesity shows that reducing the exposure of children to digital marketing for energy-dense and nutrient-poor foods is key to improving future health indicators (WHO, 2016^[53]). There are nevertheless a number of challenges facing countries in addressing this problem, including information asymmetries and ethical questions. Digital marketing firms have access to sophisticated data sets concerning web and mobile application users, putting them in a position to harvest information to reach consumers in highly targeted ways. Other questions such as whether policy makers,

researchers, or private companies should be able to track the behaviour of children online and the appropriate role of government in influencing parental decisions also need to be addressed in formulating effective policies. Given the exponential proliferation of new communication platforms and the complexity of digital environment, research findings typically do not remain current for long (WHO, 2016^[52]).

In response to these challenges, several countries are passing measures to regulate the digital advertisement of foods to children, particularly energy-dense and nutrient-poor foods. These countries include Chile, Denmark, Ireland, Norway, Portugal, and the United Kingdom. The European Union has also pledged to address this issue. There is scope for countries to share information on this topic, especially on the use of techniques to audit online marketing algorithms and to supervise the data mining practices of food marketing firms (WHO, 2016^[52]).

4.4. Fiscal measures

The use of digital instruments in these three public policy tracks has so far not managed to reverse or significantly impact trends in overweight and obesity. At the same time, the effects on trends in sustainable consumption are also unclear. Thus, policy makers are increasingly considering fiscal measures in the form of both penalties and incentives (Giner and Brooks, 2019^[8]). For example, a popular target for fiscal measures has been to impose taxes or levies on processed and refined sugar, the consumption patterns of which have long exceeded guidelines recommended by experts and dietary professionals.

Studies have presented several examples in which the credible threat of a tax or levy is sufficient to prompt swift reformulation. In the United Kingdom, for example, a levy on sugar on soft drinks resulted in several major companies reformulating their products so as to avoid incurring the tax (Giner and Brooks, 2019^[8]). Similarly, the introduction of mandatory requirements to label product ingredients can drive reformulation so as to avoid public scrutiny on unpopular or undesirable ingredients (Ares et al., 2018^[54]).

Several countries have created allowances to incentivise desirable consumption habits on behalf of selected groups. For example, Korea's Organic Food Assistance Programme (established in January 2020) offers assistance to pregnant women and new mothers to purchase organic food products via digital vouchers. Korea has also established its Food Voucher Assistance Programme, a pilot scheme supporting low-income households to access fresh foods by using an online order system with digital vouchers. As with the examples of France's SOLAAL scheme and Canada's Carrot Rewards app, this combination of digital technology with fiscal incentives offers an attractive blend of demand-side policy, and has the potential to guide user behaviour towards healthier and more sustainable dietary choices. The Korean Organic Food Assistance Programme is still in its first year of operation, and evaluation information remains forthcoming. The Korean Food Voucher Assistance Programme ran as a pilot between September and December 2020, and involved around 18 000 households (OECD, 2020^[18]).

In these cases, the use of digital tools and technology is not a fundamental aspect of the successful performance of demand-side policy. However, digital tools offer a way to explain fiscal measures (both taxes and allowances) to producers and consumers in easily understood terms, and can boost engagement in schemes designed to change consumer behaviour (Te, Ford and Schubert, 2019^[55]). Furthermore digital tools can make monitoring of the effectiveness of policies easier by allowing more real time data collection. For example, the United Kingdom's soft drinks levy was accompanied by considerable online engagement with consumers and industry groups, and has seen significant progress in reducing the sugar content of soft drinks (Public Health England, 2019^[56]).

5. Digital tools for food data collection

The development of data systems is another government priority for evidence-based food related policies (Giner and Brooks, 2019^[8]). Given the health and sustainability implications of food consumption patterns, countries would like to evaluate and assess the effectiveness of policy instruments (including the demand-side instruments detailed above) in affecting food choices. This requires an integrated data system that incorporates layers of data from different sources:

- *the food environment* – keeping track of food products available on the market and sold by both the retail and food away from home sectors
- *consumer food choices* – tracking household food purchases and acquisition and linking them to individual food intake; and
- *food product information* – monitoring the evolution of food product ingredients or production methods, and the way in which information on these attributes is communicated to consumers.

Such a data system involves the integration of a range of data sources, including food intake surveys, food sales databases, food products databases, household panels, household budget surveys, and more (Giner and Brooks, 2019^[8]). In addition, some countries are capable of linking other sources of data to food data infrastructure, such as education surveys, national census results, tax information, or sectoral reviews; however, linking multiple databases is not straightforward and can be an obstacle to gathering high-quality nutrition data.

Despite these efforts, a number of gaps still exist in these attempts to integrate food data systems. Most notably, obtaining accurate information on consumer food choices continues to pose a challenge as survey participants tend to underreport their consumption of energy-dense and nutrient-poor food items (Macdiarmid and Blundell, 1999^[57]). Countries also face challenges to access food sales databases as this information is proprietary in nature and is made available by private data analysis companies such as Kantar, Nielsen, and GFK. Such underreporting combined with the cost of data access create gaps which hamper the ability of countries to build a comprehensive picture of what consumers eat, and limit governments ability to connect data sources that would provide answers to relevant policy questions.

Data concerning the purchase and consumption of food is central to a wide variety of policy areas, including the study of food insecurity and nutritional deficiencies. For example, food intake surveys are critical for an understanding of:

- food fortification programmes, such as the inclusion of iodine in salt and folic acid in bread
- the consumption habits of low-income and food-insecure households (Placzek, 2021^[12]), and
- the geographic availability of food in certain areas, including the study of food “deserts” and food “swamps”.¹⁴

Data is often collected that is relevant for formulating food systems policies, yet without a structured effort to organise and integrate data across different policy areas the full benefit of this data collection cannot be realised. Given that data collection spans a diverse set of areas such as agricultural, environmental, health, economic, trade, and competition policy, policy makers must negotiate a complex and often fractured data system. This is a significant wasted opportunity, and can lead to unnecessary duplications in cost. For example, there is significant scope to include questions concerning food insecurity for individuals and households participating in national dietary surveys. More efforts to standardise data sets would enhance the comparability of nutritional data collected by different organisations. Improved methodologies for collecting useful health data from emerging technologies would enable more refined assessments of the data. More attention on alternative methods for collecting information from remote, rural and Indigenous populations would help address the risk of collecting biased data from smartphones.

To address these issues, three food data system proposals previously identified for OECD Food Chain Analysis Network discussions remain relevant (Giner and Brooks, 2019^[8]):

- Examine options for national and international purchasing negotiations with major proprietary data companies with the aim of developing a better understanding of consumer food decisions.
- Consider the development of standardised food product information databases using barcode information, and of standardised guidelines for the information provided on food receipt tickets to ease the burden of collecting food purchase information.

¹⁴ Food “deserts” refer to areas without access to sources of nutritious foods, whereas food “swamps” refer to areas with a high rate of energy-dense and nutrient-poor fast foods and convenience foods. For more detail, see OECD (2021^[79]).

- Consider the development of new information sources tailored to government needs (this could be facilitated by digital technologies, in particular mobile apps).

5.1. Practical examples: The United States, Portugal, Finland, Australia, and Canada

Digital tools and technologies offer new solutions to these problems, and new directions for the three food data system proposals considered in late 2019. These solutions can be observed in five examples of country food data systems: the United States, Portugal, Finland, Australia, and Canada.

The United States' food data system in particular offers some useful lessons. This is an extremely sophisticated data system featuring a high degree of integration across traditional sources of food data (such as the Consumer Expenditure Survey, the National Health and Nutrition Examination Survey, and the United States food composition database). The system also matches this data with proprietary data in the form of retail sales and household scanner data collected by private vendors (IRI and Nielsen) for market research purposes.

This data is also combined with the USDA's food consumption survey, the National Food Acquisition and Purchase Survey (FoodAPS). Following the use of online data collection methods in 2015, FoodAPS will incorporate mobile app technology in its next survey. Specifically, a new smartphone app will help reduce respondent burden, and an alternative web-based Food Log using a barcode scanner will be available for households unable to use the smartphone app. The smartphone app will allow respondents to scan UPC barcodes of food and beverage items purchased at grocery stores and other retail outlets, and barcodes that match USDA databases will be assigned nutrients. The app will instruct respondents to photograph or upload receipts for food purchases directly into the app, reducing response time and facilitating easier access to household consumption data. There may be useful lessons for other countries to learn from this approach and to consider replicating in their systems, where appropriate.

Health Canada is using digital technologies to better understand pre-packaged food labelling information (including nutrition labelling information) available to consumers online such as the industry-developed [smart label](#) (which can also be accessed with smartphones by scanning QR codes on products in-store) and Health Canada's [Canadian Nutrient File](#). Health Canada also leverages various data sources and systems for monitoring changes in the food supply including: data on nutrition information, new products on the market, food formulations, ingredient innovations and market food sales. These examples demonstrate the possibility of maintaining food nutrition databases with up-to-date information and the benefits that can be achieved through these efforts.

The United States collects and stores information concerning the evolution of packaged food products with its Branded Food Products Database, which is similar to France's OQALI database (Giner and Brooks, 2019^[8]). Further information on the United States' experience with its food data system, particularly on the use and limitations of digital data aggregation and analysis, is outlined in Box 2.

Portugal's You Eat & Move platform uses digital tools to enable the collection and aggregation of food survey fieldwork and participant data, and is used to collect sociodemographic, anthropometric, food propensity, food security, and general health data. This data is collected from participants through an online platform, rather than through telephone or in-person interviews. Participants can input a detailed 24-hour digital food diary that is synchronised with food composition databases, allowing for easy access to nutritional information. Participants can also photograph the food they eat during the 24-hour period (instead of describing it), and photographs of receipts can be provided for food purchased, moving away from the need to collect hardcopy receipts.

The incorporation of digital tools into food survey processes has allowed Portugal to access detailed food system data. In addition, the use of digital tools leads to less onerous survey processes for participants, and results in data that can be aggregated and analysed more easily by government agencies and other interested parties. These tools enable survey respondents to provide a greater depth of personal demographic information, such as BMI and other data, which allows a more complete and accurate picture

of consumer food purchasing behaviour. Now that this system is in place, future surveys can be undertaken at a lower cost.¹⁵

In Finland, the National Institute of Health and Welfare (THL) draws from several data sources to develop its national food data system, including proprietary food sales information from Mintel and barcode-based management systems. Finland also has access to consumption data from its FinHealth Study (in particular its FinDiet Survey) conducted every five years, allowing for some comparison between food sales and consumption.

According to Finland, the data collection efforts focusing on food sales data have highlighted the limitations of existing food databases, and have shown the uncertainties inherent with calculating the nutritional content of food items from established databases. By using different tools, for example, Finland is able to obtain different nutrition results for the same food item or meal. This highlights common issues faced by many countries with the representativeness or quality of food nutrition databases; these databases often do not include information concerning the latest food products, and require constant updating to stay relevant. One approach to addressing these issues would be for countries to collaborate on comprehensive and accurate shared databases.

A forthcoming report on Finland's NordCoLa healthy choices branding scheme (Kara, 2019^[59]) will compile the results of food data system pilots, in particular the country's experience with Mintel, and the inherent uncertainties involved with food labelling and composition databases.

Like the United States, Australia is exploring the use of novel data sources (e.g. supermarket transaction data) to monitor trends in food sales and purchases, compare food purchasing behaviour between population groups, estimate aspects of diet quality, and provide information on the local food environment.

The Australian Bureau of Statistics (ABS) collects data on the consumption of specific food and beverage groups (for example, alcohol, fruit, and vegetables) through the National Health Survey and Household Expenditure Survey. The ABS conducted a comprehensive Nutrition and Physical Activity survey in 2011-12 that involved the collection of 24-hour dietary intakes. A similar survey is planned in 2023, with results expected to be published in 2025.

Since 2014, the ABS has been using retail transactional data to improve price measurements for the Consumer Price Index (CPI). Australia is taking active steps to make greater use of scanner data in this context, including aggregates of data captured by major supermarkets through barcode scanning at the point of sale. While these transaction data have the potential to enhance the accuracy and relevance of the CPI, the data also create methodological challenges for price index practitioners, in particular concerning methods for the aggregation of large volumes of data (Australian Bureau of Statistics, 2016^[59]).

Australia is currently investigating a range of new data sources. These include administrative data for publicly funded medical services and prescriptions, geospatial data to provide information concerning access to supermarkets and fast food restaurants, and using apps or online diaries for food diary information. These data sources, and the nature of questions Australia plans to ask survey recipients, reflect a similar approach taken in the United States' FoodAPS model, showing the benefits of information exchange between countries concerning common challenges.

In Canada, there is no systematic or on-going approach to collecting dietary intake data through population health surveys, however the government periodically purchases data on market food sales and acquires scanner data of retail food prices across the country by working with key food retailers. Currently, Canada is exploring the use of a new technology in dietary assessment and will be implementing electronic questionnaires in the 2021 national health surveys run under Statistics Canada's Canadian Community Health Survey (CCHS) programme. New methods being assessed include the use of mobile phones, web-based systems, apps and smartphones for measuring dietary intake and behaviours more objectively. For instance using photos of food consumed is being considered to improve the accuracy of dietary intake data.

¹⁵ It should be noted that the implication in accuracy in switching from in-person measurements of health indicators, such as blood pressure and BMI, to self-reported measurements via digital tools have not yet been fully considered. Given the opportunity to self-report, it is possible some respondents may underreport attributes such as weight.

5.2. Common challenges and limitations in food data collection

The examples of the United States, Portugal, Finland, Australia, and Canada all serve to highlight the common challenges and limitations faced by countries in the collection, aggregation, and analysis of food data, including data relating to food consumption, food availability, household expenditure, and related areas. This is an area of significant potential for cooperation and exchange of information between countries.

Anecdotal evidence assembled by the OECD highlights a number of challenges relating to national dietary surveys. These surveys are comprehensive and involve participants providing detailed dietary information in the format of multiple 24-hour diaries that specify the type and quantity of food items consumed. Participants also provide responses with respect to, for example, income and education levels, as well as physical information such as blood pressure and BMI. Often dietary intake data is collected as part of larger health promotion surveys (as is the case in Australia and Canada). This makes getting “space” on these already lengthy questionnaires for food consumption questions difficult.

Due to the substantial organisational requirements, national surveys of this type are conducted infrequently, meaning data can become less relevant and applicable over time. New Zealand, for example, has reported that the frequency of its national health and dietary surveys creates data gaps, particularly relative to children. The New Zealand Total Diet Study is conducted approximately every five years, with the most recent study completed in 2016. The US National Health and Nutrition Examination Survey (NHANES) collects data on an ongoing basis. Lags are more attributable to the time it takes to process these data and generate data files, a problem that technological innovation may be able to address.

While the frequency of these surveys is understandable given the cost of the exercise,¹⁶ the lack of recent data is a problem faced by many. New technologies such as Computer-Assisted Personal Interviews, Computer-Assisted Telephone Interviews, or mobile-based survey applications offer low cost solutions, but shifting to new survey methods also requires investments. Given the cost of conducting national dietary surveys, and the rapid developments in technology available to assist with conducting these surveys, countries must ensure that they allocate sufficient resources to conduct their surveys and analyse the resulting data, while also ensuring their data collection methods remain current.

Another issue faced by countries relates to consistency in the number of households and participants surveyed, and the types of questions posed. Countries are constantly revising and updating their survey methods to reflect specific areas of interest. While this revision contributes to a greater richness in data, it can diminish the comparability of results between surveys.

A 2018 review of the national nutrition surveys conducted in the 53 countries monitored by the WHO Regional Office for Europe examined this challenge in greater detail (Rippin et al., 2018^[60]). This review examined 109 nationally representative dietary surveys conducted across 34 of the 53 countries following 1990, and found that the most common survey methods used were multiple 24-hour participant recall and food diaries. This review showed that fewer than two-thirds of WHO European countries have dietary surveys satisfying national representativeness requirements, thus highlighting the implications of the varying survey methodology used and acknowledging that these differences may limit the scope for inter-country comparisons (Rippin et al., 2018^[60]). These findings illustrate the challenges faced by countries in planning and conducting nationally representative dietary surveys and incorporating the results in food data systems.

Despite these challenges, the 2018 review noted that nutrition and health surveys have become, over the last two decades, the main source of information for the assessment of dietary risk factors and physical inactivity in a systematic analysis of disease risk in 21 regions worldwide (Rippin et al., 2018^[60]). The review also indicated that although the use of digital technologies (such as web-based dietary assessments with self-administered record or recall methodologies) was limited during the period of assessment, these technologies have the potential to reduce data entry expenses and allow for data collection for large numbers of participants on multiple days over different time periods. The review points to myfood24 as one example of an online 24-hour dietary assessment tool that can be used for approved 24-hour recall or food diary methods (Rippin et al., 2018^[60]).

¹⁶ Australia, for example, conducted its National Health Survey in 2011-12 at a cost of approximately AUD 12 million.

Countries should collaborate as much as possible on their approaches to conducting dietary surveys – including the use of tools to reduce the burden of data analysis and response fatigue. Exchanging information can also contribute to solving common problems. Portugal's You Eat & Move platform offers a good example of the use of digital tools to solve the challenge of response fatigue and data specificity that could be usefully adopted by other countries.

Box 2. United States' food data system: Key trends and observations

The experience of the United States with its food data system, and in particular the use of this system to evaluate food policies at a wider level, illustrates several key trends regarding efforts to establish and maintain food data systems.

The USDA's Economic Research Service (ERS) has used proprietary household data and stored scanner data for more than a decade to research food policy. This involves over 120 000 households reporting food shopping decisions through handheld barcode scanners, and also incorporates store scanner data.

The ERS purchases this data from Information Resources Inc., a private company. Because this data is proprietary and is not publicly available, it can only be shared with third parties (such as universities and research institutes) within the terms of specified legal agreements. The use of this data by third parties leads to more research being undertaken for the benefit of policy makers.

Scanner data can be linked with food nutrition databases to provide a robust picture of the health implications of household dietary purchases. However, researchers must be aware of the limitations and requirements of this data. For example, the data is not representative to the same degree as national survey data or commercial databases such as Nielsen, and performs differently between foods sold by weight (e.g. fruits, vegetables, or meats) and packaged foods.

Despite these limitations, the US food data system features a high degree of integration between proprietary data, public administrative data, and FoodAPS data. This allows for granular and multi-faceted analysis, and allows for highly specific analyses using digital tools, including (USDA, 2020^[61]):

- [analysis of the purchasing power of supplemental nutrition program recipients](#)
- [analysis of price premiums consumers are willing to pay for organic products](#)
- [in-depth comparison of FoodAPS to other national food surveys](#), and
- [comparison of the spending habits of millennial households](#).

The ability to monitor and assess the flow-on effects of food policies is a major advantage of the food data system, and illustrates the benefits of integrating food intake, acquisition, sales, and product information, and linking these with wider sources of data. This system is helpful in monitoring and evaluating existing policies, to assist policy makers to design and implement policy, and to shape their understanding of the *status quo* concerning questions around household nutrition and wellbeing.

The costs involved are significant. Operating a food data system involves the purchase of proprietary commercial data, and requires investment in data storage, security, governance, and expertise. To get maximum value from this investment, the ERS is expanding communities of expertise, including a partnership with the Coleridge Initiative, a university-based start-up that works with over 100 federal and state agencies to develop data analysis capacity.

A data system of this level of sophistication cannot be the goal for every country. For the majority, the level of investment in capacity, and the expertise required is simply too great. Countries should consider, however, which aspects of this system may be appropriate to replicate (such as Australia's use of relevant FoodAPS questions in its National Health Survey).

6. Practical obstacles to delivering demand-side policies via digital tools

Digital tools and technologies hold significant promise as instruments to facilitate the effective design, delivery, monitoring, and evaluation of demand-side policies increasing consumer nutritional health and the sustainability of the food system. However, these tools are not a solution unto themselves; to succeed, they must be tailored to fit a defined need or policy problem, and must be designed with a specific goal in mind.

The review of existing efforts to use digital tools has identified several practical obstacles faced by countries, as well as several potential solutions.

6.1. The capability and capacity of governments to adopt digital tools is mixed

Digital transformation continues to be an area of focus for all countries worldwide (UNDP, 2019^[62]) but countries have mixed results. Despite the ubiquitous availability of data, the expansion of connectivity between private and public bodies and actors, and the significant increase in processing power over the last two decades, governments continue to face major capability and capacity challenges when it comes to the adoption of digital tools.

For many governments (as well as private actors), the focus is too much on digitisation (adopting digital processes to improve the speed and convenience of their *status quo*), rather than digitalisation (a fundamental reorientation of core functions and processes to reflect the capabilities inherent in digital tools) (Ross, Beath and Mocker, 2019^[63]). Countries need to focus on understanding how digital technology can redefine engagements between the state and the public, and need to deliberately build government capability to adopt digital tools. The OECD has its “Going digital” project aimed to build coherent and comprehensive policy approaches to bring about stronger and more inclusive growth from the digital revolution (OECD, 2020^[64]).

In practice, this means developing operational capacity and familiarity with digital technology, building a clear framework of accountability for digital engagement with the public, and sharing systems of best practice between countries. For many countries, this process has long been underway, although many countries with high capability at the government level still experience challenges in taking advantage of digitalisation.

A major aspect of this challenge relates to the secure collection, aggregation, flow, and storage of data, particularly in the context of rising global concerns with privacy and accountability for personal data use (OECD, 2020^[65]). Inherently complex data infrastructures such as Digital Traceability Systems require governments to manage the data needs of multiple parties and stakeholders, and to actively manage the timely flow of accurate information. Even countries with comparatively simple food data systems face hurdles when it comes to the safe and secure management of user data, particularly private data.

Mu et al. (2019^[16]) noted that despite the potential uses of digital technologies in pursuing nutritional or environmental food system policies, policy makers should exercise caution concerning data privacy and the intrusion of technology into the lives of citizens (Mu, Spaargaren and Oude Lansink, 2019^[16]). Countries advancing demand-side policies making use of digital technologies should bear these concerns in mind. Principles concerning the privacy and integrity of user data, including the principles outlined in the OECD Privacy Framework (OECD, 2013^[66]), the OECD Recommendation of the Council on Digital Government Strategies and the data privacy principles of the OECD’s Data-Driven Public Service (DDPS) model (OECD, 2019^[67]) provide guidance in this area.

For example, countries should bear in mind recommendations 1, 9, and 10 from the OECD Recommendation of the Council on Digital Government Strategies:

- the need for transparency, openness and inclusiveness of government processes and operations (specifically, through effective accountability regulations);
- the need for clear business cases to sustain the funding and focused implementation of digital technologies projects; and

- the need to reinforce institutional capacities to manage and monitor the implementation of digital projects (including risk management, evaluation, and the measurement of effectiveness) (OECD Recommendation of the Council on Digital Government Strategies, 2014^[68]).

6.2. User capacity to adopt digital tools is also mixed

The capacity of individual users to adopt digital tools is mixed. Despite widespread uptake of digital technologies such as smartphones and web-based applications around the world, user capacity to adapt to the use of digital technologies is not always sufficient to ensure the smooth introduction of public policies or data collection activities involving digital tools. This has the potential to exclude some individuals from experiencing the benefits of demand-side policies, for example food system actors without the resources necessary to participate in digital schemes for the certification of credence goods. For example, Australia has noted one of the reasons digital labelling was not pursued is that not all consumers have access to the tools necessary to access digital nutritional information. Therefore, all mandatory food information must still be included on physical labels.

This question of user capacity is also highlighted by the USDA's experience with its food data system. Household food scanner data is not always complete, and can be underreported for certain items. These patterns are due in part to participant capability to adopt the digital tools used in the collection of food purchase data (Einav, Leibtag and Nevo, 2008^[69]). This can introduce the risk of collecting biased food and dietary intake data.

Ireland reports a similar obstacle associated with gathering quality data from food system actors participating with its Origin Green initiative. This is due to limited technology literacy amongst some primary producers of food, and of general fatigue with the variety and nature of digital tools participants are required to use.

For demand-side policies involving the use of digital instruments to be most effective, countries must pay particular attention to ensuring adequate access to digital technologies on behalf of consumers and food system actors from a range of demographic and socio-economic backgrounds. This includes considering the costs to food system actors, consumers, and government of transitioning to digital tools and technologies (for example, digital traceability systems), and the unintended consequences that may follow as a result (for example, increased downstream costs for processors and farmers).

6.3. Data cost and complexity can be prohibitive

Integrated food data systems can involve a prohibitively expensive and complex level of data. For example, the US food data system not only involves significant cost in terms of purchasing proprietary data from market research companies, but also in terms of IT expenditure, data storage and access, specialised software and coding requirements, and organising the many terabytes of data into a structured database. The food data system also requires a number of permanent staff with expertise and skills in data science and complex systems. Given that government agencies are often not able to offer the same kinds of salary incentives, attracting and retaining staff with this expertise can be challenging.

This food data system involves handling proprietary commercial data, so USDA must strike the right balance between transparency and maintaining a trusting relationship with vendors concerning the treatment and use of this data. For these reasons, the use of food data system technology may not be suitable for every country, particularly for low-income countries without a depth of sectoral experience in complex data systems (Muth et al., 2020^[70]).

6.4. Digital tools require targeting to address specific policy problems

A theme running through the many examples of demand-side nutritional health and food system sustainability policies delivered through digital tools is that of localisation: in order to increase the effectiveness of policy delivery, these tools must be designed with a clear and consistent purpose, and must be tailored to suit the local customs, preferences, and habits of target users. In developing these digital tools, countries must have a thorough understanding of the information they are attempting to collect or distribute, or the behavioural changes they are trying to promote. The relative weight of different factors

in consumer decision-making must also be considered, as digital tools must address the priorities of consumers (for example, price motives vs. ingrained habits). Countries must also consider the rapid pace at which digital tools and technologies evolve and change, as this evolution may risk outpacing a country's ability to reflect these changes within their chosen tools and technologies. Users and consumers may become accustomed to certain features and functions in digital tools for personal use, and where these attributes are not reflected in a country's tools, these tools may be less effective.

A Wageningen University study examining the preferences of Chinese and Dutch consumers using a mobile app highlighting the sustainability of food choices when dining out illustrates this point (Mu, Spaargaren and Oude Lansink, 2019^[16]). The use of the same app resulted in different rates of engagement and behavioural nudging for the two groups of consumers. These groups exhibited different levels of familiarity and comfort with the usage of mobile-based apps in the dining out experience, different values and priorities in terms of sustainability awareness, contrasting baseline diets, and different preferences concerning the use of digital technology in the context of food consumption decisions (Mu, Spaargaren and Oude Lansink, 2019^[16]).

Mu, Spaargaren and Oude Lansink (2019^[16]) also noted the different definitions of sustainability between the two groups, highlighting the ambiguity and complexity within the term, and with users' practical experiences in making sustainable choices.

This illustrates the need for digital tools to be tailored and shaped to match the local user context, and to reflect the communication and engagement preferences of target groups. For example, the United States MyPlate website offers a high degree of customisation and targeting in the provision of nutritional advice to different user groups, including low-income households, and recipients of supplemental nutrition programmes (USDA, 2020^[71]). Canada's Food Guide website provides numerous tips including on how to purchase foods consistent with a healthy diet on a restricted budget, as well as healthy eating tips for different stages of life.

Another useful example is the SOLAAL scheme in France, which has achieved a strong rate of participation and activity in countering food waste through a combination of practical technology and fiscal incentives reflecting a high degree of detailed knowledge concerning the intended user base (i.e. farmers, food supply companies, and community organisations). This example demonstrates the advantage of having a tightly defined set of objectives in developing digital tools; if an application is overburdened with features and competing policy objectives, it is less likely to function cleanly and efficiently.

6.5. Digital tools might offer no improvement over existing tools

The four-track approach to demand-side policies aims to influence consumer behaviour largely through providing information. While digital tools can assist in the flow of this information (for example, by providing nutritional information through labelling systems connecting users to food databases through mobile apps), changes in food prices lead to stronger incentives for changes in choice.

For example, the most significant impact of the United Kingdom's soft drinks levy was to impose additional costs on consumers. Even though information concerning the goals and objectives of this levy was communicated to consumers through digital media, the main driver of behavioural change was a shift in the prices faced by consumers. While digital tools may assist in the delivery of demand-side policies (particularly in the ease of communication), the use of these tools may not result in an increase in policy effectiveness.

Digital tools are capable of making the collection of food data faster and more accurate, still some stubborn and widely acknowledged problems may be beyond the reach of such tools. For example, despite the use of sophisticated databases, smartphones, and handheld scanners, it is likely that participants in the United States' FoodAPS survey will continue to underreport the household consumption of foods associated with unhealthy dietary choices, such as energy-dense and nutrient-poor foods (Giner and Brooks, 2019^[8]).

7. Digital tools and platforms as potential solutions

Digital tools and platforms offer a number of potential demand-side solutions to nutritional health and food system sustainability problems. As examined in Section 5, these solutions involve the accurate and unencumbered flow of information between consumers and food system actors, and, notably, allow for the emergence of markets for premium goods. Digital technologies can also support international and cross-border cooperation in food systems, notably through establishing systems for the convenient exchange of product origin information, as well as shared labelling systems.

Existing markets for differentiated food products suggest some consumers are willing to pay a premium for high-quality or sustainable products. The additional value resulting from this market can in principle be shared throughout the food supply chain (including farmers and food suppliers), particularly through the use of digital technologies allowing for greater transparency and product traceability.¹⁷ The use of Digital Traceability Systems is particularly relevant here.

The use of digital tools also presents significant potential in promoting centralised or shared standards of sustainability for food chain actors. For example, farmers and food suppliers could communicate their compliance with land use practices contributing to greater soil health and diminished GHG emissions to consumers via mobile apps or digital labelling schemes (such as QR codes) (USDA, 2017^[72]).

As shown in the many examples of digital tools aimed at offering nutritional guidance and information for consumers, there is considerable potential to offer educative interventions and behavioural nudges through instruments such as mobile apps, social media engagement, and community platforms. Instruments offering a blend of these features, together with fiscal incentives (such as Canada's Carrot Rewards app) demonstrate considerable potential in shifting consumer behaviour, as they offer a blend of features and support identified in OECD analysis as contributing to improvements in weight loss and individual health (OECD, 2010^[73]).

There is considerable potential for the development of an internationally shared customisable mobile-based application offering nutritional guidance and advice, which could be tailored to suit the communication preferences of the specific target group, and prevailing dietary health trends present within different countries. Such an application would involve shared design elements, such as a standardised user interface able to be tailored to suit different languages and communication preferences.

In gathering and synthesising vast amounts of user data, these digital technologies also allow for the development of new demand-side policies promoting nutritional health and food system sustainability. For example, though proprietary in nature, the collection of user habit information by online food delivery apps such as Uber Eats and Deliveroo could offer significant additional insights into drivers for nutritional health, and the demand-side policies needed to promote healthier dietary choices for individuals.

There is also significant potential in efforts to pair food information databases from disparate sources, as household nutrition data is most useful when combined with extant data sets. For example, the USDA's "purchase to plate crosswalk" initiative is an attempt to pair household and store food scanner databases with wider USDA nutrition databases (Carlson, 2019^[74]). This project is a way to increase the reliability and usefulness of food systems data, and demonstrates the additional analytical capabilities involved with integrated data systems.

The USDA's data analytics training partnership with the Coleridge Initiative¹⁸ illustrates the potential for digital tools to solve outstanding issues relating to nutritional health and food system sustainability. By expanding the pool of data analysts capable of leveraging the food data system, the USDA is facilitating the broader use of this system, increasing the return on investment generated by this system, and is increasing capacity to investigate and solve complex problems. To enhance food research capability in the United Kingdom Department for Environment, Food and Rural Affairs (DEFRA) is considering partnering

¹⁷ For example, the USDA Food Safety and Inspection Service is working with IBM to explore the use of blockchain technology in modernising food export certification. See <https://www.foodqualityandsafety.com/article/ibm-to-create-blockchain-technology-for-fsis/>.

¹⁸ See, for example, the Coleridge Initiative's Applied Data Analytics programme, <https://coleridgeinitiative.org/training>.

with the [Consumer Data Research Centre](#) where the Universities of Leeds, Oxford, Liverpool and College of London are using consumer data from retailers to undertake academic research (OECD, 2020^[18]).

Finally, the experience of the United States with its FoodAPS survey illustrates the capacity for digital tools to ease the perennial problems of survey response burden, delays in providing information, and general survey fatigue. By incorporating digital instruments such as mobile apps and handheld scanners in its survey practices, the United States can better facilitate access to accurate and timely information concerning household nutritional habits, while minimising the response burden for participants. The United States notes the use of digital tools as an ongoing area of development in relation to FoodAPS.

The use of individual digital tools in delivering demand-side policy interventions is also a question of broader government approaches to digital technologies. To successfully transition to digital platforms, countries must establish clear systems of governance; develop skills and capabilities in the use and oversight of digital tools; support a data-driven public service; and establish an open government data strategy (OECD, 2019^[75]). The OECD's Data-Driven Public Sector model, particularly the six-part approach to data governance in the public sector focusing on leadership and vision; capacity for coherent implementation; regulation; data value cycle; data infrastructure; and data architecture, provides insights into this strategy (OECD, 2019^[67]).

As noted in the UN 2019 Global Sustainable Development Report, countries must focus on establishing clear lines of communication, accountability, and governance over food systems (UNDP, 2019^[62]). Digital tools (such as integrated food labelling systems) have the potential to assist significantly in this area.

This report offers an opportunity for countries to discuss the wider potential uses of digital tools and technology in the design, implementation, and monitoring of demand-side policies for nutritional health and food system sustainability. These technologies also have the potential to empower greater citizen participation in the design and implementation of these policies.

7.1. Policy evaluation using digital technologies

A significant advantage of digital tools in the context of demand-side policies is the ongoing monitoring and evaluation of policy interventions that is possible (Box 2).

The lack of dependable and integrated food system information is an issue for many OECD countries wishing to monitor food availability for domestic consumption, track average food intake in comparison to national guidelines for dietary consumption, and track trends in household food spending, and the nutritional composition of food items consumed (Giner and Brooks, 2019^[8]). Digital technologies offer a way to address this gap. For example, by tracking engagement with interactive nutritional guidance tools such as Hong Kong, China's NuCal app, the United States MyPlate app, or Ireland's Weight-Mate app, countries can gain a detailed profile of the nutritional and food environmental challenges facing individuals, and can incorporate this information in the design and delivery of wider policies. Countries must also continue to build and maintain public confidence in the use of personal data by anonymising all relevant data and observing the privacy recommendations such as those of the OECD Privacy Framework (OECD, 2013^[66]), the OECD Recommendation of the Council on Digital Government Strategies and the data privacy principles of the OECD Data-Driven Public Sector model (OECD, 2019^[67]).

As the suite of USDA ERS monitoring and evaluation reports demonstrates (USDA, 2020^[61]), the United States food data system offers a way to track the impact of specific demand-side policies in detail, and to use this analysis to inform the design and implementation of future policies. While this food data system involves significant investment in time and resources, it can be seen as a robust and powerful way to measure policy effectiveness and cost-benefit analysis (Muth et al., 2020^[70]).

8. Conclusion

The use of digital tools and technologies in demand-side policies is characterised by rapid change. Countries continue to dedicate substantial resources to the collection, analysis, and availability of food system data, and to pursue policies that address the challenges of modern health and sustainability via digital instruments.

An important priority for countries using demand-side policies should be to align their operation of food systems with the incentives shared by consumers and food-chain actors. In practice, this involves the following uses of digital tools and technologies.

- Correcting information asymmetries, notably by providing consumers with accurate information concerning the health and sustainability attributes of the products they purchase.
- Speeding up the exchange of data between food system actors (e.g. between suppliers and consumers).
- Creating transparent markets in which premiums are awarded for credence goods (including through the use of Digital Traceability Systems).
- Collecting accurate and comprehensive food system data to inform future policy (including by integrating fragmented data systems and reducing the response burden faced by national survey participants).
- Monitoring and evaluating the effects of demand-side policy interventions.

In addition, countries could use digital tools to address divergent private-public incentives, including the transmission of health and sustainability information designed to internalise any negative externalities involved with the purchase of energy-dense and nutrient-poor foods or unsustainable food products, and the use of tailored platforms to guide and educate consumers to make healthier nutritional choices.

As the capacity for harnessing increasing volumes of food system data continues to increase, countries will look for new ways to co-operate and share information concerning the use of digital tools. Although countries continue to face significant health and sustainability challenges, the evolution of digital technologies such as tailored mobile applications and traceability systems offers promising ways to address these challenges.

Nevertheless, as the examples shown here have demonstrated, digital technologies are not a silver-bullet solution. Instead, they offer the opportunity to address deficiencies in the delivery of demand-side policies, such as reducing both information gaps and implementation burdens.

Due to the powerful and potentially invasive nature of these technologies, the use of digital tools can also give rise to concerns regarding the security and privacy of user data. Countries must actively monitor industry developments in this area, and must ensure that the use of digital tools is in accordance with relevant national legislation and international principles, such as the OECD Privacy Framework (OECD, 2013^[66]). Appropriate use of these tools is an opportunity to build public trust in the handling of anonymised personal data according to the data privacy principles of the OECD Data-Driven Public Sector model (OECD, 2019^[67]).

The majority of demand-side measures involving digital tools requires further long-term monitoring and evaluation to prove their effectiveness in creating lasting changes to the food system. At present, this is an area that needs improvement in many countries. There is significant potential for collaboration and information sharing (including the exchange of case studies and evaluations) among countries.

In light of the trends and opportunities described in this report, it is recommended that countries undertake the following.

- Foster inter-country collaboration by:
 - discussing opportunities for collaboration on the use of digital tools in pursuing demand-side food system health and sustainability policies, and

- continuing to exchange best-practice guidance, case studies, and effectiveness analyses on the use of digital tools, and their ability to address nutritional health challenges within food systems;
- Improve food data systems by:
 - considering the development of standardised food product information databases using barcode information (including requirements for all new food products to be included within these databases) as well as standardised guidelines for the information provided on food receipt tickets to ease the burden of collecting food purchase data;
 - examining key examples of digital tools used in national nutritional surveys (most notably the United States' FoodAPS survey and Portugal's You Eat & Move platform) and considering the suitability of duplicating these approaches; and
 - studying advanced food data systems and examining opportunities to learn from the design and operation of these systems, including the challenges involved in integrating data from several commercial and public sources.
- Conduct outreach with the private sector by:
 - consider working with online retailers and advertisers on behavioural prompts for users to consider healthier dietary choices when shopping for food online;
 - examining options for national and international purchasing negotiations with proprietary data companies with the aim to develop a better understanding of consumer food decisions (e.g. consider options that would make information available to universities and research institutes);
 - working with training institutes and universities to build communities or practitioners able to aggregate, analyse, and assess food systems data, and consider the use of scholarships to attract academic candidates to this area; and
 - examining the possibility of supporting private sector initiatives having complementary health and sustainability goals (e.g. collaborating with private food waste minimisation initiatives such as Winnow or Too Good to Go).

Annex A. Overview of existing digital instruments that deliver consumer health and environmental sustainability initiatives

Intervention name (country / territory)	Intervention type	Target group(s)	Years active	Engagement / evaluation of available data
Consumer health digital instruments				
MyPlate nutrition website / app (United States)	Digital app / dietary guidance / budgeting advice Includes component addressing food waste	All age groups / households	2011-present	Yes
NuCal nutrition calculator (Hong Kong, China)	Digital app / nutrition database encouraging reduction in processed food consumption	Children / adults Household food purchase decision makers	2010-present	Yes
Health Star Ratings (Australia and New Zealand)	Nutritional labelling / guidance delivered through educational videos	All consumers	2014-present	Yes
Healthy Food Partnership (Australia)	Promoting and communication information about appropriate portion sizes Includes industry food reformulation scheme	Public	2015-present	No
VegEze app (Australia)	Digital app promoting increased vegetable intake amongst adults	Adult consumers	May 2020-present	Yes
Weight-Mate (Ireland)	Safefood and Irish Nutrition and Dietetic Institute Weight Loss App (dietary and exercise advice / counselling)	Public	January 2016-present	Unclear
Organic Food Assistance Programme (Korea)	Subsidy and digital voucher supporting access to organic food for pregnant women and new mothers	Pregnant women and new mothers	January 2020 – present	Forthcoming
Food Voucher Assistance Programme (Korea)	Subsidy and digital voucher supporting access to fresh foods for low-income households	Low-income households	September - December 2020	Forthcoming
OQALI (France)	Food reformulation project	Consumers, food industry reps	2017-present	Yes
Open Food Facts (France)	Open source food product database	Consumers	2012-present	Yes
GS1 CodeOnline Food (France)	Digital food product information database	Industry groups, consumers	2019-present	Yes

Intervention name (country / territory)	Intervention type	Target group(s)	Years active	Engagement / evaluation of available data
NutriScore (France)	Food nutrition and health database (information available digitally and delivered via social media campaigns)	Public	2017-present	Yes
Eatwell Guide (United Kingdom)	Dietary guidelines delivered via website and social media	Public	2016-present	Yes
Fineli (Finland)	National food composition database (includes dietary guidance, customisable food diaries, and interactive guides)	Public	2013-present	Yes
Strategy for Food, Meals, and Health (Denmark)	Dietary guidelines delivered via website and social media	Public	2018-present	Unclear
Canada's Food Guide website (Canada)	Mobile-responsive website / dietary guidance / actionable advice / educational videos / recipes	Public, health professionals, policy makers	2019-present	Yes
Carrot Rewards (Canada)	Health and nutrition advice / counselling app (Note: Previously administered by state and federal government, relaunched under private ownership)	Public	2015-2019 (possible 2020 relaunch)	Yes
Food system sustainability digital instruments				
Sustainable Beef and Lamb Assurance Scheme (SBLAS) (Ireland)	Bord Bia scheme of sustainability assurance for consumers – communicated via social media messages / advertorials to consumers	Consumers and participating farmers	2012-present	Yes
FernMark (New Zealand)	Digital credence labelling scheme (focus on product origin information) Uses QR code technology	Overseas consumers of premium goods	1996-present	Yes
Origin Green (Ireland)	Digital credence labelling scheme (focus on food and drink sustainability) Uses QR code technology	Accredited farmers and food industry actors	June 2012- present	Yes
FoodKeeper app (United States)	Advice regarding storage / consumption of food	All age groups / households	April 2015	Yes
SOLAAL (France)	Food waste / loss avoidance scheme, features tax credits for participating farmers (Note: SOLAAL is a private charity, however the scheme	Farmers, food aid organisations	2013-present	Yes

Intervention name (country / territory)	Intervention type	Target group(s)	Years active	Engagement / evaluation of available data
	features the use of government tax credits as incentives for participation)			
Food data digital systems				
ERS InfoScan (United States)	Comprehensive food data system involving purchased proprietary data matched against national survey data System used to inform, monitor, and evaluate US food policy (Box 2)	N/A	2008-present	Yes
You Eat & Move (Portugal)	Electronic platform for computer- assisted data collection	N/A	2015-present	Yes
NMR / NKMT (Finland)	Labelling and composition databases	N/A		Yes
Canadian Nutrient File (Canada)	Labelling and composition database	N/A		
smart label	Labelling and composition database Uses QR code technology (Note: developed by food manufacturer associations in the United States and Canada)	N/A	2015 (in the United States) and 2017 (in Canada) - present	

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