DIGITAL LABELLING IN THE EU STATE-OF-PLAY REPORT

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Executive Summary

This state of play report has been prepared in support of FoodDrinkEurope's Action Plan for Sustainable Food Systems, specifically when it comes to deepening the understanding of digital labelling. As a starting point, this report takes the Joint Research Centre's 2022 literature review on means of food information provision other than packaging labels. Desktop research was used to capture the following elements as essential in expanding the evidence based JRC report:

- Most recent academic (peer-reviewed) research providing insights on digital carriers of information for consumers, specifically the most recent research published after 2018
- Insights and positions of leading consumer protection organisations on the issue of digital labelling
- Existing European regulatory frameworks enabling deployment of digital carriers of information and those that are in the pipeline
- Self-regulated initiatives in the food and drink industry
- International standards

Through the captured state of play, this report provides an analysis of the digital labelling landscape and is intended to serve as basis for expanding the conversation around policy approaches for all the food and drink industry, in support of a harmonised and coherent approach to digital labelling. The top-line findings of the report are summarized just below.

Most recent research and consumer protection organizations

The most recent academic research has captured some of the impact of the COVID-19 pandemic and on accelerated uptake of digital technologies in everyday life, and specifically the use of QR codes for the digital COVID-19 passport. While concerns raised by consumer protection organizations around digitalizing delivery of information to consumers broadly fall in the category of risk of exclusion and confusion of consumers, the research shows that it is digital natives and high-involvement consumers who are interested in accessing more information on products who tend to use digital labelling more than average consumers. Some research suggests that gender, age, education and socioeconomic status might not have significant influence on intention to purchase product with a QR code applied to it. Additionally, the presence of QR codes on products correlates to increased consumer comprehension and confidence in the product. Use of blockchain technology and the corresponding digital labels are associated with consumers' higher trust level in product claims.

Existing European regulatory frameworks implementing or proposing implementation of digital labelling

Digital labels have been broadly implemented as a solution to provide access to product information for consumers across European existing and proposed legislation, including in some of the key pieces of legislation that impact the food and drink sector already but also a wide variety of other products. Along with the most prominently perceived COVID-19 passport, these initiatives include the Common Market Organization Regulation amendments introducing digital labelling for aromatized wine; the Regulation on the common organisation of the markets in fishery and aquaculture products providing for display of mandatory information on specific fishery and aquaculture products; rules pertaining to digital labelling of centrally authorised medicinal products; the Regulation on energy labelling of energy-related products; the Regulation on labelling of tyres. The pending legislative proposals also lean on the use of digital labelling, like in the case of the batteries and waste batteries regulation proposal, the ecodesign regulation proposal, the proposal for a packaging and packaging waste regulation, and the EU fertilizing products regulation proposal. This list is by no means exhaustive, but it indicates the know-how and the legislative ability of the EU to deploy digital labels across a wide variety of products. It also signals that

the wide variety of applications of digital labels require defining a coherent, standardized approach to digital labelling so that it is product-agnostic, benefits consumers and the single market.

Self-regulated initiatives in the food and drink industry

The increased demands for transparency for consumers, in the absence of an overarching approach to digital labelling, has already led to development of different self-regulatory initiatives to provide additional product information to consumers. Such examples include the U-label platform for wine and spirits companies, launched by the Comité Européen des Entreprises Vins (CEEV) and spiritsEurope; Pernod Ricard's eLabel; Whisky Barrel's digital provenance certificate; and Mondelēz International's Snacking Right pilot programme implementing QR codes on-pack products to provide consumers with further information.

International standards

The Codex Alimentarius Commission has been working on the topic of digital labelling since 2017, with the work nearing a culmination point at the 47th session of the Codex Committee on Food Labelling taking place in May 2023, when Draft Guidelines on the Use of Technology to Provide Food Information were discussed.

Overall, while the findings of this report aim to expand the evidence base established by the JRC report, they also indicate the need for the EU to delve with the question of bringing coherence and standardization of digital labelling for food and drink products, and delivering a broader horizontal approach. The multitude of examples of digital labels already being put in place by either the legislators or the industry are encouraging as the work on this pivotal issue does not need to start from a blank slate but on the learnings and understanding of digital labelling systems already created, while keeping in mind that digital technologies have shifted the consumer landscape and consumers' digital literacy will continue to expand.

1. Introduction

The Fourth Industrial Revolution, representing a fundamental change in the way societies and businesses' function, has been delivered by technological advancements in the digital space that are commensurate with those of the first, second and third industrial revolutions. Both the disruption and digital enablement have driven different EU policies and laws regulating the digital space and boost innovation that may deliver benefits for society and global competitiveness of European industry. Digital activation of consumers accelerated during the pandemic, and regulators have in turn taken note of the advantages that the digital data space offers to providing access to information to the consumers, like in instances where digital labelling technology is already applied. With the lessons from the COVID-19 pandemic, future-proofing EU against challenges that will test its resilience is at the heart of modern-day policymaking. Innovation in digital context and how to regulate it in a way that balances opportunity and risk, is something that the EU has shown it can certainly deliver on. The COVID-19 digital certificate and the benefits it delivered to citizens, countries and different business operators world-wide as a safe, reliable and easy-to-use standard is just one, however remarkable, example of that ability.

A McKinsey survey from June 2020 of more than 20,000 European consumers found that the COVID-19 pandemic in Europe has compressed and accelerated digital adoption so that progress that would otherwise take years happened over the course of months. Digital adoption in Europe has jumped from 81 percent to 95 percent at the start of the pandemic, a jump that would otherwise require two to three years in most industries at pre-pandemic growth rates. Additionally, the pandemic had reduced the digital gap between countries, with the highest and lowest digital adoption rates falling from 32 percentage points to just 10. The increasing role of digital technology and data in everyday life of consumers is an undeniable fact. The recent breakthrough launch of ChatGPT and integration of AI in search engines that are one of the key veins for consumers to access information they need are just a couple of examples of how far digital technology and use of data has come. In the increasingly digital world of digitally savvy consumers, it is necessary for policy and policymakers to consistently support innovation and future-proofing of the food and drink industry including through regulatory solutions that work for the industry facing an increasing pressure from consumers to provide always accessible and transparent sources of trusted information on products.

Against this backdrop of data, digital technologies and innovation the EU is set to unlock, the potential to apply digital carriers of information on products in order to improve access to consumers has been taken up by businesses and regulators. Digital labelling has been a long-running policy topic, as it has been an example of innovative use of technology that enables transparency, tracking and access to information that is game-changing for the consumers. The question of alternative sources of food information appeared in connection with the Farm to Fork (F2F) Strategy which aims to improve the accessibility of food information to consumers to support choice of healthy and sustainable diets and improve health outcomes of dietary choices. While the Food Information to Consumers Regulation No. 1169/2011 (Arts 12 and 13; "FIC") requires that mandatory food information has to be provided on the package or a label attached to the packaging, supplementary information for consumers may be placed on the label (if there is room) or be provided digitally.

In order to explore new ways of providing food information to consumers through other means, including digital, the European Commission's ("Commission") Joint Research Centre's ("JRC") report published in September 2022, *"Literature review on means of food information provision other than packaging labels"* ("JRC report"), is intended to provide evidence-based scientific support to the policymaking. The

JRC report is part of a broader package of four scientific studies related to food information to consumers and delivers a literature review on the matter of alternative sources of food information, particularly via digital means, available in the marketplace apart from packaging labels.

The JRC report was commissioned to explore new ways of providing food information to consumers, and looks at important questions about digital labelling. It provides insights into digital labelling and opens a valuable evidence-based discussion on the prospects of future of policymaking around providing food information to consumer.

This report follows this path and aims to expand upon the findings of the JRC report by looking into the latest scientific (peer-reviewed) research, EU regulations, and practices with respect to digital labelling to capture the widest possible perspective on digital labels. The ambition of this report is to constructively address some of the limitations of the JRC report and provide a beneficial account of digital labelling in a world that has been marked by the new digital habits and practices following the massive acceleration of digital adoption driven by the COVID-19 pandemic as mentioned above. In order to complement and expand upon the findings of the JRC report, this report considers the most recent and relevant research on the topic of digital labelling, examples of where and how digital labels have been implemented or have been proposed, and self-regulatory efforts from the industry and summarizes the state of framing of the discussion at the international level.

The JRC Report: Research Findings, Limitations and Ways Forward

The JRC report is built around three questions:

1) What means of food information provision apart from packaging labels do consumers use?
2) What means of food information apart from packaging labels do consumers want?
3) How does food information delivered through means other than packaging labels influence behavioural outcomes, such as food purchase intentions and behaviours?

The JRC report's findings, in response to the above questions, are framed so to suggest that means providing direct access to food information, such as menu labels, shelf labels, and point-of-sale (POS) signs, are better options to influence consumers towards healthier behaviours in comparison to online means that require external tools to access the information, such as QR codes or website links. Additionally, it is suggested that because consumers value food information that is easy to process and useful, information that is immediately and visually available at the marketplace can be more effective to facilitate the choice of healthy and sustainable diets in comparison to online means of food information provision. The findings suggest that, if not provided on the food package, food information should be directly visible in the marketplace to be able to influence consumers.

Regarding digital carriers of information, the JRC report holds that adoption of an *exclusive* display of food information using digital means seems inappropriate due to lack of scientific evidence on how these means are used by consumers in the marketplace or on their behavioural effects. Online means, according to the JRC report, seem to be an interesting tool to provide food information that goes beyond elements presented on packaging labels, such as a complete list of ingredients or traceability information, but it is underlined that digital means do not seem to be the best option to improve accessibility of food information that enables consumers to make informed food choices. The JRC report qualifies providing food information exclusively through digital means as "seem[ing] risky" (p.78)[1] because it may permit access only to consumers who use mobile devices and who are also motivated

[1] The page numbers listed in this section are based on the JRC report's own pagination.

to scan QR codes or open weblinks while restricting access from others. The JRC report in its conclusion favours on-pack and in-store labelling which are claimed to be preferred by consumers over digital alternatives.

The JRC report recognizes four limitations that have shaped its findings:

- Limited possibility of cross-study comparisons due to vast difference in methodology and themes.
- There was no formal quality assessment of the evidence or risk of bias across the selected articles.
- Article screening and eligibility assessment were conducted by a single author, with a systematic approach being used to limit potential bias in article selection.
- Studies with null results were not captured due to publication bias, meaning that only those with significant results were likely to be published and thus captured.

These limitations acknowledged by the JRC report itself provide a useful starting point for subsequent stakeholders to build upon supplemental, comprehensive evidence-based research. Above all, the JRC report recognizes that substantially more research is needed to provide a comprehensive review of digital labelling solutions, and to compare the provision of food information through labels and digital means (p.80). This is the task undertaken to a point by this present report, as ongoing research continues to extend the understanding of uptake and acceptance of digital means of communicating information.

While keeping them in mind, this report further highlights additional questions that it attempts to answer as a complementary review to the one provided in the JRC report. Below are key areas that have been identified as relevant to look at, as a way forward in widening the evidence-based debate around ways to deliver food information to consumers and more precisely digital labelling.

1. **What does the most recent peer-reviewed research show about digital labelling?**
    - Out of the 40 studies on digital labelling considered in the JRC report, only 6 are dated 2021, while the other 34 studies date from 2020 or earlier.
    - The 6 most recent studies included in the JRC report pertain to blockchain technologies (3), augmented reality (2), and only one article is about food mobile apps which does not address more popular and already in-use digital labelling solutions like quick response ("QR") codes.
    - The scope of research included in the JRC report, however valuable, poses the question of the impact of the accelerated digitalisation on the consumers and the overall evidence that should be considered to inform the policy debate. The report's review of QR codes as a digital labelling solution concludes that they are "not always appreciated by consumers" and, for instance, references the Bray et al., 2019 study (p.25) which looked at QR codes in workplace canteen settings where consumer choice is likely to be more limited than at POS. The likely limited research foundation, like in the Bray study, also gives reason to look into the wider and more recent research that will tackle the question of adoption and use of digital labelling in a broader context.

2. **What is the impact of digital trends driven by new generations?**
    - All respondents or surveyed individuals, as contained in the JRC report's literature review, are aged from 18 years old (p.4) meaning that new generations, particularly the

'Generation Z' youth or digital natives born in the early 2000's are not likely to have been a significant proportion of the populations captured in the surveys. These new generations are likely to have highly developed digital skills and habits and, consequentially, different expectations or preferences about the way food information is made available to consumers.

  - Of the five articles underpinning the reports' review of QR codes, only 2 are from 2019 while the others date from 2015 and before.
  - Although QR code technologies have been available for almost three decades, they have become significantly more widely used in the past five years. Their increasing uptake and use, especially by new generations, may have influenced the way they access or expect to access food information to consumers. Moreover, as this report shows, the COVID-19 pandemic has mainstreamed the use of QR codes for several purposes and changed habits for obtaining product information.
  - Needs of and safeguards for digital natives should also be considered in the overall research, as consumers who seek digital access to information must be protected from potentially fake information and claims pertaining to food and drink products available online in absence of a structured approach to communicating legitimate and relevant additional information relevant to products and consumers.

- The absence of new generations from the scientific literature included in the scope of the JRC report is a missed opportunity to truly engage with a "forward-looking perspective to identify emerging trends in the provision of mandatory and non-mandatory food information to consumers" (p.3).

3. **What is the role that regulating digital labelling could play in the single market, in the context of the upcoming revision of the EU legislation on food information to consumers**?
   - As mentioned above, the JRC report does not support a regulatory framework for digital labelling as the *exclusive* way in which food information to consumers should be provided and conceives of it only "as complementary means of information provision" (p.3).
   - The JRC report seems to rely on the assumption that front-of-pack (FOP)/in-store labelling and digital labelling are two mutually exclusive alternatives, and thus concludes that, "it is premature to adopt an exclusive display of food information using digital means" (p.77).
   - The JRC report does not raise the critical question of whether and how complementary digital means of information provision could complement and be articulated with the provision of FOP/in-store mandatory information. Analysing how digital labelling could be regulated as complementary to FOP labelling and what benefits for consumers could be potentially unlocked from the regulating of complementary digital labelling should be an integral part of an evidence-based debate.
   - Not engaging with the question of benefits of digital labelling in the evidence-base for policy making may unintentionally lead to a tacit endorsement of the existing trend of self-regulatory approaches, subject to industry stakeholders' own willingness to adopt and develop digital information options for consumers.

4. **What are the learnings from the existing EU digital labelling initiatives and areas where digital labels have been implemented that could supplement the findings of the JRC report?**
    - To prevent a fragmented and narrow approach to assessing the role of digital labelling in the context of food and drink products, it is essential to supplement the findings of the JRC report also with a review of the wider regulatory landscape where different regulation has already been implemented or is in the pipeline, and self-regulatory initiatives that overlap and could benefit from a more coherent approach.
    - Considering the broader application of digital labelling will help address the need to understand what advances have been made in other policy pillars that can benefit the regulation of food information to consumers so that solutions and approaches defined today are future-proof. In this sense, it is valuable to take stock of the wider set of initiatives and existing examples of application of digital labelling, like in the case of the EU digital Covid certificate, or others that may be found in existing policy or pending proposals, like the recent proposal on digital labelling of EU fertilizing products from February 2023 or a plethora of others.
    - In the context of the EU Green Deal that seeks to mainstream sustainability practices and consumers' increased demand for product information on environmental, social and corporate governance criteria (ESG), the integration of digital labelling for food products into an overarching approach to digital labels could empower consumers with more transparent and complete information. In line with the spirit of the EU Green Deal, consumers may accordingly be offered relevant information to make purchasing decisions that promote sustainability and health.

2. Research Review: Consumer Perception and Uptake of Digital Labelling

This section presents the results of desktop research covering academic peer-reviewed articles and consumer protection organisations' views and research on digital labelling. Desktop research was undertaken with the purpose of building a comprehensive and up-to-date understanding of digital labelling research to expand upon the findings of the JRC report (as elaborated above).

Academic research on digital labelling

While this review attempts to provide an exhaustive account of up-to-date research on digital labelling, the volume of research and understanding of benefits and impact of digital technology on consumers is constantly growing. The findings are expected to provide valuable information about consumers' behaviour around, acceptance, uptake and use of digital labelling, however these findings might be further built out as the scientific understanding on the topic is expanded in the future.

Methodology

Desktop research was carried out to identify academic sources that address digital labelling. The scope of research includes several technologies and interaction environments that enable digital labelling of products, namely:

- QR codes
- Blockchain technologies
- Digital COVID-19 passport
- Online information on the Internet

- Mobile apps
- Social media and blogs
- Augmented and virtual reality

All articles captured in this review have been published between March 2018 and February 2023 in English-language, peer-reviewed international academic journals (for the full table of research, please see ANNEX I). The research into topics of online (food) delivery applications, digital nudging for online grocery shopping and dietary and behavioural changes as a result of online information has been excluded from the analysis due to lack of relevance. Research targeting QR codes is on the rise since 2020, a research trend likely driven by the broader digital context around the COVID-19 pandemic, and the increased use of QR codes in everyday life of consumers as a result of the need to manage consumers' mobility during the pandemic.

To build on the findings of the JRC report from September 2022, a set of additional articles on digital labelling that have been published since have been included, along with additional relevant articles published between 2018 and 2021 that were not considered in the JRC report, up until 2023.

Results

The majority of the scoped research focuses on (food) mobile apps, QR codes and blockchain technologies. The analysis of the research findings offers several conclusions about how consumers approach and think about digital labelling across a diverse set of products and sectors:

- The COVID-19 pandemic and the subsequent development of the digital COVID-19 passport have increased consumers' awareness, literacy, acceptance and use of digital labelling, specifically of QR codes (Azmadi, A. S. A., et al., 2022 & Samha A. K., et al., 2022).
- Generation Z (i.e., digital natives) and high-involvement consumers (i.e., those interested in more information on products) tend to resort to digital labelling more than average consumers, particularly when it comes to the use of online information and QR codes, to obtain information about products (Toth, M. et al., 2021).
- Consumers tend to use digital labelling and online information more for high-involvement products (i.e., products where extensive thought process is involved and the consumer considers a lot of variables before finally making a purchase decision) (Wang, Y. et al., 2021).
- The presence of QR codes on products correlates to increased consumer comprehension and confidence in the product (Treiblmaier H., & Garaus M., 2023; Bradford, H. et al., 2022; Samha A. K., et al., 2021; Violino, S., et al., 2019).
- Supermarket shoppers are, compared to traditional market shoppers, more likely to scan a QR code on a product (Yang, S.-H. et al., 2022).
- Consumers' uptake and appreciation of all forms of digital labelling is increased when the online environment is interactive and social, and allows for online communication with peers (i.e., electronic word of mouth) (Bocking, H., et al. 2022; Toth, M. et al. 2021).
- The use of blockchain technology and the corresponding digital labels are associated with consumers' higher trust level regarding the veracity of the claims being made about the products. This applies particularly to the traceability of ingredients and components, manufacturing processes, and green claims (Treiblmaier, H., & Garaus, M., 2023; Remme, A. M., et al., 2022; Nygaard, A., et al., 2022; Garaus, M, & Treiblmaier, 2021; Yeh, et al. , 2019; Sander, et al., 2018).

- Due to their horizontal, real-time and hard-to-corrupt systems, blockchain technologies benefit from higher trust levels compared to traditional FOP certifications labels (Nygaard, A., et al., 2022; Garaus, M, & Treiblmaier, H., 2021).

European consumer protection organisations' research and positioning on digital labelling

A critical element of policy dialogue is valuing the voice and the role that all stakeholders play in assessing the needs and opportunities for consumers. Consumer protection organisations' perspective on challenges and opportunities with regards to digital labelling is essential to have as broad as possible understanding of the issues that are of importance to the entire ecosystem of stakeholders engaged on the topic of digital labels. This is why the research also included a review of consumer protection organisations' output on digital labelling, alongside looking into what learnings can be sourced from the research community, and the EU and national level regulators and legislators.

Methodology

Desktop research was used to identify consumer protection organisations that have, in different ways, addressed digital labelling, including via articles, reports, studies, projects, etc. The publications and positions of consumer associations on digital labelling are analysed and categorized to also identify potential supporters and detractors.

Results

Nine consumer protection organisations, that have addressed the topic of digital labelling have been captured in the scope of the research (for a detailed overview of consumer protection organisations and their positions, please see ANNEX II). The views of these organisations present valuable perspective on digital labelling that should be also addressed throughout the policy debate on the issue.

The research shows that there is no consensus among the consumer protection organisations on digital labelling and its potential from the perspective of consumers, their rights and needs. Those in favour of digital labelling point to the benefits for transparency, enabling informed decision-making, and consumer empowerment towards more environmental and ethical purchase decisions. Those critical of digital labelling warn that application of digital technologies puts consumers at a disadvantage. However, no significant consumer research by the consumer organisations has been picked up in the course of analysis of the different sources.

One of the organisations supportive of digital labelling is a French consumer watchdog, Léo Lagrange Association for the Defence of Consumers (*Association Léo Lagrange pour la défense des consommateurs*), whose mission is to change consumer behaviour, empower citizens to be more critical and responsible, and empower consumers to defend their rights and interests. In an online article published in February 2023, the Association Léo Lagrange welcomed a new French law mandating that companies with a turnover of at least 50 million euros provide new information on the main manufacturing operations via a QR code applied to the product label. The use of QR codes in this way is deemed positive for traceability and transparency on product manufacturing conditions, such that consumers have access to all information (environmental, labour conditions, etc.) to make best-informed choices.

The Dutch *Consumentenbond*, a consumer association promoting consumer interests in the Netherlands, advocates for more transparent and comprehensive digital labelling practices to ensure that consumers have access to accurate and reliable information about the products they purchase, including information on sustainability, environmental impact, and other important factors for consumers' decision-making. Likewise, mindful of the potential risk of QR code frauds like phishing and scams, and of the need to ensure the benefits of using QR codes for consumers, the organisation published a guide (in Dutch) in September 2021 on what these fraudulent practices are, including advice on how to recognise them and mediate.

In January 2021, Consumers International, the umbrella organisation for consumer groups around the world, together with the UN Environment Programme and the One Planet Network, released three key messages and five case studies on the provision of sustainability information on plastic packaging. In this context, they encourage standard-setters and labelling organisations to embrace scannable digital technology (e.g., bar codes, QR codes) to provide further sustainability information to consumers.

Some consumer organisations welcome the development of and recognise the benefits of digital labelling while still expressing some concerns, mostly regarding the risk of confusing and excluding some consumers from accessing product information. The Swedish *Konsumentverket*, holds a more reserved position while still being in favour of digital labelling. As the government's agency responsible for promoting consumer interests in Sweden, Konsumentverket published formal opinions addressing two EU proposals for regulation that provide for a type of digital labelling:

- The Commission's 2022 proposal for the revision of the Regulation on Classification, Labelling and Packaging of Substances and Mixtures (CLP Regulation) (proposal; Konsumentverket's opinion published in March 2023). The proposal introduced a general framework to allow for the voluntary digital labelling of chemicals, particularly for chemicals with established environmentally and health-wise hazardous impacts.
- The Commission's 2022 proposal for the revision of the Regulation on Ecodesign for Sustainable Products (proposal; Konsumentverket's opinion from June 2023). The proposal provides for better information requirement, including a Digital Product Passport meant to provide information about products' environmental sustainability. It aims to help consumers and businesses make informed choices when purchasing products, facilitate repairs and recycling and improve transparency about products' life cycle impacts on the environment.

Konsumentvertket welcomed both EU policy initiatives as it sees great benefit in more transparent and accessible information being provided on traceability of ingredients and processes. However, the organisation expressed concern that this will substantially increase the amount of information for all stakeholders, which will likely confuse consumers. The organisation also claims that the capacity of consumers to identify what is essential for them to know will probably be reduced as a result of using online labelling. Hence, Konsumentverket's assessment is that it is important that the most essential information continues to be available on the product's packaging.

Similarly, the French Organisation for the Defence of Consumers and Users (*Association Nationale de Défense des Consommateurs et Usagers* – CLCV) welcomed the development of digital labelling practices while having some reserves about their accessibility to all consumers. CLCV expressed its opinion in two articles published on its website:

- Published in 2019, CLCV's article presenting the European horsemeat scandals connected to food manufacturers illegally using horsemeat labelled as beef. The organisation pointed to the potential of using blockchain technology along the meat value chain, with the use of QR codes accessible to both consumers and producers, enabling traceability and food safety.
- In another article, published in 2014 and updated in 2020, CLCV discussed consumers' increased demand for enhanced transparency and traceability of products and ingredients. The article refers to self-regulatory initiatives implementing digital labelling, especially QR codes, which can redirect consumers to online platforms where traceability information is available. The article also argues that these initiatives show that providing more food information to consumers is possible, in contrast to the opinion of the European Commission (sic) that implementing a solution for providing information on origin of food is too complicated. The article, however, does not reference a specific opinion of the European Commission but possibly commented on the broader perception of the regulatory approach.

CLCV is supportive of digital labelling initiatives as they provide solutions in line with consumers' increasing demand for traceability and food information. The one reservation that the organisation seems to have is regarding digital labelling potentially excluding some consumers who are not equipped with smartphones or are not digitally literate to access and fully make sense of the information delivered via online carriers like QR codes.

The German Federation of Consumer Organisations (*Verbraucherzentrale Bundesverbands – VZBV*) also addressed the topic of digital labelling in the context of the self-regulatory initiatives in the alcoholic beverage industry. It expressed a mixed opinion on the topic in a 2019 article, welcoming the initiatives of the German Brewers' Association and the Association of Private Breweries in Germany to voluntarily provide information on calorific value on beers and beer-based mixed drinks. VZBV warned of the lack of uniform labelling and that inconsistently labelled drinks are not consumer-friendly. Additionally, in case of failure of the alcoholic beverage industry to deliver a uniform framework for digital labelling, VZBV called for the European Commission to step in with a legislative proposal to both end the special status of alcoholic beverages and put them on an equal footing with non-alcoholic beverages.

Critical in providing their views on digital labelling, organisations that have been captured in the course of the research are: the European Consumer Organisation (BEUC), the Estonian Consumer Protection and Technical Supervision Agency (*Eesti tarbijakaitse*) and a Belgian consumer association (*Test-Aankoop*). Their concerns are also important to be considered in the context of digital labels.

As an organisation that works to promote consumer interests in Belgium, Test-Aankoop reacted to the request of the pharmaceutical industry for the European Commission to abolish the paper package leaflet in medication and replace it with a QR code on the packaging, in the context of the upcoming revision of the EU legislation on patient information. In an article published on its website in December 2022, the organisation notes that very few patients actually use QR codes and that most prefer to have information provided on the paper leaflet. The organisation recognizes, nonetheless, that information leaflets on pharmaceuticals should be made more clear and user-friendly.

As an agency aiming to strengthen the capacity of market regulation, safety supervision and the consumer environment, the Estonian Eesti Tarbijakaitse issued a statement in 2018, reacting to a March 2017 European Commission report regarding the mandatory presentation of the list of ingredients of alcoholic beverages and nutrition declaration of alcoholic beverages. On the premise that some people do not use internet on a daily basis, the agency fully endorses FOP labelling as the *unique* way of providing information on alcoholic beverages to consumers. It rejects the initiatives of the alcohol industry for digital labelling, and recommends putting the alcohol industry on the same level as other food and beverage industry with mandatory FOP labelling for alcoholic beverages as well.

In 2021, BEUC, the European umbrella organisation of 46 independent consumer organisations representing its members before the EU institutions and defending the interests of European consumers, issued a comprehensive and highly critical review of digital labellingn the *"Why moving essential product information online is a no-go"* report. The report summarizes critiques and concerns about the risk of digital labelling for consumers, as follows:

- Data-driven environments like digital labelling encroach upon consumers' freedom of choice. Information on products and services is tailored to maximize conversion, anonymous shopping is becoming a thing of the past and the offered selection of news gets tailored to induce the strongest emotional responses.
- According to BEUC, digital labelling is a flawed concept that threatens to undermine, rather than enable, informed consumer choice:
    - Digital labelling is a potential source of consumer disinformation. If product information is provided online, in an environment completely controlled by private entities, then there is a risk of exposing consumers to misleading, abusive or unfair commercial practices.
    - Digital labelling is a barrier to informed consumer choice due to the time constraint to access information, in a world where consumers generally do not have time.
    - Digital labelling is exposed to the risk of excluding consumers who are not tech literate.
    - A switch towards digital labelling raises significant concerns for both data protection and cybersecurity.
    - Most surveillance authorities at the EU and national level are currently not equipped to deal with a shift towards digital labelling, so there is a risk of difficult enforcement.
    - Digital labels are not a 'green' alternative as they emit hidden greenhouse gas emissions.

BEUC has been critical of digital labelling for a while, including initial criticism first expressed in an article published in May 2018, when the organisation reacted to the spirits industry's self-regulatory initiative around digital labelling via an on-bottle QR code. Leaning on the observation that not all consumers have a smartphone, at the time, BEUC argued that digital labelling is impractical as it does not enable consumers to compare products side-by-side at a glance and that it will only hamper consumers' legitimate easy access to information they care about. According to the article, digital labelling can only serve a purpose in providing extra information to consumers which they do not necessarily need to access in the supermarket.

BEUC's criticism of digital labelling is reflected in the JRC report, and their position and prominence in the regulatory debate is likely to influence a broader reluctance to address the topic

of digital labelling through coherent regulation at EU level. It is in this context that it is important to engage fully with the concerns raise and to build a broader evidence base that would provide steering on the severity of the risks that BEUC and other raise, and inform the policy debate with knowledge on uptake and impact of digital labels where they have already been accepted.

Advantages of digital labelling in communicating benefits of food products

Having in mind all of the above, digital labelling has been researched by academics and commented on by consumer protection organisations in a variety of applications and sectors. This section of the research points to three specific advantages of digital labelling for the food and beverage industry, in terms of catering to consumers' needs and preferences, including:

- **Supermarkets shoppers are more likely to scan a QR code on food products rather than shoppers in traditional markets** (see: Yang, S.-H. et al., 2022). While the reasons behind this consumer behaviour remain to be investigated, this suggests interesting differences between types of consumers (e.g. rural versus urban, higher versus lower purchasing power), and how shopping environments may be encouraging the uptake of QR codes by consumers.

- **The presence of QR codes on products is correlated with increased consumer comprehension and confidence in the product** (see: Bradford, H., et al., 2022; Samha A. K., et al., 2021; and Violino, S., et al., 2019). Identified by several research groups, this observation has significant implications for how QR codes can be used to increase consumers' perception of food safety, traceability, and authenticity of information, towards strengthening the trust between consumers, food producers, processors and retailers; beyond just empowering consumers with accurate knowledge on health and sustainability. This is of particular value in the rise of food scandals affecting consumers' perceptions of products and brands. This might also be generally beneficial in the event of food supply disruptions like in the case of the Russian aggression on Ukraine, which might affect trust levels with respect to certain products or locations of origins.

- **The use of blockchain technology and corresponding digital labelling on food products are correlated with higher trust levels from consumers** (see: Treiblmaier H., & Garaus M., 2023; Nygaard, A., et al., 2022; Garaus, M, & Treiblmaier, 2021; Yeh, et al., 2019; and Sander, et al., 2018). In the same vein as the presence of QR codes on products, blockchain technology is positively correlated with higher trust levels. Due to its horizontally encrypted, real-time and verified information-sharing, blockchain technology must be delivered digitally and can be well implemented via various online labelling platforms, including QR codes where there could be synergies with regard to further raising trust levels. The trust-reinforcing nature of digital labelling particularly applies to the traceability of the products and their ingredients and components, the manufacturing processes, and green claims. Moreover, the research highlights that it is important to educate and raise awareness on how traceability systems like blockchain work as this will increase understanding of how traceability is authenticated (Remme, A. M., et al., 2022). It is reasonable to expect that as digital natives become a broader proportion of the consumer base, digital literacy, and the understanding of and trust in blockchain technology will increase as a result.

To reap these benefits, however, it is crucial to acknowledge the perceived risk of information overload (as particularly highlighted in Sander, et al., 2018). This adds onto established data showing that consumers are overwhelmed by the ubiquity of certification systems, from which labels are hard to understand and distinguish in terms of relevance and credibility. Adding digital labelling, for instance, via QR codes on products, raises concerns around this issue being exacerbated. This phenomena might in turn, if unaddressed, affect consumers' adoption and uptake of QR codes, regardless of the upstream acceptance of the technology. This points to the need for digital means of communicating information to be designed in a way that is user-friendly, concise, coherent, and non-conflicting with other necessary information requirements.

Analysis of the research findings and how they help expand the findings of the JRC report

The abovementioned account of up-to-date academic research and consumer protection organisations' views published over the course of the past five years provides critical knowledge to attempt to constructively expand the findings of the JRC report, i.e. how the additional research and analysis helps nuance the conclusions about digital labelling laid out in the JRC report.

See below the overview of key findings framed as responses to each of key questions asked as essential to grow the evidence-base established by the JRC report:

1. **What does the most recent peer-reviewed research show about digital labelling?**

- From 2021 onwards – that is in the aftermath of the first COVID-19 lockdowns in Europe – the research on consumer acceptance and behaviour about digital has increased. This particularly applies to (food) mobile apps, blockchain technologies and QR codes. The findings of the JRC report, while a good starting point, must be expanded to allow for the latest perspective on real-world impact of accelerated uptake of digital technologies by consumers.

2. **What is the impact of digital trends driven by new generations of consumers?**

- This extended body of literature nuances the conclusions of the JRC particularly around the lack of popularity of digital labelling. The repercussions of the COVID-19 pandemic, the introduction and the wide-spread use of digital COVID-19 passport, and the inclusion of digital natives into social science research (who have entered research groups when reaching 18 years of age) show that some part of the populations are familiar with or are regularly using digital labelling, especially QR codes.

3. **What is the role that regulating digital labelling could play in the single market, in the context of the upcoming revision of the EU legislation on food information to consumers?**

- The 2022 JRC report finds it unnecessary to develop a regulatory framework for exclusively digital labelling and conceives of it only as a potential information complement to already existing FOP label.
- The research shows that consumers are increasingly using digital labelling and this comes with benefits particularly around trust levels associated with the use of blockchain technology. This is particularly important around high-involvement products like food, energy products or products prone to upstream deforestation practices and human rights violations.

- The promotion of greenwashing-free products in European markets, and the need to increase trust levels of consumers in information provided on products, against the backdrop of market disruptions due to the invasion of Ukraine, should give sufficient grounds for a broader consideration of a coherent approach to regulation of digital labelling. Regulating digital labelling can help reinforce use of trust-reinforcing technologies that enhance transparency between companies and consumers in accordance with the Green Deal, and the right solution to address a growing tide of self-regulatory initiatives that are currently impacting consumers' access to standardized and accurate, relevant product information.

4. What are the learnings from the existing digital labelling initiatives and areas where digital labels have been implemented that could supplement the findings of the JRC report?

- The research, whether into academic articles or consumer protection organisations' views, does not directly address this question. Peer-reviewed research and consumer organisations have not engaged with the question of future-looking policy vision but rather the implications of implementation of digital technology. The regulators are best placed to lead on a future-oriented policy vision to deliver the development and establishment of a coherent digital labelling system covering all important aspects of a product in a way that prevents regulatory fragmentation in the future.
- The strength of academic research and insights of consumer protection organisations will be highly valuable once there is an appropriate regulatory approach developed to potentially implement digital labelling. At this point, however, it is not to be expected for research institutions and consumer organisations to have had the capacity to assess what potentially might be the different approaches to developing a coherent regulation of a cross-sectoral, digital labelling system.
- The concerns raised by some of the research and some of the consumer organisations around digital labelling, however, do not amount to a level that should lead to the conclusion that digital labelling should either be prohibited or ignored in the context of providing food information to consumers. The concerns should, however, be constructively addressed through weighing of appropriate evidence that might dispel misconceptions around consumer attitudes and uptake of technology in the EU. Additionally, they should allow for future change and the need to create regulation that can secure consumers for the future, as opposed to have to walk back innovation that might develop without regard for harmonization and standardization.

3. State of Play of the EU Regulatory Framework

This section looks at what regulation has been put in place at the EU level, and what are the initiatives that have been proposed by the Commission that are focused on or support providing information to consumers through digital means, covering different sectors: from batteries to fertilizers, from health to textiles. This section also includes an overview of self-regulatory practice across different industries, showcasing industry guidelines, codes of practice or sectoral agreements at European level. As the mapped regulatory instruments and self-regulatory initiatives show, policy making as well as self-regulation is happening in several bubbles of vacuum, horizontally disconnected. The research shows that the growing number of examples where digital labels are introduced requires harmonization of approach and more coherence to make sure that consumers are indeed put first, since they are already dealing with a plethora of digital labels across different aspects of their lives.

The European Commission acknowledged that leveraging digital transformation is a key enabler for reaching the Green Deal objectives and it can help improve the availability of product information. The F2F Strategy sets out to empower consumers to make informed, healthy and sustainable food choices, including recognition of new ways to provide information to consumers through other means including digital as one of the key approaches to improve the accessibility of food information.

In the EU, the 2030 Digital Compass Communication from March 2021 declared that pursuing digital policies that empower people and businesses is the focal point of EU's regulatory ambition. A central part of the EU's digital and sustainability agenda rests on the introduction of the so-called "digital product passport" (DPP) tracking the origin of all materials and components used in the manufacturing process of everyday consumer goods and enabling efficient sharing of information. It is intended to provide access to already existing information to those that could use it the best and empower consumers to make sustainable choices.

The COVID-19 certificate represents the most widely relatable example of a successful and wide-spread information digital carrier in the EU and internationally that established – in time of unprecedented crisis – a system for integrated health cooperation and information access, and became key to facilitate pandemic management, including in cross-border context. The regulatory leadership and global standard-setting that the European Commission had shown in the example of the COVID-19 passport is the sound basis on which the future EU standard on digital labelling in the context of providing information to consumers can be built.

The Commission has also published, among others, proposals regarding batteries and fertilizers with the aim to make maximum use of the potential of digitalization of information and encompassing the entire product value chain. The proposed approach has the ambition to manage product-related data across the product lifecycle intended to improve information available to business, boost resource efficiency and empower consumers to make sustainable choices.

Finally, the pressures for transparency and expectations of consumers that businesses should lead in providing information they required has led to a proliferation of self-regulation across different industries. In the absence of a horizontal approach to digital labelling, the industry is offering solutions that consumers and the global market is demanding. The questions around

inter-operability of different digital labelling systems, type and scope of information offered and the multitude of approaches that consumers encounter in making everyday decision suggest that regulatory response is required to prevent further fragmentation of digital labelling in the EU.

Current policy relating to use of digital information carriers

It should be noted that the regulation included in this section has been mapped and presented in chronological order, with the intention to capture a trend or a coherent approach to addressing the question around how regulation tackles innovation and use of technology in the context of providing information to EU consumers. The findings, however, indicate that the issue is tackled through different sectors with no coherent trend that can be tracked across the different policy instruments. Since making most of the benefits or potential for a horizontal regulation could strengthen the EU's approach to providing information to consumers via digital means, there are considerable advantage to putting in place a coherent approach to digital labelling before further fragmentation of regulation occurs.

Analysis of the state-of-play of EU regulation and how they help expand the findings of the JRC report

This section presents the key takeaways from the overview of the existing and pending EU regulation, in way in which in the supplement the findings of the JRC report, with questions used to broaden the perspective developed by the JRC report adapted to the regulatory context, as summarized below:

1. **What do the most recent development tell us about digital labelling?**

- The instances of regulation where QR codes have already been put in place, or are proposed, cover a wide spectrum of products and industries: everything from electrical appliances and tyres to aquaculture and fisheries products, and textiles. The most prominent and possibly widely experienced by consumers is the QR code system used to manage mobility of citizens during the COVID-19 pandemic. The COVID-19 passport had undeniably boosted visibility, understanding and use of QR codes by consumers, meaning that behavioural assessment of how willing consumers are to engage with QR codes before and after the pandemic may be expected to be different.
- It is clear from the European Court of Auditor's special report from January 2023, that the QR code technology was a popular solution on the basis of adoption levels, by not just EU Member States but many non-EU countries who were looking for a solution to manage travel and information-sharing in relation to travel restrictions. While introduced to manage an unprecedented crisis, the example of the COVID-19 passport shows that there are significant advantages to implementing a standardized solution to providing information via digital carriers of information. These need to be taken into consideration when defining the direction on the future of digital labelling regulation in the EU and assessing the need and the opportunities provided by a harmonizing framework for the entire block.

2. **What is the impact of digital trends driven by new generations?**

- The benefits of using digital technologies and leaning into innovation are at the core of EU's New Consumer Agenda, the 2030 Digital Compass, the European Declaration on Digital Rights and Principles for the Digital Decade, and the EU Strategy for Sustainable and Circular Textiles. These broader policy instruments set out a clear ambition of the EU to engage on the opportunities offered by the digital transformation. It is clear from the

EU's approach in these policy instruments, that digital skills are prioritised as key to social and economic resilience.

- Specifically, the 2030 Digital Compass emphasizes the importance of fostering a digitally skilled population, sustainable digital infrastructures and digital transformation of businesses. Additionally, the European Pillar of Social Rights Action Plan projects the target for adults with at least basic digital skills to reach 80% in 2030, and introducing a right to access to education for basic digital skills for all EU citizens. These are proof points of the EU's direction towards harnessing the advantages of digital transformation as much as investment in fostering digitally literate citizens. This is an important consideration in developing future-forward policies with respect to digital labelling as well. As digital literacy and proliferation of digital tools driven by existing regulation grows, making sure that policy delivered today can keep up with innovation and consumer skills and information demand is essential.
- The EU Strategy for Sustainable and Circular Textiles is in particular interesting, since it deals with a sector that is widely present in consumers' everyday life and has been raising concerns around traceability of products, sustainability, as well as quality and security. The strategy introduces the basis for a digital labelling as a broader instrument to enable sustainable and circular textiles market, including providing key actions such as creating a Digital Product Passport.
- These examples show that future-looking policymaking is at the core of EU's approach to harnessing the benefits of digital transformation, and the opportunity exists for the same benefits to be fully harnessed in the context of food and drink products and providing information to consumers.

3. What is the role that regulating digital labelling could play in the single market, in the context of the upcoming revision of the EU legislation on food information to consumers?

- Digital labelling already plays a significant role in providing information on products to consumers in a plethora of existing and proposed regulation. The legal frameworks and guidelines for application of digital carriers of information at different scope exist across fisheries and aquaculture products, centrally authorised medicinal products, energy-related products (including electric appliances and tyres, for instance). Digital labels are also proposed as solutions to information providing for batteries, fertilizers, and the Regulation on Ecodesign intends to extend the existing ecodesign framework to cover the broadest possible range of products on the internal market (via the DPP). Finally, the new Common Agricultural Policy (CAP) for 2023-2027 introduces digital nutrition declarations for the EU wine sector.
- Consumers are already facing and engaging with digital labels, meaning that the technology and innovation behind digital labelling presents a unique opportunity for the food and drink sector, to build on existing practices and approaches in order to make sure that the revision of FIC is not lagging behind in harnessing opportunities that are already engaged with in a number of EU's legislative texts.

4. **What are the learnings from the existing digital labelling initiatives and areas where digital labels have been implemented that could supplement the findings of the JRC report?**

- There are two broad takeaways that may be highlighted across the EU's approach to digital labelling. When looking at all the existing initiatives and the areas where digital labelling has been already put in place, it is evident that the EU has the capacity and the expertise to deliver relevant and resilient frameworks for implementation of digital labels as means of delivering valuable information to consumers. The mapped initiatives and regulation show, as a second takeaway, that there is a considerable fragmentation of the approach to regulating digital labelling that is happening under the Commission. There is an opportunity to establish a horizontal, coherent approach to how digital labelling works for consumers, regardless of the product applied on.
- Without a coherent approach to digital labelling being put forward by the Commission, in collaboration with stakeholders, the EU is risking not only a fragmentation of the internal market, but also conflicting approaches across different policy instruments in place for one category of products and differing self-regulatory systems put in place for others. Having in mind that digital labels are primarily considered and implemented in the context of providing information to consumers, the EU has the licence to pour its expertise into making sure that consumers are protected from the burden of engaging with a growing number of differing standards across regulated digital information solutions that are in place (including through self-regulatory initiatives) and those that will be coming up in the future.

Broader Policy Instruments

NEW CONSUMER AGENDA

Launched on 30 November 2020, the New Consumer Agenda is a step taken by the Commission in recognition of the impact of COVID-19 pandemic on many areas of consumers' lives, and the opportunities offered by the digital transformation. The Agenda presents a vision of future consumer policy from 2020 to 2025, focusing on five priority areas – including green transition, digital transformation, enforcement of consumer rights, specific framework for vulnerable consumer groups, and international cooperation – to adapt current rules to the ongoing digitalization and increase connected products. It was launched with the ambition to strengthen consumer resilience for sustainable recovery and it takes a holistic approach covering various EU policies that are of particular relevance for consumers. While it does not deal directly with the matter of digital labelling, the Agenda recognizes the need to provide consumers with better and more reliable information, the opportunities that digital transformation offers and considerations required not to exclude those who are not at ease with digital environments. It also states that the Commission will examine ways to create a sustainable labelling framework that covers the nutritional, climate, environmental and social aspects of food products, in synergy with other relevant initiatives.

The opportunity and benefit of digital technologies is highlighted in the Agenda's key area of green transition. The digital transformation offers other new opportunities to provide more targeted and understandable information. The development of digital product passports under the Sustainable Products Initiative aims to help inform consumers on the products' environmental and circular aspects. The Agenda states that, more broadly, digital information could empower consumers to check the reliability of information, make comparisons between products, but also inform them in

a more holistic way about their environmental impacts, for example their carbon footprint. The Agenda recognizes that promoting and activating clean, climate-neutral, sustainable consumption culture and behaviour should be done in accessible, innovative and appealing ways, e.g. through smartphone applications and websites, and draw on the existing tools.

In context of addressing specific consumer needs, the New Consumers Agenda recalls importance of keeping in mind social circumstances or individuals' characteristics such as age, gender, health, digital literacy or financial situation. Consumer framework must be inclusive and functional for all and must put in place a fair and non-discriminatory approach to digital transformation, ensuring no one is left behind. For instance, older people and people with disabilities have specific consumption-related needs; it is therefore important to ensure that clear, user-friendly, and accessible information is available both online and offline, in accordance with EU accessibility requirements for products and services. The digital transformation should cater to the needs of older consumers, consumers with disabilities and more generally 'off-liners' who may be less familiar or less at ease with digital tools.

2030 DIGITAL COMPASS: THE EUROPEAN WAY FOR THE DIGITAL DECADE COMMUNICATION

Launched in March 2021, the 2030 Digital Compass: Digital Transformation for Europe's Resilience Communication set the basis for digital information policies in the EU. Although presenting a general approach, the Communication addresses long-term, measurable targets to boost digital transformation for Europe's resilience while ensuring the respect of EU values and rights. The Communication warns that ensuring that all citizens and businesses in Europe can leverage the digital transformation for a better and more prosperous life is imperative to the European vision for 2030 in a digital society where no-one is left behind.

As a response to how the COVID-19 pandemic radically changed the role and perception of digitalization in the society, the Communication recognizes that digital technologies are now imperative for working, learning, entertaining, socializing, shopping and accessing everything from health services to culture. The Commission has envisioned a Digital Compass to help deliver on EU's 2030 digital ambitions, by setting out key milestones. These are digitally skilled population and highly skilled digital professionals, secure and performant sustainable digital infrastructures, digital transformation of businesses, and digitalization of public services.

Basic digital skills for all citizens and the opportunity to acquire new specialised digital skills for the workforce are a prerequisite to participate actively in the Digital Decade (addressed under the European Skills Agenda). The European Pillar of Social Rights Action Plan projects the target for adults with at least basic digital skills to 80% in 2030. To allow all Europeans to fully benefit from the welfare brought by an inclusive digital society, access to education allowing the acquisition of basic digital skills should be a right for all EU citizens and lifelong learning should become a reality. Broad-based digital skills should also build a society which can trust digital products and online services, identify disinformation and fraud attempts, protect itself against cyberattacks, scams and fraud online, and in which children learn how to understand and navigate through the myriad of information they are exposed to online. The Communication clearly shows that any policies that are delivered today must keep in mind the accelerated digital transformation as well as the future in which 80% of EU citizens will by 2030 have at least basic digital skills.

Following the Communication launch, between May and September 2021 the Commission ran a public consultation on the formulation of a set of digital principles to uphold EU values in the

digital space, the results of which showed broad support among the Europeans. Although the consultation does not expressively mention digital labelling, it is worth noting how several respondents indicated that it is key for a digital society not to leave anyone behind. This reflects the need for any digital initiative put forward by the Commission to recognize that not all consumers are proficient users of digital tools, thus addressing existing generational discrepancies. As a next step, the first annual report on the “State of the Digital Decade” is planned to be adopted in June 2023. It will contain the trajectories along which progress will be tracked and the guidelines for Member States to present their national strategic digital roadmaps.

EU STRATEGY FOR SUSTAINABLE AND CIRCULAR TEXTILES

In March 2022, the Commission presented the EU strategy for sustainable and circular textiles, listing a number of key actions the Commission intends to take on to achieve a durable and recyclable textile market. Among the key actions for sustainable and circular textiles, introduction of information requirements and a Digital Product Passport.

In the context of, at the time announced, DPP for textiles based on mandatory information requirements on circularity and other key environmental aspects, and review of the Textile Labelling Regulation, the strategy notes that the Commission will also consider the possibility of introducing a digital label. The Textile Labelling Regulation revision is planned for Q4 of 2023 and will ensure that clear, structured, and accessible information on the environmental and sustainability characteristics of products will empower businesses and consumers to make conscious choices.

EUROPEAN DECLARATION ON DIGITAL RIGHTS AND PRINCIPLES FOR THE DIGITAL DECADE

Published on 7 February 2023, the Declaration of Digital Rights and Principles for the Digital Decade, articulates the EU’s commitment to a safe and sustainable digital transformation. It is a guide for future EU policy development to ensure people benefit from a fair digital environment. The Declaration is intended to serve as a reference point for businesses and other relevant actors when developing and deploying new technologies. In the context of establishing a fair digital environment, the Declaration states that everyone should have the possibility to compete fairly and innovate in the digital environment, and that this should also benefit businesses, including SMEs. Promoting interoperability, transparency, open technologies and standards as a way to further strengthen trust in technology as well as consumers’ ability to make autonomous and informed choices. The Declaration also states that as part of safety, security and empowerment, everyone should have access to digital technologies, products and services that are by design safe, secure, and privacy-protective, resulting in a high level of confidentiality, integrity, availability and authenticity of the information processed. The progress on the implementation of the objectives of the Declaration and additional recommendations will be delivered through the annual report on the "State of the Digital Decade" (above).

Current rules implementing digital carriers of information

REGULATION ON THE COMMON MARKET ORGANISATION FOR AROMATISED WINE PRODUCTS

The CMO Regulation 2021/2117 adopted in December 2021, formally set the new Common Agricultural Policy (CAP) for the 2023-2027 period and amends, among others, specific provisions

of Regulation 1308/2013 on agricultural products and Regulation 251/2014 on geographical indications of aromatized wine products. A new provision is introduced allowing for digital nutrition declarations and creating a legal precedent of digital labelling for the wine sector at EU level.

This is done through Article 1, point (32)(c), amending Article 119 of Regulation 1308/2013 by adding a new paragraph on the possibility to share grapevine products' nutritional information and ingredients via electronic means. The amendment provides as follows:

By way of derogation from paragraph 1, point (h), the nutrition declaration on the package or on a label attached thereto may be limited to the energy value, which may be expressed by using the symbol "E" for energy. In such cases, the full nutrition declaration shall be provided by electronic means identified on the package or on a label attached thereto. That nutrition declaration shall not be displayed with other information intended for sales or marketing purposes and no user data shall be collected or tracked.

By way of derogation from paragraph 1, point (i), the list of ingredients may be provided by electronic means identified on the package or on a label attached thereto. In such cases, the following requirements apply:

a) no user data shall be collected or tracked;
b) the list of ingredients shall not be displayed with other information intended for sales or marketing purposes; and
c) *the indication of the particulars referred to in Article 9(1), point (c), of Regulation (EU) No 1169/2011 shall appear directly on the package or on a label attached thereto*.

Therefore, the package or label can be limited only to show the energy value of the product, while the full nutrition declaration and ingredient list can be provided digitally for consumers to access through an electronic reading tool. Here, the CMO Regulation does not suggest any specific application format (a QR code or a bar code, etc.) but leaves the choice open provided that the chosen digital tool is identified on the product's package, for consumers' awareness. On top of that, Article 3, point (5) intervenes to amend Regulation 251/2014 on aromatized wine products and inserts the same provisions with specific reference to the aromatised wine category of products marketed in the EU. Therefore, with this most recent CAP, wine products' nutrition declaration and ingredients can be provided through digital solutions, except for the energy value that must always be displayed on the physical package.

Even though optional, these new labelling provisions aim at providing higher level of information to consumers and take into account their expectations in terms of production methods, sustainability in the supply chain, development of standards and technical knowledge. By scanning the codes displayed on the package or wine bottle, consumers are steered to the option to access a whole range of information in the language they prefer, while the producer will avoid overloading the package or bottle with descriptions and data. However, it must be noted that the option of sharing information digitally should not affect the existing requirement of listing on the physical level the substances causing allergies and intolerances, which need to be always visible and immediately readable for consumers' safety on the package.

The CMO Regulation entered into force on 1 January 2023, but these two specific articles will start applying as of 8 December 2023. Delegated acts, at this time pending with the Commission, will frame the display rules together with guidance on how this information should be transmitted to consumers in a digital way.

REGULATION ON THE COMMON ORGANISATION OF THE MARKETS IN FISHERIES AND AQUACULTURE PRODUCTS

The Regulation 1379/2013 on the Common Organisation of the Markets in Fishery and Aquaculture Products sets out labelling requirements for fishery and aquaculture products. The Regulation provides the option for displaying mandatory information on specific fishery and aquaculture products marketed in the European Union using a QR code to outline part or all the mandatory required information (Art. 39), states that a QR code may be used in these cases to outline part of all the mandatory information (Art. 35(1)).

Although this digital mean is no further outlined by the Regulation or its preliminary impact assessment, it is still interesting to remark on the possibility left for producers and traders to increase the sharing of product information by digital means, on a voluntary basis. This option, however, may be looked at as a sort of “testing rule” to evaluate the range of applicability and uptake. If so, that could serve as basis for future application towards other policy or be subject to delegated act to enforce its applicability as mandatory.

DIGITAL LABELLING OF CENTRALLY AUTHORISED MEDICINAL PRODUCTS

In November 2018, the European Medicines Agency (EMA) published a report on the application of mobile scanning and other technologies for labelling and package leaflet of centrally authorized medicinal products which reflects the current policy on the topic in the pharmaceutical sector. The report recognizes that with the availability of new communication technologies it has become apparent that patients/users/health care professionals may benefit from information on medicinal products provided through electronic formats. The EMA recognizes that in this context, there has been an increased demand by applicants to the centralized procedure to use mobile scanning and other technologies, such as QR codes and two-dimensional (2D) barcodes, or Near-field Communication (NFC), amongst others, as an additional way of providing information to patients and health care professionals. The EMA report addresses the use of mobile technologies to access a dedicated platform maintained by the Marketing Authorisation Holder (MAH) or a national competent authority (NCA) with information on medicinal products. It provides guidance in relation to the assessment of the content, independently of the technology used.

EMA suggests that a mobile technology feature may be included in the packaging material and/or the package leaflet for additional information, especially for multilingual packs. In fact, it is crucial for EMA that information is provided in all the EU official languages and that the design of the platform hosting the mobile technology content allows easy access to country specific information. Moreover, additional information can also include informational videos to help educate both patients and professionals: without mobile scanning technology, information and data collection of this magnitude would not be possible.

The information contained in the digital feature should be made available through a dedicated platform maintained by the Marketing Authorization Holder or a National Competent Authority with information on medical products, for safety and credibility purposes. Mobile technologies may be used to provide statutory information or additional information that is compliant with applicable regulation.

ENERGY LABELLING REGULATION

The Regulation on Energy Labelling lays down a framework that applies to energy-related products placed on the market or put into service. It provides for the labelling of those products and the provision of standard product information regarding energy efficiency, the consumption of energy and of other resources by products during use and supplementary information concerning products, enabling customers to choose more efficient products in order to reduce their energy consumption.

The Regulation defines “label” as a graphic diagram, either printed or in electronic form (Art. 2), fully integrating electronic (digital) labels into the scope of the Regulation. A delegated act is set to define the format of any additional references on the label allowing customers to access through electronic means more detailed information on the product performance included in the product information sheet. The format of those references may take the form of a website address, a dynamic QR code, a link on online labels or any other appropriate consumer-oriented means.

In order to set up a useful tool for consumers, to allow for alternative ways for dealers to receive product information sheets, to facilitate the monitoring of compliance and to provide up-to-date market data for the regulatory process on revisions of product-specific labels and information sheets, the Regulation required from the Commission to set up and maintain a product database consisting of a public and a compliance part, accessible via an online portal. According to the Regulation, suppliers should make the required product compliance information available electronically in the product database so that the information relevant for consumers and dealers is publicly available in the public part of the product database. The information should be made available as open data so as to give mobile application developers and other comparison tools the opportunity to use it. The Regulation states that easy direct access to the public part of the product database should be facilitated by user-oriented tools, such as a QR code, included on the printed label.

To enforce this provision, the Commission established the European Product Registry for Energy Labelling (EPREL) to allow the public to consult product labels and related information sheets. This was achieved after a transition period of two years following the publication of the Regulation, to allow suppliers to comply with their registration obligations in cooperation with market surveillance authorities. EPREL was launched in 2019 and ever since, products subject to energy labelling regulation must be registered in the database upon placements on the market. The registry generates all energy labels based on the data the suppliers entered when registering their product models and can be accessed by consumers via the QR codes found on the energy labels placed on the packaging of products. Within the EPREL, every product is made available from a model description page where labels and information sheets can be viewed and downloaded by consumers in all EU languages. This process achieves not only an efficient, standardized information system where products’ information is automatically updated, but also easy access and comprehension for all European consumers despite their language of origin.

One of the most interesting parts of the scope of energy labelling and the EPREL is the wide range of products they cover. Products go from cooking appliances to electronics, from ventilation machines to tires, from lighting to wine storage appliances. Here, their “efficiency check” plays an extremely important role in the purchase phase of each customer, who needs complete overview to acknowledge the meaning of energy symbols, product’s running and estimated costs, longevity, functioning, features, and models before buying it. The other advantage is that this system can

be easily and quickly accessed at any moment, whether on a smartphone, tablet, or computer. No registration is needed and, whether scanning the QR code is not possible – customers can alternatively retrieve product data by entering the brand and model name and repeat the process as often as needed for all products they're interested in. This framework established a whole new European vision for information sharing and standardization, that reaches the goals of properly informing all consumers via straightforward and exhaustive digitally-accessible information. Moreover, this is of primary importance also for the Commission itself as up-to-date energy efficiency information is crucial for market surveillance authorities carrying out their enforcement, monitoring and review tasks, key for legislation evolution. The Commission is expected to assess the implementation of the Regulation on energy labelling by August 2025.

REGULATION ON THE LABELLING OF TYRES

While tires are part of the products covered by the EPREL and the energy labelling requirements, as mentioned above, these products are also subject to the Regulation on the labelling of tyres with respect to fuel efficiency and other parameters and are worth mentioning in this report as they represent a valuable example of QR code label applied to a widely used consumer product.

The Regulation establishes a framework for the provision of harmonised information on tyre parameters through labelling to allow end-users to make an informed choice when purchasing tyres, for the purpose of increasing safety, the protection of health, and the economic and environmental efficiency of road transport, by promoting fuel-efficient, long-lasting and safe tyres with low noise levels. The tire-labelling systems serve as a functional tool to share tire's characteristics and performance and make all crucial information more visible and comprehensive for consumers, in an easily accessible digital way. All tire information is collected and published on EPREL, for consumers to access by scanning the QR code included in the printed tire label.

COVID-19 PASSPORT

As a response to managing the public health emergency and streamlining free movement COVID-19 pandemic, on 1 July 2021 the EU digital COVID Certificate Regulation entered into application, providing a standardized and secure method for European citizens to demonstrate relevant health status required for travel (vaccination, test status, recovery) within the EU, Switzerland, the EEA, and a number of non-EU countries. The EU Digital COVID-19 Certificate, available in both digital and paper format, consists of a QR code displayed with relevant identifying information available in national language and English. The QR code serves the purpose of verification of authenticity and validity of the certificate, helping reduce administrative barriers typically involved in cross-border context and vast-volume certificate controls that were broadly put in place for travel and entrance to public places. This code can be scanned by the competent authorities in the destination countries to verify that citizens have provided required information. Its digital format eased and sped up data access between stakeholders more efficient and effective. The certificate, possible to be stored on a mobile app, had made the paper version of the certificate be used as an alternative format option. Mobile apps for storage and displaying of certificate have been developed by national authorities, like in the case of the French TousAntiCovid app, Belgian CovidSafe, etc.

In January 2023, the European Court of Auditors (ECA) published a special report on tools facilitating travel within the EU during the COVID-19 pandemic. One of the key findings is that the EU Digital COVID Certificate, based on a combination of textual identifier information and the verificatory QR code, successfully facilitated travel and improved information sharing and

coordination in relation to travel restrictions. Member States and many non-EU countries used the EU Digital COVID Certificate system extensively, with more than 1.7 billion certificates having been issued in the EU and EEA states by March 2022.

Ongoing initiatives related to digital labelling

PROPOSAL FOR A REGULATION ON BATTERIES AND WASTE BATTERIES

Currently in the final stages of the legislative procedure, awaiting to be formally adopted by the European Parliament's plenary and ministers in the Council before the rules can enter into force, the proposal for a Regulation Concerning Batteries and Waste Batteries, launched in December 2020, aims to strengthen the functioning of the internal market, promote a circular economy and reduce the environmental and social impact throughout all stages of the battery life cycle. The initiative is closely linked to the European Green Deal, the Circular Economy Action Plan and the New Industrial Strategy.

Negotiators agreed on stronger requirements to make batteries more sustainable, performant and durable. According to the provisional agreement, a carbon footprint declaration and label will be obligatory for electric vehicle (EV) batteries, light means of transport (LMT) batteries and rechargeable industrial batteries with a capacity above 2kWh. Three and a half years after the entry into force of the legislation, portable batteries in appliances must be designed so that consumers can easily remove and replace them themselves. To better inform consumers, batteries will carry labels and QR codes with information related to their capacity, performance, durability, chemical composition, as well as the separate collection symbol. LMT batteries, industrial batteries with a capacity above 2 kWh and EV batteries will also be required to have a digital battery passport" including information on the battery model as well as information specific to the individual battery and its use.

The disclosure of information, the Regulation stipulates, to all end-users as well as reporting on batteries should make use of modern information technologies. The information should be provided either by classical means, such as outdoors, posters and social media campaigns, or by more innovative means, such as electronic access to websites provided by QR codes affixed to the battery; meaning that the role that classical displays of information are equalized to QR codes as way to access information relevant for consumers.

According to the pending text, QR code is defined as a machine-readable matrix code that links to information required by the Regulation. Labelling by means of QR codes, the Regulation states, serves the purpose of ensuring the availability of information over time. The Regulation recognizes that labelling plays an important role in providing end-users with transparent, reliable and clear information about batteries and their main characteristics, and waste batteries, to enable the end-users to make informed decisions when buying and discarding batteries and to enable waste operators to appropriately treat waste batteries. All the necessary information concerning main characteristics of batteries, including their capacity and content of certain hazardous substances is the kind of information to be made available by means of QR codes which should respect the ISO IEC Standard 18004. The QR code printed or engraved on all batteries should give access to a battery's product passport. The QR code has to be of a high colour contrast and of a size that is easily readable by a commonly available QR reader, such as those integrated in hand-held smartphones.

With these provisions, the Regulation endorses QR codes as a way to provide continuous access of information to consumers. Additionally, in a future-agnostic approach, it provides for the Commission to adopt delegated acts to provide for alternative types of smart labels instead of or in addition to the QR code, in view of technical and scientific progress.

PROPOSAL FOR A REGULATION ON ECODESIGN FOR SUSTAINABLE PRODUCTS

Proposed in March 2022, the Regulation for Establishing a Framework for Setting Ecodesign Requirements for Sustainable Products was prepared as a response to a fragmented national efforts in setting ecodesign requirements to a wide variety of products. In the absence of legislation at EU level, diverging national approaches to improving the environmental sustainability of products have already emerged. To safeguard the functioning of the internal markets, the proposal extends the existing ecodesign framework to cover the broadest possible range of products on the internal market. A part of that is also creating a digital product passport (DPP), something that, according to the consultation and impact assessment carried out by the Commission, is generally supported by clear majorities across all stakeholder groups.

The DPP is proposed to represent a product-specific set of data that includes the information accessible via electronic means through a data carrier, i.e. a linear bar code symbol, a two-dimensional symbol or other automatic identification data capture medium (i.e. QR code). They are intended to electronically register, process and share product-related information amongst supply chain businesses, authorities and consumers.

According to the proposal, digitalised information about the product and its life cycle or, where applicable, its passport should be easily accessible by scanning a data carrier, such as a watermark or a QR code complying with the ISO/IEC 15459:2015 standard. Where possible, the data carrier should be on the product itself to ensure the information remains accessible throughout its life cycle. However, exceptions are possible depending on the nature, size or use of the products concerned. Using a digital information carrier to connect the product passport to a unique product identifier (string of characters that identifies the product and enables a web link to the product passport) is one of the mandatory general requirements for the product passport that are proposed.

Specifically for consumers, the proposal sees physical labels as an additional source of information at the place of sale. They can provide a quick visual basis for consumers to distinguish between products based on their performance in relation to a specific product parameter or set of product parameters. They should, where appropriate, also allow for the accessing of additional information by bearing specific references like website addresses, QR codes, links to online labels or any appropriate consumer-oriented means. The Commission is tasked with setting out in the relevant delegated act the most effective way of displaying such labels, including the possibility of requiring the label to be printed on the packaging of the product. This proposal falls in line of the overall future-forward approach that the Commission has taken in choosing digital data carriers as the appropriate way to provide consumers with decisive information to steer their decisions.

PROPOSAL FOR A DIRECTIVE EMPOWERING CONSUMERS FOR THE GREEN TRANSITION

In March 2022, in parallel with the above-mentioned proposal for a Regulation on Ecodesign, the Commission also published a proposal for a Directive on empowering consumers for the green

transition through better protection against unfair practices and better information. This proposed update to EU consumer protection rules focuses on providing better information on the durability and reparability of certain products to consumers before concluding the contract.

The Commission's preliminary impact assessment and public consultation report shows that during the expert workshops collected views of industry associations on use of digital means to provide product information, highlighted some opportunities that digital tools (QR codes, e-labels) offer for providing mandatory product information and for simplifying product labels. It also highlights some of the challenges, particularly for SMEs who may need financial support to implement these tools and for vulnerable consumers who do not have access to, or who cannot use, them.

The Commission's Regulatory Scrutiny Board has, during the impact assessment, warned of a problem that consumers lack reliable information at the POS to make environmentally sustainable consumption choices. While the Commission considered potential policy options, in order to ensure full coherence with other Commission initiatives under way, it was decided that some of the elements of the preferred policy options selected in the impact assessment to tackle unclear/unfounded sustainability labels/digital information tools will be implemented via the other initiatives. So while it does not set out specific rules on digital labelling, the proposal leans on other policy initiatives where, as we can see across proposals that have been mapped, digital labels are recognised for playing a role in access to product information.

PROPOSAL FOR A REGULATION ON PACKAGING AND PACKAGING WASTE

On 30 November 2022, the European Commission published its proposal for a Regulation on Packaging and Packaging Waste (PPWR) to ensure that all packaging is reusable or recyclable in an economically feasible way by 2030. This initiative complements the Commission's proposal on ecodesign for sustainable products (above). The proposal states that where the packaged product is covered by the Ecodesign Regulation or other legislation requiring a digital products passport, the latter should also be used for providing the relevant information outlined in the PPWR. The ratio is to avoid multiplication of labels on packaging, meaning that the information required for a product needs to be accessible via the same data carrier.

In addition, the PPWR proposes that packaging shall dispose of either a label or a QR code/digital data carrier to provide further information on packaging reusability (Article 11(2)). This would include the availability of a system for re-use and collection points in order to facilitate packaging tracking and recycling efficiency. These labels and digital data carriers are required to be placed, printed or engraved visibly and indelibly on the packaging. The proposal recognizes the advantages of investing in digital means of communicating additional information to consumers, as a main driver for material recovery and improved availability of secondary raw materials.

PROPOSAL FOR A REGULATION ON DIGITAL LABELLING FOR EU FERTILIZING PRODUCTS

Published on 27 February 2023, the proposal for a Regulation on the Digital Labelling of EU Fertilizing Products, seeks to improve the readability of the labels of EU fertilizing products and to facilitate the economic operators' management of such labels. Annex III to Regulation 2019/1009, which the proposal amends, lays down the labelling requirements applicable to EU fertilising products. The form in which EU fertilising products are labelled in accordance with that Regulation, the proposal now seeks to adapted to technological and societal changes in the field

of digitalisation. The proposal introduces voluntary digitisation of the labels of EU fertilising products, leaving the choice with the manufacturers, importers or distributors of EU fertilising products. The proposal defines “data carrier” as a linear bar code symbol, a two-dimensional symbol or other automatic identification data capture medium that can be read by a device

Under the proposal, economic operators would be allowed to provide all the labelling elements required under Annex III to Regulation 2019/1009 only in a digital format in two situations: when the EU fertilising products are sold without a packaging, or when the EU fertilising products are sold to economic operators (which are not end-users of the products).

The economic operators opting for the digital labelling of EU fertilising products supplied to end-users in packaging will have to provide also a physical label, containing the most important information. The physical label will contain all the information concerning the protection of human health and the environment, as well as the most important information on the agronomic efficiency and content of the product, or information used after purchase.

The proposal lays down the general rules regarding the digitisation of labels. In particular, the economic operators will have to ensure that the digital label can be accessed free of charge and is easily accessible all over the EU, and they will have to take into account the needs of vulnerable population groups. The Commission may adopt delegated acts to supplement the general digital labelling requirements and further adapt Annex III by deciding which labelling elements could be provided digitally when EU fertilising products are made available to end-users in packaging, depending on the evolution of the society.

Once economic operators choose to provide digital labels, the proposal requires economic operators to ensure that the digital label can be accessed free of charge and is easily accessible all over the EU, and they will have to take into account the needs of vulnerable population groups. In addition, digital labelling of EU fertilizing products contributes to the ongoing progress with regard to digitalization of the European agricultural sector and can facilitate the reporting obligations of farmers regarding the use of such products.

4. Overview of Self-Regulatory Initiatives

In response to the rising consumer demand for access to information and transparency from the industry, the industry has been stepping ahead of the regulator and providing information that consumers expect. The 2021 NielsenIQ Global Health & Wellness Study showed that across all retail sectors, consumers expect businesses and governments to play a more active role in their health and well-being journey. In fact, a majority (72%) of surveyed global consumers feel that companies have a big role to play in the availability and access of healthy food for all. An even greater number of global consumers (77%) expect for product labels to be more specific and transparent to facilitate making healthier choices. As many as 72% of surveyed respondents around the world say they would be willing to pay a premium for products that claim to be sustainable, 52% would be willing to pay a little bit more, and 20% of global consumers would be willing to pay a lot more for sustainable products. The demand for information coming from consumers has led, without a coherent standard to adhere to, to a growing trend of self-regulatory initiatives spreading across the industry that increasingly lean on the advantages of the digital technology to provide consumers the required level of transparency.

This section looks at what are the leading initiatives in Europe, how they are framed, and also puts into perspective the reality of an industry that is in step with the uptake of digital labelling and opportunities it provides for access to information for consumers. To bring forward the key takeaways from the state of play across relevant examples in the industry, this section first provides key take-aways from self-regulatory trends, and then sets out the findings from the different examples.

Analysis of the self-regulatory trends and how they help expand the findings of the JRC report

In order to supplement the findings of the JRC report, and to fully establish the need for a coherent and harmonizing approach to digital labelling in the EU, it is necessary to consider the established practices and self-regulatory initiatives, and look at how they complement the findings of the JRC report. The key takeaways regarding existing self-regulatory initiatives are summarized below, in alignment with adjusted questions that are relevant to be asked about self-regulatory initiatives:

1. **What do the existing self-regulatory initiative tell us about digital labelling?**

- The industry is accelerating adoption of digital technology in providing information on food and drink products to consumers, across a wide variety of segments, including information supply chain traceability, healthy eating education, and sustainability information. Without considering the real-world uptake and adoption of QR codes and other digital carriers of information, any conclusions around the approach to regulating digital labels based solely on the findings of the JRC report risk being incomplete and out-of-step with the market reality for consumers and the industry.
- The surveys conducted by the industry, i.e. spiritsEurope survey into use of digital labels and Mondelēz' findings regarding a QR code pilot program in UK, show that there is a pool of consumers who are not only familiar with QR codes, but are willing to use them to access additional product information and also helpful guidance on their own consumer decisions and recycling advice. These fairly recent findings give reason to believe that a snapshot of consumer's use of and expectations from packaging labels and digital labels

specifically can be taken only through a tailored, EU-specific research that can stand the test of representative sampling and bias.

2. **What is the impact of digital trends driven by new generations?**

- Innovation and use of technology in context of food and drink products is at the forefront of a competitive and future-oriented industry sector, as digital consumption of goods and services continues to complement the analogue consumer experience. The extent to which the industry has built self-regulatory frameworks, especially looking at the example of the U-label platform, indicates that there is a strong need and an opportunity to define digital labelling standards that work for the food and drink market.
- While not all consumers may want to or expect to access product information via digital means, that does not mean that all consumers should be left with the burden to navigate the existing fragmented self-regulatory approach without standardization and coherent regulation of digital labels to support consumer protection, quality and veracity of information provided and certainty in making purchasing decisions.

3. **What is the role of digital labelling in the context of the self-regulatory initiatives and the upcoming revision of the EU legislation on food information to consumers.**

- The increasing number of self-regulatory initiatives providing digital label on products, points clearly at the need to develop a regulatory framework. Consumers are increasingly using and interacting with digital labelling for accessing information on food products, for a fragmented selection of products that self-regulatory initiatives apply to, and with access to information that is not standardized. The upcoming revision must address the role that digital labelling is already playing in the food and drink sector, otherwise the consumers will unintentionally be left with the burden of managing the ever-evolving and not entirely aligned or compatible approaches delivered by the industry.

4. **What are the learnings from the existing EU digital labelling initiatives and areas where digital labels have been implemented that could supplement the findings of the JRC report?**

- The benefits that are clearly recognised by consumers that have taken part in industry pilot programs and surveys around digital labels, give reason to look deeper into the impact that the current solutions provided by the industry have had on consumers, food purchase intentions and behaviours. Understanding specific benefits, as opposed to looking into potential risks and gaps, is key to building a strong foundation for defining the EU's approach to digital labels.

European alcoholic beverage sector

While the FIC Regulation exempts alcoholic beverages above 1.2% by volume of alcohol from the provisions requiring a list of ingredients or a mandatory nutrition declaration, the industry has, however, acknowledged consumers' demand for increased transparency, traceability and authenticity. Over the past years the alcohol beverage sector in Europe has developed voluntary digital labelling schemes, providing information to consumers via the application of QR codes on the label, and other digital means. While there is information available on these initiatives, the data on consumers' behaviour around the acceptance, uptake and use of QR codes is still limited with some insights provided by the industry research.

European spirits industry

In March 2018, seven trade associations (AICV, The Brewers of Europe, Comité Européen des Entreprises Vins – CEEV, CEVI, COPA COGECA, EFOW and spiritsEUROPE), representing producers of spirits, wine, cider and beer presented a joint voluntary commitment, the Self-regulatory proposal from the European alcoholic beverages sectors on the provision of nutrition information and ingredients listing to, at the time, Health Commissioner Vytenis Andriukaitis. In the spirits-sector-specific annex to the joint document, spiritsEUROPE – representing the spirits sector's 30 national associations and 10 leading multinational companies – committed to ensure that, by the end of 2022, information on the nutrition and ingredients of all spirits sold in the EU is made available to consumers. As the spirits sector agreed to a number of additional commitments in dialogue with the European Commission, in June 2019, a Memorandum of Understanding (MoU) was launched, setting up commitments on the provision of the energy value and list of ingredients on spirits drinks and a number of specific principles and rules with regards to the questions of how energy information should be provided on the label and in which manner ingredients should be listed online. The information provided by the MoU includes energy information on-label combined with comprehensive ingredients and nutritional information online. At the onset, the plan was to roll out the commitment in a phased way so that the collective total EU market share (by volume) of products placed on the EU market providing energy information on-label and list of ingredients online amounts to 25% by the end of 2020, 50% by the end of 2021, and 66% by the end of 2022. The MoU provided for ingredients to be declared on line, and in addition, spirits producers committed to include information on raw materials for certain spirits categories in the online ingredient list. The industry worked with the global supply-chain standardization body GS1 to make consumer information directly available from bottles by providing the list of ingredients through digital labels (a bar-code or a QR code).

Following the revision of the CMO Regulation in 2021 and the new labelling obligation that will be rolled out for wine products as of December 2023, the wine sector already activated and put in place initiatives to bring the sector to the frontline of digital labelling innovation. In October 2021, Comité Européen des Entreprises Vins (CEEV) – the association representing European companies in the industry and trade of all wine categories – and spiritsEurope launched the U-label, an e-label platform for wine and spirits companies to provide information about their products by means of an e-label, accessible to consumers through a QR code printed on the back-label of the bottle. The information is provided in all EU official languages and includes list of ingredients, nutrition information, responsible drinking guidelines and information about sustainability. The sector is therefore prepared for the new regulatory changes foreseen by the CMO Regulation and since October 2021 has been forward-looking and up-to-speed with the new labelling trends.

In September 2022, spiritsEurope published the findings of an online consumer survey conducted by market research firm Appinio on behalf of spiritsEUROPE across five European countries (Czechia, France, Germany, Italy, Spain) on consumer use and attitude toward digital labels. 5,000 participants responded to the survey, and the findings show that 75% of surveyed consumers say they have scanned a QR code on a food or drink product, and nearly half say that they do so regularly; nearly all of those who have scanned a QR code find it an easy way of accessing product information. Convenience, reliance, and readability of information are cited as the greatest advantages of digital labels, compared to physical labels. As many as 87% of respondents tend to favour the introduction of policies to ensure that product-specific information

conveyed digitally (such as via a QR code or barcode scan) is truthful and accurate. Vast majority of consumers, 8 out of every 10 are used to scanning QR codes (43% scan them regularly, 40% occasionally). And, interestingly, most consumers only look at consumer information occasionally – some never look at labels at all, others look every time. While this survey is limited in terms of any bias that could be engrained in selection of participants and potential bias, it raises the question of what the attitudes are and what is the consumer experience when it comes to using QR codes to access different information relevant to food products.

Implementation of U-label in Italy

U-label is partnering with other organisations for the dissemination of digital labels, including in supporting compliance with national laws, like in case of Giunko, an Italy-based company, to provide the digital solution supporting regulatory compliance and access to digital information related to product packaging and recycling. As of 1 January 2023, wines and spirits placed on the Italian market must provide information on the identification and classification of the product packaging, i.e., the nature of the packaging materials used and their disposal. The Italian regulations makes it possible for producers to convey this information digitally via an e-label, accessible by scanning a QR code on the bottle with a smartphone.

On 28 September 2022 a Ministerial Decree was adopted in Italy, to providing new and updating established standards for packaging labelling under the 2006 Legislative Decree on the management of packaging waste. The new rules provide that the use of digital tools is always allowed in order to fulfil the environmental labelling obligation of packaging intended for commercial, industrial and domestic destination. No specific indication is made on which digital tool it is possible to adopt, therefore the choice is completely up to the producers. The Italian consortium for packaging (CONAI), in the *Vademecum* for the use of digital tools for the environmental labelling of packaging, favours implementation of a QR code for such purpose as it uniquely identifies products through a standard structure of the web address (URL) using products' identification codes (GTIN). By doing so, QR codes ensure a few important things:

- It is a free and open standard and not a proprietary solution.
- It is usable and compatible with any solution companies choose to provide information to consumers, since it impacts only on the QR Code printed on the product and not on the site and linked pages.
- It contains the same information used for 50 years to identify the product (the GTIN) and in the future will be able to support and replace the traditional barcode in all product management processes, including sale to the consumers.

- It has a permanent standard structure which should not be modified if, for example, the site changes or the pages associated with the product change.
- Finally, it forms a direct link between the product and any information concerning it (disposal of the package, composition or ingredients, allergens, nutritional value, marketing, origin, traceability, etc.) which through a simple web redirection mechanism, it can avoid the proliferation of symbols on the package.

Italian legislation is in line with the national process of technological innovation and simplification, where digital carriers are conceived as means to completely replace or supplement the information normally reported on a packaging. Companies are allowed to choose whether to completely replace physical labelling and make information available only digitally, communicate only some of the mandatory information via digital tools (e.g., for recycling), or report the mandatory information directly on the packaging and redirect consumers to consult digital platforms for additional information.

It is, however, foreseen that instructions on digital tools and how to use them must be clear and easily accessible in order to ensure the so-called "bridge" between the physical and digital world and leave no one behind. This national example of openness on digital tool as a means of conveying information to consumers can help inform the EU policy debate around the need for regulated approach to digital labelling.

Pernod Ricard eLabel

In June 2022, Pernod Ricard, a France-based multinational specialized in the production and distribution of alcoholic beverages, launched a digital labelling system to provide consumers information about the products they purchase and on responsible drinking.

The pilot program was launched in July 2022 in Europe and is planned to be rolled out globally across all brands in the Group's portfolio by 2024. Every bottle of Pernod Ricard's brands will carry a QR code on its back label which, when scanned, will redirect consumers to a platform where they can access relevant information such as list of ingredients and full nutrition facts, information about the health risks and responsible drinking guidelines issued by consumers' own country's government authorities, displayed in the local language.

The Whisky Barrel digital provenance certificate

In March 2022, the Whisky Barrel, a Scotland-based online retailer and bottling company of Scotch whisky, introduced a full digital provenance certificate (DPC) for single-cask Scotch. Building off of increasingly popular blockchain technology, the Whiskey Barrel partnered with Aberdeen-based CD Corp (CryptoDramz) to analyse the Scotch whisky provenance process and apply blockchain-based DPC using Non-Fungible Tokens (NFTs) to digitally certify its whisky. Unique QR code, applied to the bottle label, links to its corresponding digital certificate, providing digital proof of ownership, authenticity and information on the supply chain and product characteristics, including the distillery, its location, cask type and bottle number.

According to The Whisky Barrel, DPC provides an enhanced layer of security for buyers, ensuring authenticity and traceability of products. The innovation is motivated by the consumers' demand to know the provenance of a product and the history behind it, and also by their interest in paying

a premium for reliable geographical indication systems that guarantee the product's authenticity in a market environment increasingly burdened by counterfeit products.

European snack sector

Mondelēz International's Snack Mindfully

In 2019, Mondelēz International, one of the world's largest snacking companies, established the goal to place the Snack Mindfully portion icon on all packs, for all snacks, globally by 2025. The activation started in 2020, and the company's Snack Mindfully website was put in place to provide resources, tips and information on mindful snacking.

As part of the company's commitment on mindful snacking, in 2022, in the UK, Mondelēz piloted QR codes on-pack, to provide consumers with further information. When scanned, the QR code leads the consumers to the online platform 'Snacking Right' which provides information about the company's global Snacking Made Right programmes, including its cocoa sourcing programme Cocoa Life, tips on mindful snacking and locally relevant recycling information. The QR code was placed on back of pack for 19 stock keeping units across range of Cadbury, Oreo and Barny products in UK. The company reported high QR code scan rate of around 1.3k per month, and 4,755 QR code scans during a five-month period, relative to comparable Mondelēz projects. An on-site survey showed that 75% of users found that the website delivered the information they need, 90% of users found the site helpful to act on recycling and/or mindful snacking.

It should also be noted that Mondelēz has developed specific principles it adheres to in support of the transition to off-pack digital labelling solutions. These include: developing digital regulations and standards with appropriate governance in place to facilitate harmonisation of approaches; a common regulatory framework around information available on-pack and off-pack through digital solutions; voluntary approach to a complementary way of providing both mandatory and voluntary product information either on or off-pack; proportionate and demonstratively beneficial to consumers approach, with relevant and evidence-based information being provided; abiding by the same principles as on-pack food information, including harmonised principles of accuracy, transparency, reliability and fairness; supported by appropriate government-led consumer awareness/ education campaigns, ensuring also support for vulnerable groups; developing solutions in consultation/partnership with multi-stakeholders, including national food authorities, regional and international bodies, industry, digital platforms (such as GS1), and food retailers to ensure the infrastructure is in place to enable the uptake, success, and execution of such digital technology and to ensure industry/regulator alignment; based on international guidelines such as the Codex Guidance on the use of Technology in Food Labelling and Guidance on the Food Information requirements for packaged foods to be offered via e-commerce; regularly reviewed by governments to take into consideration consumers' evolving information needs and the constant evolution of innovative technology.

5. Codex Alimentarius Commission

The Codex Alimentarius Commission (CAC), the standards body of the Food and Agriculture Organisation (FAO) and the World Health Organisation (WHO) has been focusing on the topic of digital labelling since 2017, and more increasingly as of recent. The Codex Committee on Food Labelling (CCFL), tasked broadly with labelling applicable to all foods, including standards, codes of practice and guidelines, has been leading on the work within CAC with the 47th session in May 2023 scheduled to consider the proposed approach to guidelines on use of technology to provide food information.

The significance of this lies in the fact that the Codex Alimentarius, as a collection of internationally adopted food standards and related texts, while in essence recommended for voluntary application by members, serves in many cases as a basis for national legislation and support harmonization in order to facilitate international trade. Should guidelines on use of technology to provide food information be endorsed by CAC, this will be a strong signal that harmonization of regulation around digital labelling is an expected standard for regional and national regulatory authorities to take notice of. With respect to the EU, this would be a strong signal to follow with relevant harmonizing framework.

On the work of the Codex Committee on Food Labelling

During the 44th session of the CCFL held in 2017, CCFL had identified innovation and use of technology in food labelling as a subject of possible new work, and had agreed to issue a call to collect information on the current practices, issues and any potential role for CCFL in this area. The discussion paper on innovation – use of technology in food labelling was requested at the time. As a follow-up to this, at the 45th CCFL session held in 2019, CCFL held a general discussion on the subject of innovation and use of technology in food labelling and noted the following views expressed by delegations:

- The topic was an acknowledgement of the development and evolution the way food information could be provided to consumers, industry and competent authorities i.e. websites; QR codes; text messaging; mobile phone applications. Consequently the definition of a label and labelling in the General standard for the labelling of prepackaged foods (GSLPF) would need further consideration in order to allow that some information could be provided by use of innovative technologies.
- Innovation and use of technologies should assist consumers to compare food products and make an informed choice when buying, however care should be taken not to mislead the consumers.
- Consumer familiarity with, and access to, technology should be taken into account.
- The area of innovation and use technology in food labelling overlaps with the proposed new work on internet sales/e-commerce; and work on these topics should progress in parallel but each at its own pace.
- It would be important not to merge innovation and use of technology with the work on internet sales/ e-commerce as these two subjects were distinct. However, consideration should be given to the broad application of innovation and technology in food technology space; and it would be important to get clear understanding of how information in virtual

space was used by consumers while at the same time meeting the objective of consumer protection and fair trade.

The Committee agreed to prepare the discussion paper to further clarify the scope of innovation and technology in food labelling. Subsequently also a circular letter was compiled and findings presented at the 46th CCFL session in 2021. The findings highlighted support for mandatory information to remain on the physical label of prepackaged foods and that the definition of "label" should continue to pertain to the physical product with rare exceptions such as for small packages; general principles of the GSLPF should apply and that adjustments would be needed to the GSLPF; the scope should be limited to prepackaged foods intended for consumers as the draft general standard for labelling of non-retail container already addressed this in those foods; and that technology can and is being used for supplementary or voluntary information or to repeat information found on the food labels through means such as websites or QR codes. It was proposed that the new work would address the gaps in the GSLPF to enable the general principles in the GSLPF to apply to food information provided through technology. The new work was proposed to be focused on developing broad guidelines on the use of technology in food labelling in areas such as circumstances where the use of technology would be appropriate in food labelling; consistency between information on the label and provided through technology; and legibility, language, presentation of information and accessibility to consumers. The scope of the work set for CCFL covers both voluntary and mandatory labelling and the need for consistency in the information provided on a label and through technology.

The 47th session of CCFL, held in May 2023, discussed the proposal for Draft Guidelines on the Use of Technology to Provide Food Information: Amendment to the GSLPF (GUTPFI). The GUTPFI apply to food information that is accessed using technology via a reference on a prepackaged food's label or labelling, and will provide principles for the use of technology in food labelling, and outline relevant standards to be applied. The CCFL clarified the definition of "Food information" as meaning the information subject to a Codex text about a prepackaged food; and the definition of "technology" was included as any electronic or digital means, including but not limited to websites. CCFL47 agreed to re-establish the electronic working group (EWG) to further develop the Guidelines by CCFL48.

The outcome of the work of the EWG will be significant for further reinforcement of the evident need for harmonization of regulation of digital labelling for food information but also more broadly as this technology becomes increasingly recognised and used by the consumers, the industry, and the regulators around the world.

6. Table of Abbreviations

CMO (Regulation)	Common Organization of Markets
DPP	Digital Product Passport
EC	European Commission
ECA	European Court of Auditors
EMA	European Medicines Agency
EPRES	European project registry for energy labelling
ESG Criteria	Environmental, social and corporate governance criteria
ESPR	Regulation on Ecodesign for Sustainable Products
EU	European Union
eWOM	Electronic word of mouth
JRC report	Joint Research Centre report
PPWR	Packaging and Packaging Waste Regulation
QR code	Quick Response code
FOP labelling	Front-of-pack labelling
GHG	Greenhouse gas
POS	Point-of-sale
QR code	Quick Response code

Annex I. Table of Academic Research on Digital Labelling

*Years marked with an asterisk in the table indicate articles listed in the 2022 JRC Report and included in this study in light of their topical and temporal relevance.

No	Year	Title	Journal	Technology	Methodology & Size	Main results	Key take-away
1	**2023**	"Using blockchain to signal quality in the food supply chain: The impact on consumer purchase intentions and the moderating effect of brand familiarity" Treiblmaier H., & Garaus M. Link	International Journal of Information Management	Blockchain	Surveys n1=152 n2=151	Drawing on signalling theory and the results of two experimental studies with 151 and 152 participants, respectively, the study investigates how the use of blockchain to trace food products impacts consumers' perception of product quality as a mediating variable and subsequently their purchase intention. The findings from the two experiments show that blockchain labels as a signalling mechanism in food supply chains help to strengthen consumers' perceived quality of food products, which, in turn, increases their purchase intention.	Blockchain labels improve consumers' perception of food product quality

No	Year	Title	Journal	Technology	Methodology & Size	Main results	Key take-away
2	**2022**	"Blockchain-enabled Sustainability Labeling in the Fashion Industry" Remme, A. M., et al. Link	Procedia Computer Science	Blockchain	Experiment n=84	Results showed that "blockchain trademarked" did not have much impact relative to "low price" and "high product rating". Further analysis showed that "blockchain trademarked" had a relatively stronger impact towards those participants who indicated that living a sustainable lifestyle is important. Our findings show that there is a need for educating consumers about blockchain and the associated benefits for improving future transparency in sustainability in the fashion industry. Overall, these findings provide valuable grounds for further research on how blockchain-enabled sustainability labelling can create value for both consumers and companies within the fashion industry.	Need for educating consumers about blockchain and the associated benefits
3	**2022**	"Blockchain Technology Transforms Digital Marketing by Growing Consumer Trust" Rabby, F. et al. Link	Transformation through blockchain technology	Blockchain	Study	The article demonstrates how Blockchain technology functions as an evolutionary breakthrough that empowers a consumer-centric mentality. In this chapter, we look at the potential of Blockchain technology from a marketing point of view. To understand the role of trust in Blockchain adoption in digital marketing, peer-reviewed articles were selected using the following search terms: 'Blockchain', 'big data' and 'digital marketing'. This review of the literature found that trust is a key driver to consumer–brand relations when implementing Blockchain technology in digital marketing.	Trust is a key driver to consumer–brand relations when implementing Blockchain technology in digital marketing

No	Year	Title	Journal	Technology	Methodology & Size	Main results	Key take-away
4	**2022**	"What Intentions and Interesting Information Can Attract Consumers to Scan QR Code While Buying Eggs?" Yang, S.-H. et al. Link	Foods	QR code	Survey n=1,112	This study aimed to investigate the experiences and intentions of scanning QR Code in traditional markets and supermarkets. Furthermore, the types of egg information in the QR Code were explored to identify consumer interests when purchasing eggs. Results showed that shoppers' propensity to scan QR Code revealed a significant difference between traditional markets and supermarkets, i.e., supermarket shoppers having higher a propensity to scan a QR Code. Of the 10 types of potential egg information in the QR Code, over half of respondents said that the production certificate label and inspection information were the top reasons that they would be interested in scanning a QR Code.	Supermarkets shoppers are more likely to scan QR code rather than in traditional markets. The production certificate label and inspection information were the top reasons for scanning the QR code.
5	**2022**	"Consumer purchase intention towards a quick response (QR) code for antibiotic information: an exploratory study" Bradford, H. et al. Link	NPJ Science of Food	QR code	Survey n=1,000	This study explores UK consumers' perceptions and purchase intention towards QR code labelled pork, and to identify determinants of its purchase, incorporating various theoretical constructs from the Theory of Planned Behaviour. Based on results, consumers' perceptions, perceived control, and attitudes towards QR code labelled pork are the main determinants of purchase intention. QR code labelled pork may offer a suitable alternative to antibiotic-free labelling as it provides consumers with antibiotic information without inadvertently communicating that conventionally produced pork is unsafe.	Consumers have favourable attitudes and perceptions towards QR code as an antibiotic traceability system, with a positive influence on their purchase intention. Gender, age, education, and socioeconomic status had no significant influence on intention to purchase QR-code labelled pork.

No	Year	Title	Journal	Technology	Methodology & Size	Main results	Key take-away
6	**2022**	"Consumer perceptions of QR code technology for enhanced fluid milk shelf-life information provision in a retail setting" Lau, S. et al. Link	JDS Communications	QR code	Review article	The article assessed the consumer acceptance of (1) QR code technology to communicate product shelf-life and (2) shelf-life dependent pricing based on QR codes by offering both half-gallon fluid milk with traditional printed best-by dates and identical products with QR codes to convey best-by dates over an 8-wk time period in a retail setting. The results suggest that at least some consumer segments would adopt QR code-based shelf-life labels, which presents an opportunity to better manage and communicate "best-by" dates and use dynamic pricing strategies to reduce food waste that occurs when an end-of-shelf-life product is either not sold or is discarded by consumers.	Consumers accept use of QR code technologies to display best-by dates.
7	**2022**	"Evaluating the Use of QR Codes on Food Products" Rotsios, K. et al. Link	Sustainability	QR code	Survey n=537	This study evaluates the use of a QR Code on bottled milk and more specifically on milk produced by one of the most well-known "boutique" Greek dairy producers. Data from a two-phased survey was gathered from 537 consumers of the product to capture and analyse their (i) buying behaviour, (ii) perception of the product's package, and (iii) knowledge about the product. The results show that a QR Code on the packaging of food products, which directs consumers to entertaining and enriched content, results in an increased level of usage intention. Moreover, they proved that comprehension and self-confidence are higher with the adoption of the QR Code.	QR code on packaging with entertaining content increases usage. Presence of QR code improves consumer comprehension and confidence in the product.

No	Year	Title	Journal	Technology	Methodology & Size	Main results	Key take-away
8	**2022**	"Rise of the QR code application adoption: towards a conceptual post-covid-19 smart sustainable tourism framework" Azmadi, A. S. A., et al. Link	International Journal of Social Science Research	QR code	Review article	This study aims to introduce a conceptual framework for QR code application acceptance by tourism consumers to help determine future decision-making on Smart Sustainable Tourism Practices integration in touristic destinations. This paper reviews recent technology adoption and smart sustainable tourism literature within the tourism and hospitality industry. The study then identifies factors that potentially influence travellers' acceptance and experiences of QR code applications and elements that affect their decision-making process.	Uprising trends of QR code usage among tourism destination. Tourist sustainability behaviour influences technology adoption preferences. COVID-19 pandemic worked as a stimulus towards the usage of QR code amongst tourist and tourism destination.
9	**2022**	"Influence of Communication Channel and Information Form on Consumers' Purchase Behavior" Wang, Y., et al. Link	Technical Gazette	All digital labelling platforms	Survey =55 4 experiments based on survey results	This study investigates the different effects of information forms on consumers' purchase behaviour, both online and offline. Two surveys and four laboratory experiments were conducted to investigate whether and why consumers would react differently to information forms within different communication channels. The results indicated that, for highly involved consumers, online listed information was more effective than narrative information, while the opposite was true in offline situations.	High consumer involvement and high involvement products positively impacts use of online information.

No	Year	Title	Journal	Technology	Methodology & Size	Main results	Key take-away
10	**2022**	"I'm no expert, but…? Consumer use of supportive digital tools in health services" Bocking, H., et al. Link	Journal of Service Theory and Practice	All digital labelling platforms	Qualitative survey (interviews) n= 30	The purpose of this paper is thus to explore consumer perceptions of supportive services and self-management health tools using digital platforms for different levels of interactive features as social support in a health services context. Consumers are motivated by a desire to control and monitor health concerns and avoid overuse of the health system. The findings showed a preference for social support to go beyond informational support, with a need for interactivity that personalized support in a proactive manner.	Supportive digital tools are positively perceived by consumers. Consumers more motivated to use digital tools when there is an interactive element.
11	**2022**	"Sustainable development and greenwashing: How blockchain technology information can empower green consumers" Nygaard, A., et al. Link	Business Strategy and the Environment	Blockchain	Review article	The review articles concludes that blockchain technology, more than regular certifications or other digital labelling option, has significant impacts on consumers' perception of greenwashing. Perceived greenwashing leads to a situation where consumers cannot pursue their intentional choice of buying green products in favour of unsustainable products.	Use of blockchain technology reinforces consumers' trust in green claims.
12	**2022**	"The influencing factors of digital health passport adoption and acceptance during COVID-19 in Saudi Arabia" Samha A. K., et al. Link	Digital Health	Covid-19 Passport / QR code	Survey n=103	The purpose of this research was to investigate the elements that influence a traveller's decision to acquire and use a digital health passport (DHP). The factors "perceived ease of use", "perceived usefulness", "information quality" and "service quality" have a significant impact on the public's acceptance and use of the Covid passport.	Acceptance and use of Covid passport was motivated by perceived usefulness and quality.

No	Year	Title	Journal	Technology	Methodology & Size	Main results	Key take-away
13	**2021**	"The Relationship between Online and Offline Information-Seeking Behaviors for Healthy Nutrition" Fehér, A., et al. Link	Int. J. Environ. Res. Public Health	All online and digital platforms	Survey n=612	The study aims to identify university students' online and offline information-seeking attitudes related to healthy nutrition. In relation to university students' information-seeking competence, the component of electronic health literacy was determined. Online and offline sources of information accompany university students' transition of the relevant stages of changes.	Majority of students tend to get their information from online sources. Students usually use digital information to strengthen their behavioural change.
14	**2021**	"Improving Food Consciousness - Opportunities of Smartphone Apps to Access" Toth, M. et al. Link	Journal of Agricultural Informatics	Mobile apps & augmented reality	Review article Survey n=376	The paper surveyed and analysed the attitude of young food consumers due to their personal needs, the extent of attention to package information, and the most important factors when purchasing goods. It also surveyed the interest in smartphone applications that may support the decision. The results suggest that there is a willingness to use an interactive application to gain personalized food information immediately. The majority of respondents would use an application that provides complex information service.	Interest from the youth to have access to online food information. More willingness to use interactive online platforms.
15	**2021**	"Passport to a Mighty Nation: Exploring Sociocultural Foundation of Chinese Public's Attitude to COVID-19 Vaccine Certificates" Hu, M., et al. Link	Int. J. Environ. Res. Public Health	Covid-19 passport	Survey n>2,000	Based on a national sample of over 2000 participants administered in April 2021, the current study examines the Chinese public's attitudes to the so-called Covid-19 vaccination passport and factors contributing to their viewpoints. Generally, the Chinese people had favourable opinions on the passport.	High income, personal benefit perception, the subjective norm of COVID-19 vaccination, and nationalism were significantly associated with the public's positive attitude to the COVID-19 passport.

No	Year	Title	Journal	Technology	Methodology & Size	Main results	Key take-away
16	**2021***	"Augmented Reality-Delivered Product Information at the Point of Sale" Hoffmann et al. Link	The Journal of the Academy of Marketing Science	Augmented reality	Survey S1 n=403 S2 n=51	A field study in a supermarket showed that, when exposed to detailed AR for breakfast cereal with a high controllability, consumers fear that they are less comprehensively informed and have reduced purchase intentions, negative brand image, and make fewer purchases. S2 shows that AR providing extra product information increases the variety of beer types purchased only during relaxed shopping times. Information delivered through AR influences consumer decisions at the point of sale. Effectiveness depends on the controllability and details of the product information presented, yet a high level of both creates a backfire effect. The effect is mediated by perceived comprehensiveness and moderated by the medium, consumer stress, and shopping times.	Reduction in purchase intentions, brand image and actual purchases when AR presents too much information.
17	**2021***	"Digitalization as solution to environmental problems? When users rely on augmented reality-recommendation agents" Joerss, T., et al. Link	Journal of Business Research	Augmented reality	Experiment n=120	An experiment conducted in a grocery shopping laboratory showed that tablets providing positive sustainability information through AR lead users to choose more sustainable products. On average, subjects more often picked products rated as sustainable, notably for coffee, cereals, and milk (but not for jam).	Increase in product choice for sustainable products when sustainable information is presented through AR.
18	**2021***	"Consumers' Intention to Adopt Blockchain Food Traceability Technology towards Organic Food Products" Lin et al. Link	International Journal of Environmental Research and Public Health	Blockchain	Survey n=300	A survey in China (n=300) showed that attitude towards blockchain and perceived behavioural control significantly and positively affect the usage intention for information about a blockchain food traceability system (BFTS).	Positive attitudes for blockchain for organic food. High intention to use blockchain for organic foods.

No	Year	Title	Journal	Technology	Methodology & Size	Main results	Key take-away
19	**2021***	"The influence of blockchain-based food traceability on retailer choice: The mediating role of trust" Garaus, M, & Treiblmaier, T. Link	Food Control	Blockchain	Experiments S1: n=180; S2: n=150; S3: n=439	Three experiments show that being informed about a blockchain-based traceability system increases consumers' retailer preferences and that this effect is mediated by trust in the retailer. Consumers experience higher levels of trust in retailers who implement a blockchain-based traceability system compared to a traditional traceability system. Unfamiliar retailers benefit more from the implementation of a blockchain based traceability system compared to familiar retailers	Blockchain traceability systems for food products increase preferences for retailer due to trust.
20	**2021***	"Consumer valuation of blockchain traceability for beef in the United States" Shew, A., et al. Link	Applied Economic Perspectives and Policy	Blockchain	Experiment n=1,096	A choice experiment about meat traceability with a representative sample of the U.S. population showed higher preference and willingness to pay for meat with labels ensuring its traceability issued by the governmental agency label (USDA), followed by the government-issued blockchain label. Regarding blockchain, no difference appeared in terms of terminology (Distributed Ledger or Blockchain) or in terms of blockchain governance system.	Low preference for blockchain label in comparison to USDA label for meat traceability. Blockchain was preferred only when government certified.
21	**2021***	"From individual to collective empowerment: Investigating the Yuka mobile application case" Gauthier, et al. (Link to article not available)	Working Paper	Mobile apps	Online consumer reviews (n=1,500) and press articles (n=117)	A qualitative analysis of online consumer reviews and press articles in France showed that the Yuka food app facilitates consumers' access to food information, enabling knowledge acquisition, and increased control of food decisions. The app helps consumers to interpret food labels and is considered easy to use, useful, providing a positive experience	Improvement in access to food information, food knowledge and control. Positive attitudes towards the app.

No	Year	Title	Journal	Technology	Methodology & Size	Main results	Key take-away
22	**2020**	"Traditional Foods at the Click of a Button: The Preference for the Online Purchase of Romanian Traditional Foods during the COVID-19 Pandemic" Petrescu-Mag, R.M., et al. Link	Sustainability	Online grocery shopping	Survey n=223	Conducted via a survey taking place in three cities, the results suggest that although participants had a great desire to know how their food was produced and handled, it was their understanding of, and confidence in, food traceability systems that strongly predicted their willingness to pay for having their food traced.	To gain consumer trust in food traceability, consumers must be informed about how the system works.
23	**2020**	"Establishing confidence in food safety: is traceability a solution in consumers' eyes?" Zhang, A., et al. Link	Journal of Consumer Protection and Food Safety	Blockchain	Survey n=489	With an online survey, the study examined consumers' perceptions of, and confidence in, the food traceability system to fulfil the role of ensuring food safety. The results suggested that although participants had a great desire to know how their food was produced and handled, it was their understanding of, and confidence in, food traceability systems that strongly predicted their willingness to pay (WTP) for having their food traced	To gain consumer trust in food safety, it is critical to inform consumers how blockchain works to build their confidence in the system.

No	Year	Title	Journal	Technology	Methodology & Size	Main results	Key take-away
24	**2020***	"A randomized controlled trial examining consumers' perceptions and opinions on using different versions of a FoodFlip© smartphone application for delivery of nutrition information" Ahmed, M., et al. Link	International Journal of Behavioral Nutrition and Physical Activity	Mobile apps	Experiment n=1,997	An experiment with a representative sample of Canadians compared a mobile phone application displaying traffic light labels, health star ratings, and "high-in" warning labels, with no label (display of the Nutrition Facts Panel with no other functionality, control condition) in a between-subjects design. Participants had to scan 20 products with a food application that displayed information in different formats. Results show that the display of the health star rating was considered less useful, believable and understandable than all the other conditions, suggesting that this type of display of nutrition information in a food application is less effective. The display of "High in" and of traffic light labels in the application increased participants ability to compare products' healthfulness in comparison to both control and health star ratings conditions.	Positive attitudes towards the display of "High in" and traffic light labels on app. Increase in the ability to compare products' healthfulness. Display of health star ratings on app was not different than control and less positive than other labels.

No	Year	Title	Journal	Technology	Methodology & Size	Main results	Key take-away
25	**2020***	"Consumers' acceptance of an online tool with personalized health risk-benefit communication about seafood consumption" Minnens, F., et al. Link	Food and Chemical Toxicology	Mobile apps	Survey n=504	A survey in five European countries (Belgium, Spain, Portugal, Norway, and Ireland) measured the acceptance of an online tool to facilitate fish choice. This article specifically evaluated the FishChoice tool, developed and launched in 2016, and providing risk-benefit information online about several seafood species. Participants were asked to test the online tool for as long as they wanted and were then asked to complete the survey. Results showed that participants had positive attitudes towards FishChoice, perceived it as useful and easy to use. 68% of participants agreed they would use the information provided by the tool when choosing seafood species. Heavy users of the seafood category had higher intentions to reuse the tool.	Positive effects on attitudes towards the app. High intentions to use app provided information.
26	**2020***	"Do Millennials Believe in Food Vlogger Reviews? A Study of Food Vlogs as a Source of Information" Briliana, V., et al. Link	Journal of Management & Marketing Review	Blogs and social media	Survey n=330	A correlational study showed that the higher the perceived benefit of online food vlogger reviews, the higher the intention to use food vlogger reviews for purchase decisions. Perceived benefit of online food vlogger reviews also influenced perceptions of YouTube, including perceived usefulness and enjoyment.	Positive attitudes towards vlogger reviews when the reviews were useful High intentions to use vloggers' information.

No	Year	Title	Journal	Technology	Methodology & Size	Main results	Key take-away
27	**2020***	"Effects of an Evidence-Informed Healthy Eating Blog on Dietary Intakes and Food-Related Behaviors of Mothers of Preschool- and School-Aged Children: A Randomized Controlled Trial" Dumas, A. A., et al. Link	Journal of the Academy of Nutrition and Dietetics	Blogs and social media	Experiment n=84	An evidence-informed healthy eating blog written by a registered dietitian, at a rate of 1 blog entry/week, had no effect on dietary intakes, including vegetables, fruit, milk, and alternatives consumption, self- perceived meal planning and cooking skills, as well as the body weights of French-speaking mothers of preschool- and school-aged children after 6 months, when compared with a control group with no access to the study blog.	No effect of blog exposure on food intake, self-efficacy or weight.
28	**2020***	"Understanding the Effects of Antecedents on Continuance Intention to Gather Food Safety Information on Websites" Tsai, H., et al. Link	Frontiers in Psychology	Blogs and social media	Survey n=298	Perceived ease-of-use, satisfaction, and usefulness indirectly affected social media continuance or the intention to continue to use social media to obtain food safety information.	Positive attitudes when easy to use. High intentions to use social media for food safety information.
29	**2020***	"Consumers' Purchase Intention of Organic Food via Social Media: The Perspectives of Task-Technology Fit and Post-acceptance Model" You, J.-J., et al. Link	Frontiers in Psychology	Blogs and social media	Survey n=235	A survey with participants of organic food promotion Facebook communities investigated how social media influences consumers' self-reported selection of organic food. Results showed that consumers' intention to gather organic food information through a social media forum is influenced by satisfaction with the platform. And satisfaction with the social media platform on organic food is determined by its functionality and its capacity to provide information about organic food (You et al., 2020)	Attitudes towards social media organic food information are influenced by satisfaction with the platform. Increase in intentions to use social media for organic food information.

No	Year	Title	Journal	Technology	Methodology & Size	Main results	Key take-away
30	**2020***	"Assessment of nutrition-focused mobile apps' influence on consumers' healthy food behaviour and nutrition knowledge" Samoggia, A., & Riedel, B. Link	Food Research International	Mobile apps	Experiment n=143	The use of a nutrition-information app (app that reads product labels, assesses quality of ingredients and nutritional values based on users' personal data, and recommends healthier food alternatives) for 12 weeks decreases the perception of the barriers to healthy food eating and increases the perceived personal strength in approaching healthy food. For app users in charge of food purchases in the household, the app allows for the gaining of additional knowledge about healthy food.	No effect of app on purchases of fruits and vegetables.
31	**2019**	"Are the Innovative Electronic Labels for Extra Virgin Olive Oil Sustainable, Traceable, and Accepted by Consumers?" Violino, S., et al. Link	Foods	QR codes and near field communication, tamper-proof device plus radio frequency identification	Questionnaire n= 1120	Results show that 94% of the consumer respondents are interested in the implementation of electronic label technologies, and among them 45% chose QR-code featuring a gamification system for consumers with a blockchain infotracing-platform.	Vast majority of consumers interested in implementation of digital labelling. QR codes with blockchain technology favoured option over near-field communication and tamper-proof devices.

No	Year	Title	Journal	Technology	Methodology & Size	Main results	Key take-away
32	**2019**	"The influence of the diffusion of food safety information through social media on consumers' purchase intentions: An empirical study in China" Cui, L., et al. Link	Data Technologies and Applications	Social media	Survey n= 199	The study reveals that friend recommendation and perceived risk directly affect consumers' purchase intentions and opinion leader recommendation, quality of information, credibility of information and demand for information indirectly affect consumers' purchase intentions through the diffusion of food safety information using social media.	People tend to look more for food information online and on social media. Social considerations in online environments, like electronic word of mouth and online reviews impact consumer behaviour.
33	**2019**	"Digital labelling in the retail environment: a domain-specific innovativeness perspective" Tanner, S. A., et al. Link	International Journal of Retail & Distribution Management	QR codes	Experiment n=19	Confusion regarding the functionality and purpose of QR codes adversely affected willingness to use and utility perceptions. Source trust and information credibility emerged as key concerns for those considering QR codes, with consumer risk aversion and innovativeness orientations influencing the nature of trust concerns. A perceived lack of complementarity between QR codes and retail environments reduced perceived relevance.	QR codes must alleviate the risk aversion of consumers.

No	Year	Title	Journal	Technology	Methodology & Size	Main results	Key take-away
34	**2019***	"An Interactive Mobile Phone App (SMART 5-A-DAY) for Increasing Knowledge of and Adherence to Fruit and Vegetable Recommendations : Development and Pilot Randomized Controlled Trial" Appleton, et al. Link	Journal of Medical Internet Research	Mobile apps	Experiment n=94	The use of an app designed to improve fruit and vegetable (FV) knowledge and choice for four weeks did not influence FV knowledge. Self-reported FV intake was higher for those using the app. Behavioural choice was measured in weeks 2 and 4: the choice of a fruit product was higher only in week 2, while no significant differences emerged in week 4. Self-reported use of the app was high and qualitative evaluations were positive.	Mobile apps have no effect on food knowledge. Positive attitudes towards the mobile app use, high self-reported fruit intake in week 2, but no significant changes in week 4.
35	**2019***	"An Augmented Reality App to Learn to Interpret the Nutritional Information on Labels of Real Packaged Foods" Juan, M.-C., et al. Link	Frontiers in Computer Science	Mobile apps	Survey n=40	Using an app with augmented reality to help consumers interpret the nutritional information about carbohydrates in packaged foods improved participants' objective knowledge about carbohydrate choices contained in packaged foods. Participants were also satisfied with the app and believed that it was very useful for learning.	Improvement in food knowledge and positive attitudes towards using of AR app.
36	**2019***	"Understanding Consumer Purchase Intention in a Blockchain Technology for Food Traceability and Transparency context" Yeh, et al. Link	IEEE	Blockchain	Survey n=264	Blockchain positively impacts trust towards the food provider and purchase intention of food products in general.	Blockchain increases trust towards food provider and purchase intention for food products.

No	Year	Title	Journal	Technology	Methodology & Size	Main results	Key take-away
37	**2019***	"How nutrition information influences online food sales" Zou, P., & Liu, J. Link	Journal of the Academy of Marketing Science	Online grocery shopping	Empirical Model and experiment	Analysis of data from 1,474 online food sellers in China and an eye-tracking study (n=60) show that consumers pay attention to nutrition information when grocery shopping online and that such information increases food sales. The effect of nutrition information on product sales is stronger for sellers with high reputation. Healthy food with nutrition information tends to attract more purchases than unhealthy food. The eye-tracking experiment shows that attention on nutrition information increases for healthy foods but not for unhealthy foods.	Increase in healthy food purchases. Decrease in unhealthy food purchases. Stronger effect for high reputation sellers and for healthy foods. Attention to nutrition information is increased for healthy foods.
38	**2019***	"Anthropomorphism and augmented reality in the retail environment" van Esch, et al. Link	Journal of Retailing and Consumer Services	Augmented reality	Survey n=319	Exposure to anthropomorphised product information for eggs through an AR shopping device (tablet, smartphone) positively influences consumers' experience (confidence, convenience of the transaction, perceived innovativeness, number of perceived usage barriers, diminished perception that AR will cause unintended health effects or side effects in general), which in turn influences attitude towards the brand.	Positive effect of anthropomorphised AR information on consumers' experience and brand attitudes.

No	Year	Title	Journal	Technology	Methodology & Size	Main results	Key take-away
39	**2019***	"Let Me Imagine That for You: Transforming the Retail Frontline Through Augmenting Customer Mental Imagery Ability" Heller, et al. Link	Journal of retailing	Augmented reality	Experiments S1 n=304 S2 n=238 S3 n=214	Information delivered through AR on menus positively influences word of mouth (WOM) intentions and product choice. The effect is mediated by processing fluency and decision comfort, and is moderated by consumers' processing type. In comparison to a traditional menu an AR application that shows only augmented information (ingredients and price), an AR application that virtually places 3D digitized replicas of desserts alongside ingredients and price information on the table increases processing fluency, decision comfort, and WOM intentions	Positive effects of AR food information on WOM intentions (mediated through processing fluency).
40	**2019***	"Food information presentation: Consumer preferences when eating out" Bray, et al. Link	British Food Journal	QR code	Survey n=452	A survey was conducted to assess preferences for food information displayed in a workplace dining setting in four countries (Denmark, France, Greece, and U.K.). Six types of food information were compared: traffic light labelling, information box (with ingredients or nutrition), quality assurance, brand, interactive information with QR code, footnotes (on the menu). Preference for information sources was assessed using a best-worst scaling method (respondents selected their most and least preferred option in each set). Results show that traffic light labelling, information box, and quality assurance are ranked in the top three for all four countries. Results revealed a very low preference for interactive information, provided through a QR code in France, Denmark, and U.K. This preference was higher in Greece.	Low preference for QR codes in comparison to labels.

No	Year	Title	Journal	Technology	Methodology & Size	Main results	Key take-away
41	**2019***	"To Scan or Not to Scan: The Question of Consumer Behavior and QR Codes on Food Packages" Li, T., & Messer, K. D. Link	Journal of Agricultural and Resource Economics	QR code	Experiment n=417	A field experiment compared four formats of food information provision: no info, printed, computer link, QR code alone, QR code + smartphone. 20.2% of participants clicked on the link to obtain additional information when the computer link was available, while only 1.2% of participants scanned the QR code. 52.6% scanned the QR code when a smartphone was available. There were however no effects of form of nutritional information provision on overall preference for oysters.	Very low spontaneous use of QR codes to access food information. Average use of QR codes only when smartphone was available to access information. Consumers' response to additional information was the same regardless of the medium of delivery.
42	**2019***	"Trends in and factors associated with the adoption of digital aids for smoking cessation and alcohol reduction: A population survey in England" Perski, et al. Link	Drug and Alcohol Dependence	Mobile apps	Survey n=2,998	The survey showed that only 3.6 % of drinkers who had made a quit/reduction attempt in the past year used a digital aid—website or mobile app. Only 15.3 % of all drinkers made a quit/reduction attempt.	Low use of apps and websites among drinkers who made an attempt to quit / reduce drinking.

No	Year	Title	Journal	Technology	Methodology & Size	Main results	Key take-away
43	**2018**	"Consumers' online information adoption behavior: Motives and antecedents of electronic word of mouth communications" Hussain, S., et al. Link	Computers in Human Behavior	Online information	Survey n=520	The study explains an overview of key elements of eWOM communication antecedents, addresses eWOM motives to analyse food products purchasing factors associated with consumer engagement. Certain factors of eWOM are found that should be considered in decision making according to the model for information adoption. It is revealed that consumers' need for social interaction, economic incentives, and self-worth reinforcement are the primary drivers of eWOM involvement.	Online social exchanges or electronic word of mouth positively impact on consumer perception of products.
44	**2018**	"Online traceability for halal product information: perceptions of Muslim consumers in Indonesia" Sagoyo, Djoko Link	Journal of Islamic Marketing	Online traceability of product/ blockchain	Survey with questionnaires n=160	This paper aims to provide a preliminary understanding of factors that contribute to consumer perceptions of value and usefulness regarding online traceability for product compliance to halal principles. Muslim consumer's perception of online traceability as useful is influenced by three main factors: the consumer's disposition to trust, a healthy lifestyle and the reputation of the company, as well as the certification bodies.	Religious considerations like halal certification make consumers perceive online traceability more positively.
45	**2018***	"Effectiveness of the Nutritional App «MyNutriCart» on Food Choices Related to Purchase and Dietary Behavior: A Pilot Randomized Controlled Trial" Palacios, et al. Link	Nutrients	Mobile apps	Experiment n=51	Exposure to an app that generates healthy grocery lists for eight weeks did not change purchases of fruits and vegetables compared to the control group. There were no changes in weight.	No effect of app on purchases of fruits and vegetables.

No	Year	Title	Journal	Technology	Methodology & Size	Main results	Key take-away
46	**2018***	"Design and Development of FoodGo: A Mobile Application using Situated Analytics to Augment Product Information" Abao, et al. Link	Procedia Computer Science	Mobile apps	Experiment n=30	Participants of a within-subjects experiment conducted in the Philippines were better able to identify the healthiest product when using an app that provided augmented information when scanning the barcode of a food product, in comparison to the control condition (manual assessment).	Improvement in capacity to identify healthy options when using app.
47	**2018***	"The acceptance of blockchain technology in meat traceability and transparency" Sander, et al. Link	British Food Journal	Blockchain	Survey: n=141 Qualitative research: n=12	The article evaluates the potential of acceptance of blockchain technology as a viable transparency and traceability system. Blockchain implementation appears to increase consumers' self-reported purchasing decisions for meat products, mediated by consumers' quality perceptions.	Blockchain technology and traceability and transparency systems positively influence consumers' trust and quality perceptions.
48	**2018***	"The Most Preferred Food Labels Among Online Shoppers" Gumirakiza, J. D., & VanZee, S. M. Link	Journal of Agricultural Science	Online grocery shopping	Survey n=1,205	Results showed that the likelihood for online shoppers to consider food information (other than price) in their purchase decision-making when shopping for fresh produce is 86%. The relative probability for "locally grown" labels to be the most important attribute influencing purchase decision is 46%, 7% for "organically grown", 24% for both local and organic, and 23% for other kinds of labels (nutrition content and country of origin). Those who give significant consideration to food labels are older, Caucasian, and primarily female.	Online shoppers are highly likely to use food information, other than price, when buying fresh produce.

No	Year	Title	Journal	Technology	Methodology & Size	Main results	Key take-away
49	**2018***	"Consumer wants and use of ingredient and nutrition information for alcoholic drinks: A cross-cultural study in six EU countries" Grunert, et al. Link	Food Quality and Preference	Online information	Survey n=5,395	Information desire and information use are mainly determined by product involvement and, to a lesser extent, by health interest. Use of sources of information about ingredients' and nutritional information for alcohol products is generally low (including online sources). Average levels of information want and use differ between the six countries, with the highest levels in Spain and the lowest in Denmark and the Netherlands.	High interest in institutional websites and in-store alcohol information. Low use of online means of alcohol information.
50	**2018***	"Is More Better? Insights on Consumers' Preferences for Nutritional Information on Wine Labelling" Vecchio, et al. Link	Nutrients	Online information	Experiment n=103	A controlled experiment with 103 Italian wine consumers compared wine labels (calories per glass, nutritional panel for 100ml, link to website, key nutrients per glass). Preference (assessed through WTP for wine) was the lowest for the website link label, and higher for more descriptive labels (nutritional panel or key nutrients). Use and interest to obtain wine information from other sources is very low.	Low preference for wine with only website link label. High interest for nutritional panel or key nutrients display.

Annex II. Consumer Protection Consumer Organisations' Research

List of reports and publications on digital labelling published by European consumer protection organisations.

Legend: green - in favour of digital labelling; yellow – in favour but has some reserves/concerns or neutral; red – against digital labelling

No	Organisation	Level	Description	Publication	Key take-aways
1	The European Consumer Organisation (BEUC)	EU	BEUC is the umbrella group for 46 independent consumer organisations from 32 countries. its main role is to represent them to the EU institutions and defend the interests of European consumers	Report: Alcohol information: label vs. screen? (2022)	• The report looks down upon the current digitalizing trends of private sector companies across practice and use. Data-driven environments like digital labelling encroach upon consumers' freedom of choice. Information on products and services is tailored to maximize conversion, anonymous shopping is becoming a thing of the past and the offered selection of news gets tailored to induce the strongest emotional responses. • EU consumer law, despite being one of the most developed areas of EU law, it is not yet up to the challenge to effectively protect consumers in a digitalized economy.
				Report: Why moving essential product information online is a no-go (2021)	• Despite its undeniable potential to improve both the availability of product information and the capacity to effectively reach consumers, digital labelling is a flawed concept that threatens to undermine, rather than enable, informed consumer choice: ○ It is a potential source of consumer disinformation. If product information is provided online, in an environment completely controlled by private entities, then there is a risk of that consumers are exposed to misleading, abusive or unfair commercial practices. ○ It is a barrier to informed consumer choice due to the time constraint to access information, in a world where consumers generally do not have time. ○ Digital labelling is exposed to the risk of excluding consumers who are not tech literate. ○ A switch towards digital labelling raises significant concerns for both data protection and cybersecurity. ○ Most surveillance authorities at the EU and national level are currently not equipped to deal with a shift towards digital labelling, so there is a risk of difficult enforcement. ○ Digital labels are not a 'green' alternative as they emit hidden greenhouse gas emissions. • Keep information essential to consumer health, rights, and interests on FOP or in-store labels. • Digital labelling can be a voluntary, complementary enabler of informed consumer choice.
				Article:	• BEUC reacted to the request of the pharmaceutical industry to the European Commission for abolishing paper package leaflet and

				Alcohol information: label vs. screen? (2018)	replacing it with a QR code on the packaging, in the context of the upcoming revision of the EU legislation on patient information. • Digital labelling is impractical as it does not enable consumers to compare pro(ducts side-by-side at a glance. • Digital labelling will only hamper consumers' legitimate easy access to information they care about. • Digital labelling can serve a purpose in providing extra information to consumers which they do not necessarily need to access in the supermarket.
2	**Test-Achats/Test-Aankoop (Belgian consumer association)**	Belgium	Belgian consumer organisation that works to promote consumer interests in Belgium.	Article: Paper leaflet must remain (2022)	• The organisation wrote this article in reaction to the European Commission 's intention to abolish the paper package leaflet and replacing it with a QR code on the packaging. • It is against this replacement owing to concerns around consumers' preference for paper information and lack of experience with using QR codes. The organisation recognizes, nonetheless, that information leaflets on pharmaceuticals should be made clearer and more user-friendly.
3	**Eesti tarbijakaitse (Estonian Consumer Protection and Technical Supervision Agency)**	Estonia	The Consumer Protection and Technical Supervision Agency aims to strengthen the capacity of market regulation and safety supervision and the consumer environment	Statement: The consumer has the right to know what is in alcoholic beverages (2018)	• The statement reacts to European Commission's March 2017 report to the European Parliament and the Council regarding the mandatory presentation of the list of ingredients of alcoholic beverages and nutritional information on the labelling of alcoholic products. • On the premise that some people do not use internet on a daily basis, the Agency endorses FOP labelling as the unique way of providing information on alcoholic beverages to consumers. As such, it agrees with the stance of the European Commission.
4	**Konsumentverket (Swedish Consumer Agency)**	Sweden	Government agency responsible for promoting consumer interests in Sweden.	Statement: Referral statement - on amendment to Regulation (EC) 1272/2008 of the European Parliament and of the Council on classification, labelling and packaging of substances and mixtures (2023)	• The statement reacts to the European Commission's proposal to revise its Regulation for classification of substances and mixtures, and the rules on labelling and packaging for hazardous substances and mixtures, particularly for chemicals. The proposal introduces a general framework to allow for the voluntary digital labelling of chemicals. • The Swedish Consumer Agency sees advantages in a voluntary digital labelling scheme but is concerned with the potential time constraint and information overload from the perspective of consumers. The Swedish Consumer Agency's assessment is therefore that it is important that the most essential hazard information continues to be available on the product's packaging.
				Statement: Referral opinion - The European	• In the context of the European Commission's proposal for a revision of the Regulation on ecodesign for sustainable products, the Swedish Consumer Agency reacted to its provision for Digital Product Passport.

				Commission's proposal for a regulation on ecodesign for sustainable products (2022)	• The Digital Product Passport is meant to provide information about products' environmental sustainability. It should help consumers and businesses make informed choices when purchasing products, facilitate repairs and recycling and improve transparency about products' life cycle impacts on the environment. • While the Swedish Consumer Association welcomes the idea of a Digital Product Passport for its transparency potential, it is concerned with the amount of information faced by consumers, which is difficult to absorb and makes it difficult identify what is essential. • Therefore, it does not consider that the digital product passport is suitable as the main source of information for consumers, but it can be good for the consumer who is looking for more detailed information about a certain product.
5	**Association Nationale de Défense des Consommateurs et Usagers (National Organisation for the Defense of Consumers and Users)**	France	Independent non-profit organisation working for the defence of consumers and web user in France	Article: Indicate the source of ingredients: a utopia? (2014, but updated in 2020)	• The article presents consumers' increased demand for enhanced transparency and traceability of products and ingredients. It refers to self-regulatory initiatives within industry that has provided digital labelling, especially QR codes, which can redirect consumers to online platforms where traceability information is available. • The article briefly argues that these initiatives show that providing more food information to consumers is possible, against the opinion of the European Commission. • However, the article remarks that digital labelling is not accessible to everyone.
				Article: What meat on our plate? (2019)	• The article presents the 'European horsemeat scandals' whereby food manufacturers illegally used horsemeat, publicly labelled as beef. • The establishment of Europe-wide blockchain technology along the meat value chain, with the use of QR codes for both consumers and producers, is presented as a solution to avoid such scandals in the future.
6	**Verbraucherzentrale Bundesverbands (German Federation of Consumer Organisations)**	Germany	Umbrella organisation for Germany's 16 consumer organisations and numerous other consumer organisations	Article: Uniform nutritional information needed for drinks (2019)	• In the article, the German Federation welcomes the initiatives of some European alcohol industry stakeholders to provide information on nutritional values or ingredients via digital labelling embedded in an on-product QR code. • However, it notes that the digital labelling initiatives are inconsistent, which is crucial for clear information provision to consumers. The Federation calls for uniform and comprehensive labelling of nutritional values to be implemented by industry itself. • In case of failure by the industry to provide such framework, the Federation claims that the European Commission should step in to issue a legislative proposal to end the special status of alcoholic beverages and put them on an equal footing with non-alcoholic beverages.
7	**Défense des Consommateurs (in defense of consumers)**	France	The association works to change consumer behaviour,	Article: Textile: Transparency on the labels! (2023)	• The article welcomes the new French legislation that mandates companies whose turnover is at least 50 million euros to provide new

			towards citizens who are more critical, more responsible, knowing how to choose and defend themselves.		information on the main manufacturing operations via scanning a QR code on the product label. • Use of QR code in this way is deemed positive for traceability and transparency on product manufacturing conditions, such that consumers have access to all information (environmental, labor conditions, etc.) to make the best-informed choices.
8	**Consumentenbond (Netherlands Consumers' Association)**	The Netherlands	Dutch consumer organisation that works to promote consumer interests in the Netherlands.	Report: Digital guide September 2021 - QR fraud_(2021) (Link1 – report in Dutch) (Link2)	• Consumentenbond is in favour of the use of QR codes to obtain product information and other services. It has noticed the development of QR code fraud like phishing and scams that expose consumers to various financial and legal risks. • The organisation advocates for more transparent and comprehensive digital labelling practices to ensure that consumers have access to accurate and reliable information about the products they purchase, including information on sustainability, environmental impact, and other important factors.
9	**Consumers International**	Global	Consumers International is the membership organisation for consumer groups around the world.	Statement: Key Messages And Case Studies To Provide Credible Sustainability Information On Plastic Packaging (2021)	• In collaboration with the UN Environment Programme and the One Planet Network, Consumer International published a public statement presenting several solutions to improve the provision of sustainability information on plastic packaging. • Digital labelling, especially scannable digital technologies like QR codes, is identified as a potential solution to provide further sustainability information directly to consumers.

Annex III. Key Data Points on Digital Labelling from Research[2]

Data on consumer preference with respect to digital labelling

- 68.35% of supermarket shoppers would like to scan QR codes (product in the experiment: eggs), while only 55.76% of traditional market shoppers would like to scan QR code on food products. **(Yang, S.-H. et al., 2022)**
- 38.99% of respondents want to see QR codes used more broadly in the future. **("QR Code statistics 2022" report by QR Tiger[3])**
- 67% of respondents agreed that QR codes make life easier. **("QR Code statistics 2022" report by QR Tiger)**
- 60% of respondents preferred a blockchain-based traceability system, while only 40% preferred when retailers implemented a company-owned traceability system. **(Garaus, M., & Treiblmaier, T., 2021)**
- 94% of the consumer respondents are interested in the implementation of three information delivery systems supporting product traceability (namely: near field communication; tamper-proof device plus radio frequency identification; and QR code) **(Violino, S., et al., 2019)**
    - Of those, the majority (44.6%) prefers QR codes for traceability information delivery on products.

Data on consumer use of digital labelling

- Main reasons why consumers do not scan QR codes. **(Yang, S.-H. et al., 2022)**:
    - "Package information is enough, do not need to scan it" – 34.79%
    - "Not aware of QR Code" – 34.64%
    - "Do not have much time to scan during shopping" – 31.78%
    - "Do not have an interest in it" – 14.76%
    - "I fear of the complex information" – 14.01%
    - "I seldom bring my cell phone during shopping" – 13.55%
    - "Don't trust information in QR code" – 9.34%
    - "My cell phone does not have internet" – 7.08%
- What information makes consumers want to scan QR codes. **(Yang, S.-H. et al., 2022)**:
    - Production certificate label – 57.73%
    - Inspection information – 53.33%
    - Producer information – 45.95%
    - Production records – 42.81%
    - Discount – 40.83%
    - Nutritional value information – 37.77%
    - Expert introduction of traceability – 33.09%
    - Recipe recommendation – 24.46%

[2] Some of the quantitative data from the listed scientific literature above could not be translated into concise digestible *numerical* data points, since Edelman could not access datasets underlying regression-based statistical observations. See: Nygaard, A., et al., 2022; Samha A. K., et al., 2022; Bradford, H. et al., 2022; Toth, M. et al., 2021; Hu, M., et al., 2021; Shew, A., et al., 2021; Zhang, A., et al., 2020; and Tanner, S. A., et al, 2019.

[3] QR Tiger is a Singapore-based software company specialised in generating QR code solutions for consumers and business.

    - Carbon footprint – 22.57%
    - Processing information – 20.59%
- 51% of respondents with a smartphone have used it to scan a QR code (for antibiotics information on food products). **(Bradford, H. et al., 2022)**
- 62.9% of university students in Hungary tend to get their information about healthy nutrition from online sources. **(Fehér, A., et al., 2021)**

Data on consumer support for digital labelling

- In an experiment, 62% of milk containers sold over an 8-week time period featured QR codes (for shelf-life information) and 48% of QR code scans were linked to subsequent sales, suggesting the possibility of substantial consumer acceptance of novel technologies to display and communicate best-by dates. **(Lau, S. et al., 2022)**
- 87.2% of the consumers surveyed think the process of obtaining information on the product was easier with QR codes on the label of milk bottles. **(Rotsios, K. et al., 2022)**
- 83.7% of consumers believe they received better information about the product with the use of a QR code. **(Rotsios, K. et al., 2022)**
- 85.7% of consumers believe the use of QR codes made the process of obtaining information about the product more efficient. **(Rotsios, K. et al., 2022)**
- 74.7% of consumers think that the use of the QR codes is safe. **(Rotsios, K. et al., 2022)**
- 81.5% of consumers believe that the use of QR codes constitutes a useful technology that effectively facilitates food product purchases. **(Rotsios, K. et al., 2022)**
- 75% of (US) respondents show a willingness to use more QR codes in the future (10 key digital trends for marketers in 2022 by **Insider Intelligence[4], 2021**)
    - From the same study, 83% of (US) respondents aged 18-29 show a willingness to use more QR codes in the future
    - The same percentage (83) applies to (US) respondents aged 30-44
- 65% of the surveyed Muslim consumers in Indonesia appreciate having additional information or links to an external website to trace and verify product compliance. **(Sagoyo, D., 2018)**
- 79% of Muslim consumers believe it is very useful to be able to verify to ensure that a product and its production process complies to Halal practice and process through web or mobile applications. **(Sagoyo, D., 2018)**
- The average success rate of the participants when selecting the healthier food product manually is 65.33%, while the average success rate of the participants to select the healthier food products when using the FoodGo mobile app (food information) is significantly higher at 84.33%. **(Abao, et al., 2018)**

Data about general consumer habits that strengthen the argumentative framework in favour of digital labelling

- In 2022, 84 % of individuals in the EU accessed the internet on a daily basis with a further 5% using it at least once a week (but not daily). As such, 89% of EU individuals aged between 16 and 74 were regular internet users. **(Eurostat[5] from December 2022)**

[4] Insider Intelligence (formerly known as e-Marketer) is a US-based subscription-based market research company that provides insights and trends related to digital marketing, media, and commerce. It publishes research reports available to the public on societal trends relevant for business development.
[5] Eurostat is a Directorate-General of the European Commission located in Luxembourg, responsible for publishing high-quality Europe-wide statistics and indicators that enable comparisons between countries and regions.

- By 2025, smartphones will account for nearly 84% of total mobile phone connections in Europe, versus 80% in 2021. **("The Mobile Economy Europe 2022" report, published by GSMA[6])**
- By 2025, 5G network coverage in Europe will rise to 70% (from 47% in 2021). **("The Mobile Economy Europe 2022" report, published by GSMA)**
- By 2030, blockchain will have created more than $3 trillion in annual market value **(Rabby, F. et al., 2022)**
- By 2030, 10–20% of the global economic infrastructure will be using Blockchain-based systems **(Rabby, F. et al., 2022)**

Annex IV. EU Policy and Initiatives

List of European legislation and policy

No	Title	Source
1	Regulation (EU) No 1169/2011 of the European Parliament and of the Council of 25 October 2011 on the provision of food information to consumers	Link
2	Regulation (EU) 2017/1369 of the European Parliament and of the Council of 4 July 2017 setting a framework for energy labelling	Link
3	Regulation (EU) 2020/740 on the labelling of tires with respect to fuel efficiency and other parameters	Link
4	The New Consumer Agenda	Link
5	Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions on a 2030 Digital Compass: the European Way for the Digital Decade	Link
6	Regulation (EU) 2021/953 of the European Parliament and of the Council of 14 June 2021 on a framework for the issuance, verification and acceptance of interoperable COVID-19 vaccination, test and recovery certificates (EU Digital COVID Certificate) to facilitate free movement during the COVID-19 pandemic	Link
7	Regulation on the Common Organization of Markets	Link
8	EU Strategy for Sustainable and Circular Textiles	Link
9	Delegated Regulation on the safety features of medical packaging	Link
10	European Declaration on Digital Rights and Principles	Link
11	ECA Special report 01/2023: Tools facilitating travel within the EU during the COVID-19 pandemic – Relevant initiatives with impact ranging from success to limited use	Link
12	Mobile scanning and other technologies in the labelling and package leaflet of centrally authorized medicinal products	Link

Timeline of ongoing and upcoming EU proposals, reports and initiatives

No	Title	Source	Publication
1	Proposal for a Regulation of the European Parliament and of the Council concerning batteries and waste batteries, repealing	Link	10.12.2020

[6] GSMA (GSM Association) is a non-profit industry organisation that represents the interests of mobile network operators worldwide with approx. 1,200 members.

	Directive 2006/66/EC and amending Regulation (EU) No 2019/1020, COM (2020)798		
2	Proposal for a Regulation establishing a framework for setting ecodesign requirements for sustainable products	Link	30.03.2022
3	Proposal for a Directive of the European Parliament and the Council amending Directives 2005/29/EC and 2011/83/EU as regards empowering consumers for the green transition through better protection against unfair practices and better information	Link	30.03.2022
4	Proposal for a Regulation on Packaging and Packaging Waste	Link	30.11.2022
5	Proposal for a Regulation of the European Parliament and of the Council amending Regulation (EU) 2019/1009 as regards the digital labelling of EU fertilizing products	Link	27.02.2023
6	First Commission's annual report on the "State of the Digital Decade"		June 2023
7	Revision of the Regulation on Food Information to Consumers (FIC)		Q4 2023
8	Revision of the Textile Labelling Regulation		Q4 2023
9	Commission's assessment of the implementation of the Regulation on energy labeling		August 2025

Annex V. Self-regulatory initiatives

List of self-regulatory initiatives in the EU

No	Title	Source
1	Self-regulatory proposal from the European alcoholic beverages sectors on the provision of nutrition information and ingredients listing	Link
2	Spirits sector annex to the self-regulatory proposal from the European alcoholic beverages sectors on the provision of nutrition information and ingredients listing	Link
3	U-Label Digital Information	Link
4	Pernod Ricard's digital label system	Link
5	The Whisky Barrel's digital label system	Link

Annex VI. National regulation

Italian legislation

No	Title	Source
1	Ministerial Decree regarding the adoption of guidelines on packaging labels	Link