

Alternatives to single-use plastics: Appendix B Search Protocol

Review of evidence base for alternatives to single-use plastics in food packaging and production

Evidence review protocol overview

Research aims

The core focus of this research will be to search, gather, review, synthesise and report literature which provides evidence on the growing market of alternatives to single-use plastics within the food industry. More specifically, literature that provides insight into the types of alternatives and their current use, emerging trends in innovation, consumer preferences and the changing policy environment for the FSA will be key. Through the process, the quality and quantity of the evidence will be considered, identifying gaps where they exist.

Priority research questions

Themes	Primary research questions	Secondary research questions
1 Emerging single-use plastic alternatives	1.1 What are the emerging alternatives to single-use plastics in food production and packaging?	<p>1.2 What benefits/risks do single-use plastics offer?</p> <p>1.3 What unique benefits/opportunities do specific alternatives offer?</p> <p>1.4 What risks come with the development and adoption of these technologies?</p> <p>Consider 1.2, 1.3 and 1.4 with regards to STEEPLE themes:</p> <p>Social, for example, food safety for the general public and specific consumer groups (allergens, pathogens, toxicity, cross-contamination); food availability, nutrition, choice; consumer acceptability; food fraud/crime and traceability;</p> <p>Technological, for example, materials, functionality, durability;</p> <p>Economic, for example, cost-effectiveness, market maturity, business model innovation (egg, circular business model, retail model), adoption and spread of innovation/solution both currently and in the future (next 5-10 years);</p> <p>Environmental, for example, sustainability including carbon footprint, resource use, waste and pollution in production, transport, storage, disposal;</p> <p>Political, for example, legislation, advocacy;</p> <p>Legal, for example, regulatory and enforcement; and</p> <p>Ethical, for example, accountability, responsibility.</p>
2 Current adoption of alternatives to single-use plastics in the UK food industry	2.1 To what extent are the alternatives already in use within the UK?	<p>2.2 Where do alternatives already have significant presence, both within the UK and similar developed economies?</p> <p>2.3 Which businesses, food industries and demographic consumer groups are most involved?</p>
3 Forecasted trend of alternative development and use	3.1 What trajectory are the alternatives likely to take, over the next ten years, in terms of innovation, adoption spread and becoming established in the UK food industry?	<p>3.2 What are the associated enablers of this change?</p> <p>3.3 What are the associated barriers?</p> <p>3.4 What level of unpredictability exists in possible trajectories?</p>

Themes	Primary research questions	Secondary research questions
4 Adapting UK Food Regulation	4.1 Are there any changes required to UK food regulation in the context of the alternatives, and if so, what are the potential changes at the legislative, governance and training and enforcement levels?	4.2 What challenges are likely to exist in making these adaptations in regulation?
5 Role of the FSA	5.1 What is the role that the FSA could play in advocating for food safety, promoting awareness and supporting innovation and consumer acceptance?	5.2 What trade-offs are present and likely to emerge between protecting different stakeholder groups? 5.3 How can the FSA appropriately balance the needs of protecting consumers, businesses, and the environment?

Protocol for searching, screening and reviewing the literature

Stage 1: Database searches

We will be reviewing relevant literature from two sources. The first source is academic literature which has been published in scientific journals. The second is grey literature which originates from the UK government and its public agencies, international public agencies, non-governmental organisations, market reports and patents. Rachael Posaner (University of Birmingham, Knowledge, and Evidence Services (KES)) will conduct the search for published/academic literature via the University of Birmingham Library Services based on agreed search terms, whilst RSM will conduct the search for grey literature and manage the wider call for evidence. We will use the PRESS checklist ([footnote 1](#)) to structure our search strategy and fully optimise the time available for the search.

Our advisor Dr Samuel Short will be asked to contribute any key sources, including those not yet published, available to them given their academic knowledge and network. RSM will also issue a call for evidence and ask the FSA expert panel, and our advisor to disseminate this call for evidence.

We propose the following search criteria and databases. Parameters may need to be refined depending on the scarcity of available and relevant sources.

Search terms and inclusion criteria

Criteria	Details
Language	English or accredited translations
Time period	January 2017 to present
Search strings	The search terms will be a variation of: [Terms for:] alternatives OR innovation OR technology OR technologies OR developments OR novel OR horizon scanning OR opportunity OR spread OR innovative OR emerging OR future AND [Terms for:] non-plastic OR active packaging OR biopolymers OR bioactive OR biodegradable OR edible film OR reusable OR recyclable OR renewable OR zero packaging OR sustainability OR sustainable OR single-use packaging OR refillable OR circular packaging OR eco-friendly OR compostable OR dissolvable OR plastic replacement OR plastic substitute OR plastic-free OR plastic free OR biobased OR bio-based OR composite OR smart packaging OR intelligent packaging OR loose produce OR glass OR paper OR silicone OR metal OR synthetic materials OR beeswax OR circular economy OR circularity OR refillable OR bring your own OR BYO AND [Terms for:] food safety OR food packaging OR food production OR food system OR food risk OR food hygiene OR food distribution OR food waste

Criteria	Details
Database/sources	<p>Published academic literature:</p> <p>Two databases out of the following, depending on scoping search results: Web of Science, SCOPUS, ScienceDirect (Elsevier), JSTOR, SAGE, Taylor and Francis, Wiley Online Library</p> <p>Grey literature:</p> <p>Government sources (for example, Gov.uk, the Food Standards Agency, the Health and Safety Executive)</p> <p>Websites of national and international (specifically the UK, the USA, Canada, the EU, Germany and Australia) organisations, related to food safety/health (for example, International Association for Food Protection, the World Health Organisation, the Food and Agriculture Organisation), AgriTech, consumer groups and/or environment advocates (for example, United Nations Environment Programme, Greenpeace)</p> <p>Academic advisor:</p> <p>Sources identified by Dr Samuel Short</p> <p>Call for evidence amongst panel of experts:</p> <p>Sources identified by the expert panel who will also highlight areas of key interest</p>

Stage 2: Screening of titles and abstracts

Using our various sources of literature, we will review a longlist of a maximum 600 titles of published and unpublished studies, articles and reports ('grey literature') pertaining to the research questions on single-use plastic alternatives as specified above.

The table below sets out the first level inclusion/ exclusion criteria which we will apply to each title. We anticipate excluding 25% to 50% of titles at this point either because they are not of central relevance to single-use plastic alternatives, or they are duplicate studies in our sample.

1st level criteria	Inclusion criteria	Exclusion criteria
Topic	Key details about the alternative/s (covering at least one of the STEEPLE themes) and/or related to implications for the FSA	Does not offer any information on single use plastics alternatives, does not cover any STEEPLE themes.
Language	English	All other languages
Quality	Peer reviewed for academic sources, perceived credibility for grey literature	Non-peer reviewed work for academic literature, unknown or perceived as non-impartial for grey literature.
Other	-	Duplicates

We will then review around 300 abstracts and executive summaries at the second stage of screening, having already excluded irrelevant titles and duplicates. The second level criteria are listed below and relate to the detailed research questions. These may need to be refined depending on the number of studies retrieved. Abstracts which do not meet any second level inclusion criteria will be discarded and the remaining abstracts will form the shortlist of relevant literature for further screening and quality assessment.

Second level criteria	Inclusion criteria	Exclusion criteria
Topics based on research questions	<p>Related to one or more of these topics:</p> <p>Emerging alternative technologies to single-use plastic in food production and packaging</p> <p>Current market size and characteristics of alternatives</p> <p>Trajectory of alternatives and future developments (next 5 to 10 years) in the sector</p> <p>Changing policy context given the development of the plastic alternatives market and the possible net social benefit associated.</p>	Not related to any of the topics related to the research questions.

Stage 3: Quality assessment of full texts

After removing irrelevant abstracts, we expect to shortlist about 60 full texts. They will be examined and screened to identify the final list of the most relevant, informative and useful studies to undergo full review. The selection will be based on tighter inclusion criteria, including quality measures i.e. the extent to which methodologies/ evidence bases are robust following DEFRA guidance ([footnote 2](#)) using the following steps:

a) Score the relevance of the evidence for each research theme on a 3-point scale, (from 1=low to 3=high), considering:

- To what extent does this text help to provide an evidence-based answer to the research question/s that come under this theme?

b) Score the robustness of the evidence on a 3-point scale (from 1=low to 3=high) where the following rating system would apply:

Scale rating	Description
1	Significant methodological limitations which must be taken into account when comprehending key findings and conclusions.
2	Some of the methodological approach is appropriate for the research and limitations are thought unlikely to alter the conclusions of the study (risk of bias)
3	All or most of the methodological approach appropriate for the research (low risk of bias)

c) Combine the two scores from a) and b) into one final measure of quality, i.e. scored from 1 (1*1) up to 9 (3*3) and coded to result in a red-amber-green rating.

d) Present the process and results clearly to ensure transparency and replicability.

Throughout the search process, a log will be kept on a spreadsheet which will eventually be developed into the full literature review log in the next stage of the search protocol.

Stage 4: Full review and data extraction

We will complete a full review of a maximum of 60 papers or reports, and extract information from the review literature into a spreadsheet which can be filtered for each research theme. The suggested headings for the spreadsheet are below. If after reviewing all full texts significant gaps in the literature remain, it may be required that we conduct a purposive second round search to gather new information to conduct a complete STEEPLE analysis.

To keep our approach structured, we will follow the Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) reporting items ([footnote 3](#)) to allow for a transparent, encompassing and comparable collection of article records included in our final review list.

Headings for the full literature review log:

- document title
- author(s)
- date of publication
- organisation/owner
- study type
- aims
- methodology
- summary of findings
- strengths
- limitations
- evidence gaps
- quality appraisal - relevance
- quality appraisal - robustness
- research questions

Quality appraisals will be completed concurrently with the extraction process. We will ensure that our work meets quality ratings according to AMSTAR (A Measurement Tool to Assess Systematic Reviews) ([footnote 4](#)).

Findings across the evidence base will be synthesised following ESRC guidance on conducting narrative synthesis ([footnote 5](#)). The synthesis will be grouped by research question and will provide single-sentence evidence statements for each. Within this synthesis, information on the volume and quality of evidence per research question will be included, highlighting gaps where they exist.

1. [PRESS 2015: checklist for search strategies | Karolinska Institute University Library \(ki.se\)](#)
2. [The Production of Quick Scoping Reviews and Rapid Evidence Assessments: How to guide \(PDF\)](#)
3. [PRISMA 2020 explanation and elaboration: updated guidance and exemplars for reporting systematic reviews | The BMJ](#)
4. [AMSTAR - Assessing the Methodological Quality of Systematic Reviews](#)
5. Popay et al. (2006) Guidance on the Conduct of Narrative Synthesis in Systematic Reviews. Institute for Health Research, Lancaster University