Alternatives to single-use plastics: Appendix A Alternatives to single-use plastics matrix

Alternative to plastic	Food safety (including; contamination, physical damage, shelf life, traceability and allergen concerns)	Convenience and acceptance (including labelling, branding, consumer perceptions and acceptance)	Circularity (including biodegradability, recyclability, reusability)	Productior costs (incl material, la infrastruct requiremer
Paper	Slightly worse: not sealable/airtight, moderate physical protection, regular shelf life, traceable, no allergen concerns, permeable.	Mixed or similar performance: suitable for labelling and branding, not transparent, perceived as sustainable by consumers, well known.	Slightly better: Biodegradable (can release methane, a strong green-house gas, if buried in a landfill)[ii], recyclable, but not if contaminated with food, crease or plastic coating [iii], limited reusability.	Mixed or sir performanc chemicals, and energy production[deforestatio infrastructu available.
Glass	Mixed or similar performance: sealable, strong physical protection, extended shelf life (oxygen, moisture and UV light barrier), traceable, no allergen concerns, impermeable	Slightly worse: stickers required for labelling and branding, transparent, well known by consumers, heavier than alternatives and risk of shattering[vii].	Slightly better: non-biodegradable, recyclable, food and grease contaminations and not preventative, [viii] indefinite reusability.	Mixed or sir performanc intensive pr recycling, a materials[x] scaled and

Alternative to plastic	Food safety (including; contamination, physical damage, shelf life, traceability and allergen concerns)	Convenience and acceptance (includinglabelling, branding, consumer perceptions and acceptance)	Circularity (including biodegradability, recyclability, reusability)	Production costs (incl material, la infrastruct requiremen
Metal	Mixed or similar performance: sealable for packaging, strong physical protection, extend shelf life, traceable, no allergen concerns, impermeable.	Mixed or similar performance: stickers required for labelling and branding, not transparent, well known by consumers, light and convenient (aluminium foil).	Slightly better: non-biodegradable, cost effective recycling compared to new production [xii], long term reusability.	Slightly wor intensive pr harder to ol materials co other altern infrastructu available.
Natural fibrous material such as bamboo, cotton, jute	Significantly worse: not sealable, moderate physical protection, shortened shelf life, tracing difficulties, allergen concerns from source material and permeable.	Slightly worse: stickers required for labelling and branding, not transparent, no evidence found on acceptance.	Slightly better: biodegrades in natural conditions, non-recyclable, medium term reusability,	Slightly bett production, material, hig land require certain mat cotton[xv], c food agricu
Synthesised from biomass; Seaweed polysacchardies	Mixed or similar performance: sealable, weak physical protection, extended shelf life (antimicrobial and antioxidant properties), traceable, allergen concerns from source material	Slightly worse: stickers required for labelling and branding, transparent, no evidence found on acceptance	Significantly better: biodegrades quickly in natural conditions, non-recyclable, limited reusability, limited knowledge on the ecological impacts of seaweed farms [xvi].	Slightly bett fast growing source whic ocean acidi high produc continued i needed for

Alternative to plastic	Food safety (including; contamination, physical damage, shelf life, traceability and allergen concerns)	Convenience and acceptance (includinglabelling, branding, consumer perceptions and acceptance)	Circularity (including biodegradability, recyclability, reusability)	Productior costs (incl material, la infrastruct requiremer
Synthesised from bioderived monomers: Polylactic acid (PLA)	Mixed or similar performance: sealable, strong physical protection, regular shelf life, traceable, allergen concerns (dependent on source material), impermeable.	Mixed or similar performance: stickers required for labelling and branding, transparent, some evidence of bioplastics perceived as unsustainable[xx], consumers unlikely to be able to differentiate between bio-based and petroleum plastics[xxi].	Slightly worse: biodegradable only in industrial conditions at temperatures of at least 55 degrees [xxii], waste PLA can contribute to plastic litter in terrestrial and marine environments [xxiii], recyclable, but not currently at scale[xxivxxvxxvi], risks contaminating current plastic recycling systems[xxvii], reusable, PLA can derive from fossil-based sources or food waste/by-product[xxviii].	Mixed or sir performanc material so significant v input[xxix], cost for foo production, impact on fo environmer using pestic fertilisers[xx

Alternative to plastic	Food safety (including; contamination, physical damage, shelf life, traceability and allergen concerns)	Convenience and acceptance (includinglabelling, branding, consumer perceptions and acceptance)	Circularity (including biodegradability, recyclability, reusability)	Production costs (incl material, la infrastruct requiremen
Produced by microorganisms: Polyhydroxyalkanoates (PHAs)	Mixed or similar performance: sealable, strong physical protection, extended shelf life, traceable, allergen concerns (dependent on source material)	Mixed or similar performance: stickers required for labelling and branding, transparent, some evidence of bioplastics perceived as unsustainable[xxxiii], consumers unlikely to be able to differentiate between biodegradable PHA and non-biodegradable plastics[xxxiv].	Slightly better: Biodegradable under natural conditions[xxxv], recyclable but not widely recycled[xxxvi], can be made from fossil-based sources or food waste/by-product[xxxvii], no evidence on reusability of material.	Slightly wor production associated and carbon sources[xx of chemical research re identify cos innovations
Reducing packaging (either no packaging or less packaging)	Significantly worse: contamination risk, physical damage risk, reduced shelf life, some tracing difficulties, allergen concerns from cross contamination of exposed foods such as nuts.	Slightly worse: labelling and branding limitations, product visibility, growing consumer trend[xliii], less convenient, especially for wet foods and liquids. Consumers may have to bring their own packaging.	Significantly better: less materials and resources used, less waste, requires bulk packaging products for example, dispensers.	Slightly bett inputs, requ infrastructu

Alternative to plastic	Food safety (including; contamination, physical damage, shelf life, traceability and allergen concerns)	Convenience and acceptance (includinglabelling, branding, consumer perceptions and acceptance)	Circularity (including biodegradability, recyclability, reusability)	Production costs (incl material, la infrastruct requireme
Reusing packaging	Slightly worse: potentially sealable, strong physical protection, regular shelf life, some tracing difficulties, allergen concerns depend on packaging type	Mixed or similar performance: stickers required for labelling and branding, can be transparent, growing consumer trend[xlv], less convenient[xlvi].	Significantly better: reuse circularity, requires bulk packaging products for example, dispensers.	Slightly bett input requir investment store infras example, di washing se transport logistics[xlv
Recyclable packaging and systems	Mixed or similar performance: sealable, strong physical protection, extended shelf life, traceable, no allergen concerns	Mixed or similar performance: stickers required for labelling and branding, can be transparent, accepted by consumers[l].	Slightly better: recycling circularity, process inefficiencies and energy costs, not feasible for some materials for example, multicoated wrappers, thin plastics.	Slightly wor input requir virgin mater sustain dura material[li], with current separation infrastructu
Active packaging	Slightly better: antimicrobial and/or antioxidant, extended shelf life, traceable, allergen concerns from source material	Novel to consumers, convenience from extended shelf life, consumers are unfamiliar with a mild to slightly positive attitude to this technology[liv].	Slightly worse: biodegradability varies per product, not recyclable, not reusable.	Slightly wor research co and produc significantly

Alternative to plastic	Food safety (including; contamination, physical damage, shelf life, traceability and allergen concerns)	Convenience and acceptance (includinglabelling, branding, consumer perceptions and acceptance)	Circularity (including biodegradability, recyclability, reusability)	Production costs (incl material, la infrastruct requireme
Intelligent packaging	Slightly better: potential to extend shelf life, increased visibility of food data throughout supply chain[lvii].	Slightly better: Add on for labelling and branding, convenient for suppliers, retailers and consumers, consumers are unfamiliar with a mild to slightly positive attitude to this technology[lviii].	Slightly worse: Biodegradability varies per product, not recyclable, no evidence on reusability.	Slightly wor research co and produc significantly

Note: Alternatives are rated by category, with conventional plastics as the benchmark. Dark red means that the alternative performs significantly worse than plastics in that category, orange is slightly worse, beige is similar or mixed performance, light green is slightly better, and dark green is significantly better.

This rating system was designed through consultation with the FSA, expert advisors and desk research. In some instances, value judgements had to be made regarding what is more important in each category, so that we could determine a rating.

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