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Introduction

Circular economy approaches in public catering aim to “close the loop” on packaging by moving away from disposable foodware to reusable, recyclable or biodegradable solutions [1] [2]. In the Baltic Sea Region (BSR) – comprising Nordic and Baltic EU countries – several recent studies and projects (Interreg BSR, NGO coalitions, etc.) highlight the need to transition school, hospital and other institutional catering to sustainable packaging systems. This review synthesizes the latest literature (2018–2025) on *enablers* of this transition, organized by key themes: policy/regulation, procurement, technology, infrastructure, stakeholder engagement, and behavioral/cultural factors. Each section integrates peer-reviewed research and policy/grey literature from the EU and BSR context, focusing on factors that facilitate circular food-packaging systems in institutional catering.

Policy and Regulatory Enablers

National and EU policy frameworks create the overarching mandate for circular packaging. The EU’s Circular Economy Action Plan, Single-Use Plastics Directive (2019), revised Packaging and Packaging Waste Regulations, and the Farm-to-Fork/Sustainable Food Systems policies all reinforce recycling targets and encourage reusables in food services. Member states translate these into national laws and targets: for example, Finland and Sweden have specific national targets on packaging reuse and recycling [3]. However, as surveys show, many BSR municipalities lack explicit national rules on reusable catering packaging [1]. Stakeholders emphasize that *binding* regulations (e.g. targets or bans on disposables) are needed to drive change. For instance, in France the EGAlim law (2018) now mandates significant percentages of organic/local foods in schools – a model for how binding food service laws can enforce greener procurement [4] [5]. Similarly, several BSR cities have introduced local ordinances (e.g. taxes on disposables, deposit systems or procurement mandates) to phase out single-use containers [6] [7]. StratKIT and other projects note that policy guidance is most effective when **clear targets and guidance** exist at both national and municipal levels [1] [8]. In sum, strong policy enablers include mandatory reuse targets or bans, inclusion of packaging criteria in public procurement legislation, and harmonized recycling standards.

Sustainable Procurement Practices

Public procurement is a critical lever. Because institutional catering (schools, hospitals, etc.) is often funded or organized by governments, its contracts can demand sustainable packaging. The EU’s Green Public Procurement (GPP) framework and national “sustainable catering” guidelines offer criteria that contracting authorities can use. For example, the StratKIT toolkit (Interreg BSR) provides practical tender criteria: procurers are advised to include award criteria requiring recyclable plastics (e.g. at least X% PET) or reusable containers [9] [10]. A Danish example encourages marking PET packaging on tenders and awarding extra points for its use [10] [9]. In practice, pilots in Lahti, Finland, have begun *testing* such criteria: Lahti’s largest school kitchen is experimenting with “sustainable food packaging” criteria in its green procurement to reduce waste and incentivize reusable delivery systems [11].

Procurement capacity building is also key. Studies in the Baltic region show that many public authorities want to “go green” but find the current tendering system **too rigid**, with only limited “green” criteria (e.g. EU

Ecolabel) used [4]. There is a need for tender templates and guidance. The StratKIT "Administrative regulation" tool, for instance, guides governments in embedding sustainability (including packaging) into formal procurement rules. Researchers note that municipalities often lack knowledge of alternative packaging solutions or how to specify them [12]. Enablers include training of procurement officers on circular criteria, sharing of best-practice tender language (as in the StratKIT reports [9]), and procurement networks (e.g. multi-country public-caterer networks) to diffuse successful strategies.

Key points on procurement:
- **Criteria and incentives:** Include specific award and technical criteria for recyclable/biodegradable packaging, reusable systems and waste-sorting in catering contracts [10] [9].
- **Guidelines and templates:** Develop GPP guides and tender templates (as done by StratKIT and national GPP councils) so that cities and schools can readily require circular packaging.
- **Capacity building:** Train procurement officers in circular procurement methods, disseminating successful examples (e.g. Lahti's trial [11]) and EU GPP tools [10].
- **Flexibility:** Adapt contract models to permit local suppliers of reusable systems and small producers, avoiding overly rigid lot divisions (a barrier noted in Baltic studies [4]).

Technological and System Innovations

Innovations in packaging **materials and systems** are major enablers. On the materials side, research has advanced bio-based and biodegradable packaging (e.g. PLA, PHB, agro-waste composites) that can replace fossil plastics [13]. These new materials, often compostable under proper conditions, can help reduce waste if matched by proper waste streams [14]. However, experts caution that compostable packaging requires industrial composting and consumer sorting to avoid contamination [15] [16]. Nonetheless, the development of fully biodegradable multi-layer food containers is seen as promising (potentially reducing GHGs and waste simultaneously) [15].

Crucially, **systemic innovations** – i.e. new service models – underpin reuse. Reusable food-service systems require technical solutions for collection, cleaning and tracking. For example, RFID and QR-code technologies enable modern deposit-return schemes: in Denmark the "New Loop" system uses QR-scanned deposits to bank cards for returned takeaway containers [17]. Similarly, Estonian startups like "Ringo" provide reusable food boxes and platforms, and Finland's Kamupak system offers reusable dishware for catering (with a digital deposit) as an alternative to disposables [17] [7]. These platforms combine durable packaging (e.g. polycarbonate plates, reusable lunchboxes) with logistics: containers are collected, washed (often via industrial warewashers), and recirculated. Dedicated washing facilities are an enabler too – businesses like Eternity Systems and others now sell turnkey washing solutions for kitchens.

Some examples from the region illustrate these innovations: CupCup in Helsinki provides durable coffee cups with a chip and deposit; cups are returned to schools via collection bins and reused ≈100 times [18]. In Tallinn, Ringo Eco runs a pilot of reusable food-and-drink containers and cutlery, with return points in the Old Town [19]. These pilots test both user acceptance and technical feasibility (e.g. how to incentivize returns without littering) [19]. Importantly, advanced **packaging design** (e.g. stackable containers, standardized container sizes, or gasketed reusable jars for sauces) solves practical issues. Conversely, lack of suitable products is a barrier: one survey noted that "reusable large containers" for bulk food are still mostly missing [12], indicating an innovation gap.

Key points on innovation:
- **Reusable systems:** Development of integrated return-and-clean systems (RFID/QR deposit systems, wash-pack-service models) makes reuse feasible (e.g. Kamupak in Helsinki, Ringo in Estonia) [17] [7].
- **New materials:** Biodegradable/compostable packaging and high-recyclability plastics (e.g. fully recycled PET) reduce reliance on virgin single-use plastics [10] [13].
- **Digital tools:** Mobile apps, digital deposit accounts and tracking increase convenience (e.g. RFID tags that allow cashless refunds [17]).
- **Industrial equipment:** Ready access to commercial dishwashers and return logistics lowers the hurdle for institutions to switch to reusables. Subsidies (see infrastructure) often accompany this.

Infrastructure Readiness and Investment

Even the best technology needs support infrastructure. In practice, transition to circular packaging requires **collection, sorting and cleaning systems**. Many BSR cities currently have limited recycling: studies report "notably low" plastic recycling and reuse rates in the region [2]. To become enablers, municipalities must invest in (or facilitate) the right infrastructure: for example, separate collection bins for food containers (as piloted in Czech cities for polystyrene) and local recycling hubs for multi-layer food packaging [20]. The BALTIPLAST project maps such "technical solutions": advanced sorting facilities, recycling plants, and deposit-return machines are identified as critical.

For reuse, **washing capacity** is essential. Institutional kitchens or central cleaning centers must have or build space to wash reusable containers and tableware. Some cities offer grants or tax breaks to install industrial dishwashers (as in Germany) or bulk-scrubbing stations [21]. For example, one BSR city provided subsidies up to 75% for schools to buy reusable dishes and washers [21]. Deposit/refund infrastructure is another piece: reusable container schemes often rely on return kiosks or collection points. Cuploop (Estonia) and similar systems have deployed return stations where customers drop off used containers [22].

Hygiene and regulations also fall under infrastructure. Some barriers reported include food safety regulations that can limit reuse (e.g. difficulties storing hot food in certain reusables) [23]. Enablers include clear guidelines from health authorities on how to comply while using reusables (e.g. approved materials, cleaning protocols). The Chang(K)now survey noted that *guidance materials* (manuals, checklists) are important infrastructure of knowledge: municipalities need more widely disseminated instructions on procuring and operating circular packaging systems [24] [12].

Key infrastructure enablers:
- **Waste collection and recycling:** Expand municipal sorting and recycling facilities to handle all packaging streams (plastics, cartons, compostables) [20]. Implement or upgrade deposit-return systems for containers that can feed back into reuse loops.
- **Cleaning facilities:** Ensure institutional kitchens or partners have industrial washing lines for reusable containers and cutlery. Public-private washing contracts or on-site dishwashers (sometimes subsidized) help operationalize reuse.
- **Return logistics:** Deploy deposit kiosks, return bins, or courier pick-up to make reuse seamless (e.g. RFID-operated return units or smart bins) [17].
- **Knowledge infrastructure:** Provide templates, hygiene guidelines, and platforms (web portals, workshops) so that schools and hospitals know how to set up reuse programs (an identified need in BSR surveys [24]).

Stakeholder Engagement and Collaboration

Transition is inherently a multi-actor effort. A recurring theme in the literature is the **quadruple-helix** model: involving government, industry, academia and civil society in co-creating solutions. For example, the Lahti pilot in Change(K)now! convened stakeholders across the catering value chain (packaging producers, food wholesalers, kitchen staff, city officials, etc.) in workshops to map barriers and co-design solutions [25]. Such participatory processes ensure that technical, economic and social perspectives align. Researchers stress that stakeholders should form *advisory boards* or networks to guide implementation [26] [27].

Networking has been institutionalized in BSR. Projects like StratKIT, CHANGE(K)now! and BALTIPLAST connect tens of municipalities, NGOs and businesses. For instance, the StratKIT project created a Baltic Sea Region network for sustainable public meals, linking public authorities with catering associations and SMEs [28] [29]. This allows sharing of best practices (e.g. successful circular tenders or refill projects). NGOs also mobilize stakeholders: Coalition Clean Baltic's #ChangeKnow campaign highlights reusable packaging in schools and events, raising social acceptance.

Local champions and leadership matter. Studies find that when local governments take a *facilitative* role – acting as conveners or pilots – cooperation among suppliers, caterers and waste managers improves [27]. For example, in one Baltic food system study, a respondent noted "local government should work as a facilitator in cooperation" among farms, schools and kitchens [27]. Collaborative campaigns (e.g. "Plastic-Free Schools" by BALTIPLAST) engage parents, teachers and businesses to reduce disposables through contests and workshops [30]. Such stakeholder engagement builds the culture and trust needed to adopt new systems.

Key collaboration enablers:
- **Multi-actor projects:** Continue/interconnect EU and BSR projects (Interreg, Horizon) that bring together municipalities, suppliers, caterers and researchers to pilot circular packaging solutions (e.g. Change(K)now!) [31] [26].
- **Networks and platforms:** Support networks (e.g. StratKIT, national GPP forums) where procurement officers and caterers exchange experiences (tenders, contracts, project outcomes) to diffuse successful practices.
- **Local leadership:** Encourage municipalities to set up local sustainability boards or working groups for catering, with commitments from schools, hospitals and suppliers.
- **Public awareness campaigns:** NGOs and local authorities can run joint campaigns (like *Plastic-Free Schools*) to involve the community and make reuse/circular packaging socially normative [30] [32].

Behavioral and Cultural Factors

Finally, the attitudes and habits of users – students, staff, administrators and the public – are crucial enablers or blockers. Even the best system will falter if users resist. Recent research emphasizes the need for **training and education**: for example, one project required an "awareness raising and training program" alongside new packaging criteria [33]. Empowering kitchen staff and servers with knowledge about circular options (and why they matter) increases buy-in.

Studies note that sustainability is already valued by many catering managers: in Baltic-area surveys, respondents expressed a strong intent to buy local/organic and reduce waste, even if budgets are tight [4]

[34]. However, distrust or "disgust" around reused items can occur among consumers. Literature on consumer behavior indicates that clear communication (branding, signage) and incentives (discounts for bringing own container, deposit refunds) help overcome hesitation [35]. Some pilot schemes offer discounts or free drink-refills for reusables, effectively using carrots. For example, Hamburg's "Kehrwieder" alliance gives a small price cut to customers who bring their own mugs [35].

Embedding sustainability into culture also relies on **visible commitments**. We observed that many restaurants and schools proudly display their green credentials: they advertise on social media when menus are seasonal or when they reduce plastic [36] [37]. Seeing peers adopt reusable systems normalizes the behavior. In schools, engaging pupils via contests (counting how many disposables are avoided, etc.) was highlighted as effective [30].

Key cultural enablers:
- **Education and training:** Incorporate circular packaging topics into staff training and student curricula (e.g. workshops on waste sorting or plastic's impacts) [30] [33].
- **Incentives for users:** Provide small rewards for sustainable choices (discounts, recognition) and make reuse convenient (on-site return bins) to nurture positive habits [35] [6].
- **Communication:** Publicize successes (e.g. tonnes of waste reduced, schools attaining "Plastic-Free" awards) to build cultural momentum. Activities like "waste challenges" or sustainability week events at institutions reinforce the message.

Conclusion

Enabling a systemic shift to circular packaging in institutional catering requires **a combination of policy, practice, infrastructure and culture**. In the Baltic Sea Region, emerging evidence shows that progress comes when municipalities set ambitious targets, embed sustainability in procurement, foster innovative reuse systems, and actively engage all stakeholders (schools, suppliers, NGOs, citizens) in the transition. EU- and national-level policies (e.g. mandatory reuse targets or bans on disposables) create the framework, while practical enablers (tender criteria, washing facilities, deposit-tech) bring the circular solutions into daily operations [10] [7]. Ultimately, attitudes must change alongside systems – hence education and visible commitments are also key. Together, these enablers form an ecosystem that can transform school and hospital catering into models of sustainable, circular consumption in the BSR [1] [31].

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