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Strategies to Reduce Food Packaging

Reducing waste from single-use plastic packaging through unpackaged concepts, reusable packaging, and regional supply systems



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Strategies to reduce food packaging		
Improve the availability of unpackaged groceries	Establish sustainable reusable food packaging systems	Expand regional supply systems
<ul style="list-style-type: none"> ■ Define a binding standard for zero-packaging groceries ■ Promote zero-packaging stores to facilitate consumer access ■ Clear guidelines for the inventories of zero-packaging stores ■ Development of improved weighing and cashier systems ■ Promote a zero-packaging lifestyle through education ■ Incentivize the use of unpackaged options 	<ul style="list-style-type: none"> ■ Short transport routes ■ Distributed return and washing systems serving multiple enterprises ■ Efficient reverse logistics ■ Incentive systems to encourage returns ■ Standardized container formats ■ High container circulation rates ■ Power filling and washing systems with renewables ■ Reusable lids ■ Comparable life cycle assessments 	<ul style="list-style-type: none"> ■ Allocate land for organic farming ■ Promote regional value chains ■ Promote organic farming ■ Promote producer-consumer associations ■ Environmental and social performance bonuses ■ Reward packaging avoidance and use of reusable systems
<p style="text-align: center;">Overarching conclusions</p> <ul style="list-style-type: none"> ■ Develop measures to reduce packaging that are effective at the systems level ■ Reward pioneering businesses that aim to achieve positive social and environmental outcomes ■ Consider the implications for brand and product diversity ■ Promote plant-based diets ■ Initiate a debate on sufficiency ■ Political regulation is necessary 		

Unpackaged concepts, reusable systems, and regional supply systems

The high volume of plastic packaging currently consumed in Germany poses a complex socio-ecological risk. As part of the BMBF-funded ENSURE research consortium, environmental psychologists at the Institute for Advanced Sustainability Studies (IASS) in Potsdam have studied various policy options to promote a reduction in individual consumption of plastic food packaging.

A representative nationwide survey of 1,200 persons conducted by the researchers shows that 92 per cent of the interviewed consumers consider plastic waste in the environment a threat to the preservation of our natural resources and the foundations of life. Despite this widespread awareness, the consumption of plastic packaging continues to grow: In 2018, Germany generated over three million tonnes of plastic packaging waste; more than double the amount produced in 1997.

The findings of the ENSURE project indicate that consumers are willing and indeed wish to reduce their consumption of plastic packaging; however, they are hindered by personal and structural barriers. Political action is needed to break down these barriers to change and support consumers in their efforts. This IASS Policy Brief presents three strategic policy recommendations that could help reduce the consumption of packaging in daily life. Following an outline of the broader context and key issues, these three recommendations are explained in detail. In conclusion, we highlight the need for a systemic approach to the reduction of plastic packaging.

■ **Message 1:**
Improve the availability of unpackaged groceries

A nationwide network of easily accessible zero-packaging stores is needed to encourage consumers to adopt the unpackaged concept in daily life. We recommend the introduction of a uniform binding standard for unpackaged goods and their trade to support the implementation of this concept by retailers.

■ **Message 2:**
Establish standardized and sustainable reusable food packaging systems

Policy should seek to promote reusable packaging systems utilizing standardized containers, short transport routes, cross-company cleaning systems and optimized reverse logistics to ensure greater resource efficiency.

■ **Message 3:**
Expand regional supply systems for seasonal and organic foods

A systemic approach should be taken to strengthen and expand socio-ecological food value chains at the regional level, with a focus on providing access to a regional and seasonal range of foods with a minimal packaging footprint.

Context and background

The amount of plastic packaging waste consumed in Germany has increased steadily in recent years. Private end consumption accounts for almost half of all plastic packaging waste generated in Germany. At 228 kilograms per capita, packaging consumption in Germany in 2018 was significantly higher than the European average of 175 kilograms per capita. Between March and June 2020, the Covid-19 pandemic has led to a ten per cent increase in the generation of plastic packaging waste by households. The volume of single-use plastic packaging (especially for takeout food products) that is discarded in public spaces and contributes to environmental pollution has almost doubled.

IASS researchers with the ENSURE project have explored options to reduce the consumption of food packaging. These recommendations are based on insights gained through expert interviews, focus group discussions, and in-depth interviews with consumers as well as a representative online survey conducted with 1,200 participants. The findings of this research

and the recommendations for action have been discussed at virtual round tables with representatives from politics, industry, and research as well as from environmental, consumer protection, and business associations. The results of the expert interviews and focus group discussions have been published previously:

Steinhorst, J., & Beyerl, K. (2021). First reduce and reuse, then recycle! Enabling consumers to tackle the plastic crisis – qualitative expert interviews in Germany. *Journal of cleaner production*, 313: 127782. doi: 10.1016/j.jclepro.2021.127782

Wiefek, J., Steinhorst, J., & Beyerl, K. (2021). Personal and structural factors that influence individual plastic packaging consumption – results from focus group discussions with German consumers. *Cleaner and responsible consumption*, 3: 100022. doi: 10.1016/j.clrc.2021.100022

Further publications will follow.

Disposable, reusable, or unpackaged?

The current level of disposable packaging consumption is resulting in large amounts of packaging waste. The adoption of unpackaged and reusable systems could reduce the volume of waste. Unpackaged systems generally deliver the best environmental outcomes and their adoption is preferable. Reusable packaging solutions can outperform single-use packaging where their circulation reaches a critical volume and their deployment is supported by consumer behaviour, short transport routes, and the use of renewable energy (cf. Criteria for an environmentally friendly reusable system on page 8). This is clearly illustrated by the reuse of glass bottles: At first glance, returnable glass bottles perform worse than composite beverage cartons due to the environmental burdens associated with their transportation and cleaning. However, where returnable glass bottles are used frequently and are transported within a limited radius, they are ultimately more sustainable. Their environmental impact can be further minimized through energy savings and the use of green electricity to power filling and cleaning processes.

[Source: Results from the BMBF-funded research project *Innoredux* www.plastik-reduzieren.de]

1. Improve the availability of unpackaged groceries

The prevention of waste is the most preferred solution in the European Union's waste hierarchy. In order to reduce implementation deficits in national waste management policy, we recommend the promotion of a nationwide supply of unpackaged groceries as a strategy to reduce the consumption of food packaging.

Establish binding standards for zero-packaging groceries

Under the zero-packaging concept, food products are offered loose, in large dispensers, or at fresh food counters. Consumers fill products into reusable containers such as nets, bags, jars or cans, which they either obtain in store or bring from home. The containers are cleaned by consumers at home.

In addition to the sale of unpackaged food in retail outlets, the zero-packaging concept also aims to minimize the use of packaging across the production and supply chain. Ideally, products should be transported – without individual packaging – in large containers

or in reusable packaging solutions. In order to safeguard the integrity of this concept, binding standards for zero-packaging food items and groceries should be developed, based on the best practices of established zero-packaging retailers. This would help to prevent greenwashing practices such as the sale of previously packaged food products under the zero-packaging label.

Consumers are willing to embrace zero-packaging solutions but are unable to access unpackaged food items

According to a representative online survey conducted as part of the ENSURE project, 76 per cent of respondents would welcome the consistent availability of unpackaged fruit and vegetables. In addition, 57 per cent of respondents would often or always use reusable containers to purchase products such as pasta, rice, nuts, or sweets, if this were possible. 63 per cent reported that they would often or always use personal take-out containers to purchase products at fresh food counters if it were possible.



Consumer willingness to embrace the unpackaged concept

76 % of consumers would welcome the consistent availability of unpackaged fruit and vegetables*

63 % of consumers would often or always have products filled into their own containers at fresh food counters if it were possible

57 % of consumers would often or always use reusable containers to purchase products such as pasta, rice, nuts, or sweets

(Nationwide representative online survey with 1,200 participants; *Sum of "mostly agree" and "completely agree" answers)

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However, 65 per cent of respondents agreed with the statement that opportunities to buy unpackaged groceries are very rare. 86 per cent complain that some beverages and foodstuffs are offered exclusively in plastic packaging; and 41 per cent of respondents felt that retailers do not approve of consumers bringing their own containers to reduce packaging waste. 57 per cent of respondents said they would strongly favour policies that promote organic and zero-waste stores; 62 per cent favour measures to support weekly markets.

Promote zero-packaging stores and expand consumer access

Due to the shorter shelf life of unpackaged food items, consumers who shop at zero-packaging stores must buy smaller quantities more often rather than making occasional bulk purchases. Efforts to expand the avail-

ability of zero-packaging options should accordingly include measures to promote local access to suitable stores. In order to harness the social and environmental benefits of the zero-packaging concept, we recommend efforts to promote the nationwide establishment of small zero-packaging stores that stock the largest possible range of products. Zero-packaging stores should be accessible in both urban and rural areas and should be operated and staffed by locals to promote their acceptance and develop resilient regional economic cycles. The stores should be easily accessible on foot or by bicycle or public transport. The operators of existing unpacked shops have found that regulatory requirements around inventory management and food delivery systems (for example, whether the surfaces of bulk food storage systems must be painted or not) vary from region to region. The development of uniform and transparent standards could provide greater planning certainty for entrepreneurs.

Zero-packaging stores

Zero-packaging stores stock exclusively unpackaged products, which are sold loose or via bulk self-service dispensers. Customers can allocate portions as they see fit and usually bring their own reusable containers. During the filling process, these containers are first weighed empty, then filled and weighed again. Founded in 2006, London's "Unpackaged" was among the first zero-packaging stores. The first stores in Germany were established in Kiel and Berlin in 2014. Since then, "unpackaged" (*unverpackt*) has become a household name and the number of zero-packaging stores has grown steadily. In late 2020, there were almost 300 such stores in Germany. Today, zero-packaging stores stock a broad range of products and can meet most household needs for food and hygiene products. In addition to vegetables, fruit, sausage and cheese, the stores stock grains, muesli, pasta, cereals, and other dry products. Tea, coffee, vinegar, and oil as well as detergents and cleaning agents can also be purchased without packaging. Many of the products are sourced from organic and regional suppliers. The products are delivered by suppliers in large transport containers.

2. Establish standardized and sustainable reusable food packaging systems

The European Union has pledged to promote the uptake of reusable packaging as part of its efforts to support the transition to a circular economy. The development of standardized and sustainable reusable packaging systems, as a complement to the zero-packaging concept, is an important strategy to reduce the consumption of single-use plastic packaging in the food sector.

Reusable packaging solutions are packaging materials and containers that can be used several times, with the containers cycling through a loop of filling, sales, returns, cleaning, and refilling. Reusable containers can be made of materials such as cotton, glass, stainless steel, aluminium, or plastics. Reusable packaging solutions that customers bring to sales outlets and fill with unpackaged food and clean at home are part of the zero-packaging concept. The following discussion focuses on professional reusable systems.

Consumers ready to embrace reusable packaging

82 per cent of respondents to the representative ENSURE online survey criticized the unavailability of food products in reusable packaging. 78 per cent of respondents would welcome regulations requiring retailers to provide reusable packaging solutions. 57 per cent of respondents would be willing to pay a deposit for a returnable cloth bag, and 56 per cent expressed their willingness to use returnable and reusable deposit systems at fresh food counters. 79 per cent of respondents would use a return system based on streetside reverse vending machines. 62 per cent of respondents said they would be willing to pay a levy on single-use plastic packaging that would make reusable packaging more affordable and cross-finance reverse vending machines.

Consumer willingness to use reusable packaging

82 % of consumers criticize the unavailability of food products in reusable packaging*

57 % of consumers would be willing to pay a deposit for a returnable cloth bag*

56 % of consumers would be willing to use returnable and reusable deposit systems at fresh food counters*

(Nationwide representative online survey with 1,200 participants; *Sum of "often" and "always" answers)

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Criteria for a sustainable reusable packaging system

A number of issues must be considered in order to ensure the sustainability of reusable packaging solutions. Ideally, reusable containers should circulate through the reuse loop as many times as possible before they are recycled at the end of their service life. The case of reusable glass bottles offers a clear illustration of this (cf. *Disposable, reusable or unpackaged?* on page 4). In addition, customers must return containers to the loop for cleaning and refilling as quickly as possible after use in order to keep the total number of containers circulating through the system at any one time to a minimum. Simple and convenient reverse logistics as well as incentive systems such as deposits can guide consumer behaviour.

Moreover, it is important that transport routes between individual circulation stations are kept as short as possible. Establishing reusable food packaging systems is capital intensive and entails considerable costs for all stakeholders. Initial funding should be provided to promote the development and operation of decentralized packaging cleaning services in order to safeguard the economic viability of reusable packaging systems and secure their environmental benefits.

Increase efficiency through standardization

Reusable food containers must meet high safety standards and should be suitable for use with the widest possible range of food items. The development of industry-wide material and sizing standards for reusable packaging could enhance the overall efficiency of reusable systems. The adoption of standardized solutions would also heighten the visibility of reusable packaging and ensure that consumers are less likely to incorrectly or prematurely discard food packaging.

Life cycle assessments needed

Research shows that the use of eco-friendly cleaning agents and renewable energies in the cleaning, filling, and transport of food packaging improve the sustainability performance of reusable systems. The introduction of reusable lids could deliver additional gains. Further research is needed, however, to identify the specific use cases (and food types) in which reusable systems deliver a more sustainable outcome than single-use packaging or unpackaged solutions. Independent scientific institutions should be tasked with preparing comparative life cycle assessments to address this deficit.

Reusable systems in the takeout and online food industry

A number of innovative reusable solutions already exist. Some of these have been awarded the German government's "Blauer Engel" (Blue Angel) eco-label for environmentally friendly performance. For example, one model uses a pool-like system of reusable containers, enabling containers for to-go beverages and food products to circulate through a network of supermarkets, restaurants, event organizers, and canteens. This approach can save money on disposable packaging and reduce waste. Another model requires consumers to pay a deposit – in cash or per electronic transfer – for the use of reusable containers. Where consumers choose to pay by electronic transfer, the deposit is only charged if the container is not returned within a specified period. The system uses QR codes to monitor the circulation of individual containers and enables consumers to return them at any participating outlet. This tracking system also allows the provider to regulate the supply and distribution of containers. A third model enables consumers to shop online at zero-packaging stores and have their purchases delivered by a cargo bike courier in reusable containers in return for a deposit. Previously used containers can be returned at the time of delivery.

3. Expand regional supply systems for seasonal and organic foods

Food packaging serves to maintain the freshness of products during their transportation over long distances, as well as their storage and handling. Overall demand for packaging could be reduced if food products were grown seasonally and distributed regionally. Policy should accordingly promote the development and growth of regional economies in which the demand for packaging products is lower.

Transparent value chains create trust

The ENSURE survey showed that 83 per cent of respondents would like to see a broader range of locally grown fruit and vegetables available in stores. Regionality and short distribution chains create opportunities to improve transparency and forge closer relationships between producers and consumers. This would enable consumers to learn more about where their food comes from and the circumstances under which it is produced. Strengthening consumer-producer relationships could improve the willingness of consumers

to accept higher food costs and foster more sustainable food production.

Strengthen businesses that pioneer social and environmental solutions

Efforts to promote regional food systems with reduced packaging inputs should focus on organic cooperative farming operations and direct marketing enterprises. These businesses tend to have minimal packaging needs and most transport their products in reusable solutions. Moreover, they aim to establish fair relations between the buyers, processors, and retailers of agricultural products. The organic farming practices used on these farms contribute to the protection of soils, biodiversity, and the climate and maintain high standards of animal welfare in livestock farming. Their pricing policies aim to cover their operating costs and to properly reflect the actual costs of achieving high standards of animal welfare and producing seasonal foods sustainably.

Demand for organic, regional, and seasonal produce

83 % of consumers would like to see a broader range of regionally grown fruit and vegetables available in stores*

62 % of consumers favour measures to support weekly produce markets*

57 % of consumers would welcome policies that support organic and zero-packaging stores*

(Nationwide representative online survey with 1,200 participants; *Sum of "mostly agree" and "completely agree" answers)

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Organic farming cooperatives operate in various legal forms and rely on the active and passive (financial) support of consumers. These farms try to improve their economic certainty through long-term purchasing agreements. Many of these approaches were pioneered in the “community-supported agriculture” movement and their broader uptake should be supported.

Other opportunities to strengthen pioneering social-ecological farmers include measures to secure access to land for organic farming operations, particularly for new businesses. Measures to strengthen short and regional value chains (including direct marketing chan-

nels) by removing legislative and bureaucratic barriers should also be considered. Finally, it is vital that farmers are adequately remunerated and recognized for their contribution to society.

Holistic approaches such as the Common Good Balance Sheet (*Gemeinwohl-Bilanz*) and the Regional Value Bonus (*Regionalwert-Prämie*) can play a special role in strengthening social-ecological businesses with low-packaging supply structures. These instruments foster social-ecological management that serves the common good (see *Common Good Balance Sheet and the Regional Value Bonus*).

Common Good Balance Sheet and the Regional Value Bonus

The Economy for the Common Good is a social movement initiated by small and medium-sized businesses that advocates for an economic model in which all economic activity serves the common good. A company's contribution to the common good can be measured using the so-called *Common Good Balance Sheet*. Under the common good model, companies would receive (state) subsidies based on their contribution to the common good as measured with the balance sheet. The European Economic and Social Committee recommends that the common good economic model be integrated into both the European and national legal frameworks.

The *Regional Value Bonus* is an instrument proposed by the citizen shareholder corporation *Regionalwert AG* which would link the allocation of Common Agricultural Policy (CAP) funds to the social and environmental performance of farms. It includes a regional value accounting model to measure the contribution of agricultural enterprises to the common good and the preservation of the natural environment. This method was developed in close consultation with farmers and makes it possible to distribute agricultural subsidies based on the sustainability and common good performance of farming enterprises.

Conclusions

A cross-system approach to reducing packaging

In order to achieve the best possible environmental and social outcomes, a broader and systemic view should be taken in the development of measures to reduce food packaging. Merely substituting plastic packaging with other packaging materials is likely to generate unwelcome rebound effects. Instead, efforts to reduce the use of plastic packaging should be embedded within a broader strategy to reduce the consumption of packaging of all kinds. The adoption of unpackaged solutions and regional reusable systems could contribute to an overall reduction in the consumption of packaging. Promoting food supply systems centred on organic produce will also help to protect the climate, biodiversity, and soils as well as strengthening animal welfare and protecting human health.

Create incentives to promote zero-packaging options

At present, buying unpackaged food items is both costly and time-consuming. Consumers must plan and prepare their purchases and also bring and clean their own containers. The shorter shelf life of unpackaged food products also requires consumers to shop more often. In addition, unpackaged food products are usually unprocessed foods, requiring consumers to spend more time on food preparation at home. 41 per cent of respondents to the ENSURE online survey stated that they find it too inconvenient to bring their own reusable containers. Moreover, 53 per cent of respondents stated that shopping packaged food saves time. Many zero-packaging stores have developed elaborate systems to determine the unladen weight of containers used to purchase unpackaged food. Technological developments in weighing and checkout systems adapted to the zero-packaging concept could make for a smoother shopping experience. Fostering zero-packaging shopping will require incentives that adequately compensate for the disadvantages noted here. This includes regulatory and fiscal instruments that would make unpackaged food products significantly more affordable than packaged products.

Information and education to promote zero-packaging consumption

Information on ingredients, allergens and the shelf life of food items can be made available to consumers at zero-packaging stores through in-store signage, digital solutions or on cash receipts. Advice on food storage and processing could also be supplied to consumers through these channels. Unpackaged food items are generally unprocessed food products and their increased consumption can be expected to deliver health benefits. Young people could learn to prepare unprocessed foods in schools. Educational policy should also include programmes on healthy nutrition, with a particular focus on regional and seasonal products as well as on their processing and storage.

The implications of the zero-packaging concept for brand and product diversity

Focus group discussions hosted by the ENSURE team showed that consumers have become accustomed to accessing foods that are not currently in season or available from regional suppliers. The focus groups also confirmed that consumers place particular importance on the freshness of food products when shopping – a finding that reflects previous research. Consumers frequently fail to make the connection between the seasonal (un-)availability of food items (regionally grown cucumbers, for example) and the need for packaging solutions to preserve freshness during transportation.

Although some respondents noted that they find the wide range of products available in supermarkets disturbing, they also expected that their preferred products should always be available – an expectation that drives supermarkets to stock a wide range of products. This consumer culture of the constant availability of the broadest possible inventory is problematic for efforts to promote the zero-packaging concept.

To significantly reduce the consumption of food packaging, we must reduce the supply and consumption of food transported over long distances as well as of convenience foods and industrially processed food products. As the unpackaged concept gains ground, certain products will probably have to disappear from inventories altogether. This applies above all to industrially produced, highly processed food products, as these products generally require packaging to maintain their specific attributes and freshness. At the same time, consideration must also be given to minimizing food waste.

Changing eating habits is crucial to reduce packaging waste

Research by the ENSURE project shows that the consumption of plastic packaging is associated with the consumption of perishable animal products, such as milk, cheese, meat, and sausages (cf. diagram *Which food items are bought in plastic packaging?*). Food packaging waste could be reduced through the adoption of a diet that is based on (unpackaged) fruit, vegetables, pulses and cereals, with only minimal meat substitutes, as these usually require packaging.

The ecological footprint of meat and other animal products is many times larger than that of plant-based foods. Promoting a largely plant-based diet and providing mainly vegan options in university cafeterias and canteens in public institutions and at events can help to reduce packaging waste and contribute to the

protection of the climate and soils as well as animal and human health.

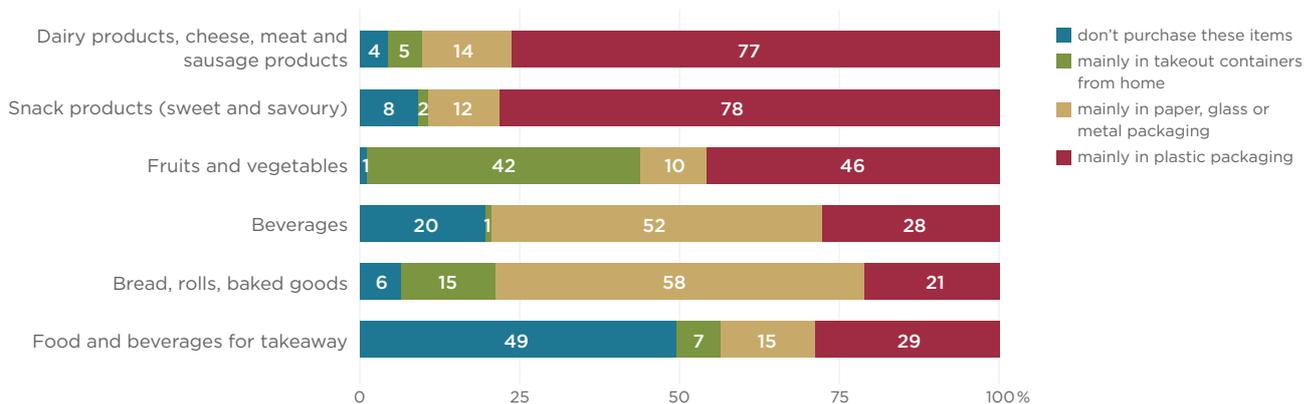
The ENSURE survey also found that 42 per cent of participants never or rarely drink tap water. Here too, an enormous opportunity to reduce the consumption of (plastic) packaging exists.

It’s time to talk about sufficiency

Our research findings and the recommendations derived from them highlight the need for a broader public debate on sufficiency-driven business models and waste prevention. In essence, we must ask ourselves what we actually need to lead a good life and what we can or must do without. Alongside efficiency and consistency, sufficiency is one of the most important strategies for achieving the goal of sustainability. The focus of sufficiency discourse is on achieving behavioural change through structural changes, based on a particular understanding of what constitutes “enough”.

It will not be possible to reduce packaging consumption simply by encouraging consumers to shop at zero-packaging stores. Instead, fundamental changes in our society, lifestyles, and infrastructures are necessary. This will require a long-term strategy to transform supply systems and individual consumption habits and to align them with the principle of sufficiency. A common vision of the future should be developed in a broad participatory process to provide

Which food items are bought in plastic packaging?



Nationwide representative online survey with 1,200 participants

guidance to both economic actors and consumers and point out important development goals.

Taking the zero-packaging concept to the mainstream

Businesses pioneering approaches to sustainability that engage with social and environmental aspects will play an important role in this transformation process. Results from socio-ecological transformation research show that it is small and medium-sized enterprises that pioneer socio-ecological business practices. With the appropriate policies and regulations in place, these niche actors can drive change across the mainstream, accompanied by changes in infrastructure, technology, user practices and the cultural meanings of packaging. However, these smaller actors must be supported and protected if they are to succeed. When large companies adopt socio-ecological business practices pioneered by niche actors, they often undermine the socio-ecological standards established in supply chains in order to maximize their profits. The resulting downward pressure on prices poses a substantial risk for small and medium-sized businesses, as seen in the Fairtrade and organic sectors. To protect these smaller market actors, we recommend that targeted support be provided to zero-packaging stores and organic farms committed to regional value chains. In addition, industry standards should be established to ensure that the socio-ecological best practices developed by pioneers are maintained.

Political regulation is necessary

The strategies recommended in this IASS Policy Brief on reducing single-use plastic packaging are already the subject of discussion within the conventional food industry. However, industry actors have hesitated to adopt these approaches or to promote their widespread uptake. Instead, a trend towards lightweight packaging and non-recyclable composite films can be observed. Many conventional retailers now offer fresh produce in two packaging options: a cheaper disposable packaging option and a more expensive unpackaged option. This practice places the responsibility for reducing packaging consumption on consumers and suggests that a regulatory solution is needed to promote reductions in food packaging waste. The IASS Policy Brief "Moving towards stronger packaging waste legislation in Germany: An analysis of the German Packaging Act" examines the potential benefits of linking a regulatory solution with the adoption of waste reduction goals.

A whole-of-society transformation towards more sustainable lifestyles requires fundamental change. Its success will rest on the decisions and actions of many individuals in different positions – including in politics and business. The implementation of our recommendations for action can contribute to this transformation. ■

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Institute for Advanced Sustainability Studies (IASS) e. V.

The Institute for Advanced Sustainability Studies (IASS) conducts research with the goal of identifying, advancing, and guiding transformation processes towards sustainable societies in Germany and abroad. Its research practice is transdisciplinary, transformative, and co-creative. The institute cooperates with partners in academia, political institutions, administrations, civil society, and the business community to understand sustainability challenges and generate potential solutions. A strong network of national and international partners supports the work of the institute. Among its central research topics are the energy transition, emerging technologies, climate change, air quality, systemic risks, governance and participation, and cultures of transformation. The IASS is funded by the research ministries of the Federal Government of Germany and the State of Brandenburg.

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