Unveiling the Complexities: Exploring LCAs of Reusable Packaging in the Take-Away Sector

Why do they disagree and how can we determine their credibility?

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Report For

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Executive Summary

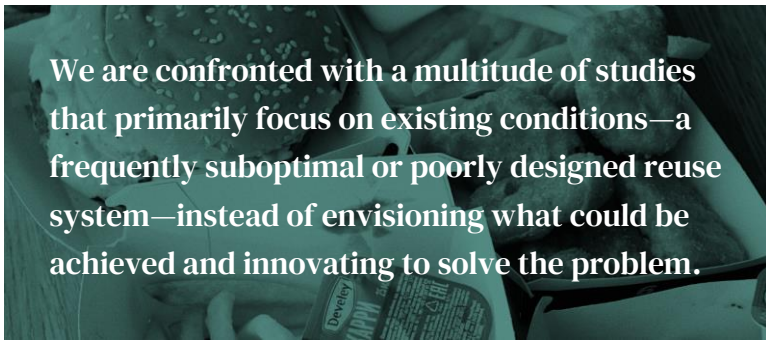
The objective of this discussion paper is to draw attention to some of the challenges associated with Life Cycle Assessments (LCAs) that compare reusable packaging with single-use options, specifically focusing on the demanding take-away sector, which presents unique complexities for implementing reuse practices. By comparing two recent studies commissioned by the European Paper Packaging Alliance (EPPA) and McDonald's—both of which aim to challenge the case for reuse in the take-away sector—with an academic paper, we illustrate how analysis of the same issue can be approached differently to yield conflicting results. The key assumptions underlying these differences are identified, helping readers comprehend how these contrasting perspectives are achieved.

Transparency is crucial in comparative LCAs to ensure scientifically valid results. Peer review and publication of complete studies allow for broader scrutiny and assessment of credibility. For non-LCAs, such as discussion papers, transparent presentation of data and assumptions is imperative. This report highlights key aspects of takeaway reuse studies that influence results and emphasises the need for scrutiny. The studies selected represent the transparency spectrum.

Static assumptions in reuse studies present challenges, particularly when empirical support is lacking. It is crucial to transparently state and test assumptions, and system trials can help validate findings. However, the McDonald's study falls short in terms of transparency regarding its methods and data, making it difficult to meaningfully validate its conclusions. As a result, caution should be exercised when considering the reliability of its findings.

Return rates, washing systems, and dedicated return journeys are critical assumptions that require scrutiny when assessing reuse for fast food packaging. It becomes evident that the EPPA study, despite undergoing peer review, is marred by a critical flaw: the creation of a baseline scenario that favours a particular outcome. Using pessimistic return rates of 50-70%, decentralised washing and excessive return transport leads to a poor outcome for reuse. However, by using the same underlying data, entirely opposite conclusions can be reached when these key assumptions are stacked in the favour of reuse.

Determining break-even points is therefore more informative than using static figures, particularly for behavioural aspects that are hard to predict. Studies that do not show the potential variation in results and highlight the dependencies are likely to be misleading.



Use of environmental indicators, such as water consumption or plastic use, need careful consideration. Water consumption alone does not indicate water impact or scarcity, and location matters. Proper comparative water footprinting methods are needed. Regarding packaging material used, paper and plastic encounter similar recyclability challenges in fast food due to food contamination. Transparent discussion on integrating fast food waste paper/card into paper recycling is necessary. But even if higher rates of recycling can be achieved, reliance on single-use paper needs to be considered in context of the wider impacts of raw materials production and consumption.

In summary, this report emphasises transparency, challenges static assumptions, and encourages asking the right questions in reuse studies. This is essential in interpreting published LCAs, which are often influenced by industry funding and biases. Transparent data, methodologies, and assumptions ensure credibility. Proper assessment of return rates, washing systems, water consumption, is crucial. The focus should shift from existing conditions to envisioning and innovating for better systems. Overcoming barriers requires designing systems for the future, not just the present. By considering these factors and scrutinising studies, better insights can be gained for effective policy decisions in the reuse sector.

Conclusions

Some key findings are:

Assumptions:

Both the EPPA and McDonald's studies focus on suboptimal/ poorly designed reuse systems—instead of envisioning what could be achieved and innovating to solve the problem.

(i) Return rates:

Both studies have estimated a low average return rate for the packaging (70% McDonald's and 50% EPPA), which means the reusable packaging would undergo reuse only 3 or 2 times which is not a viable system to aim for.

(ii) Washing:

The EPPA study assumes the average of several different behaviours when it comes to the washing of reusable containers, instead of indicating what would be the encouraged behaviour for the system to perform optimally. This averaging exercise makes it uncredible and heavily influenced by data outliers. The McDonald's study provides no indication of the assumptions behind the washing process, so it is impossible to determine whether the results are based upon sound reasoning.

(iii) Transport:

The EPPA study assumes that 50% of return journeys are dedicated, with a "conservative" sensitivity set at 20%. These assumptions heavily contribute to more than 50% of the climate change impact in the study and strongly influence the resulting conclusions. However, considering the nature of convenience in fast food consumption, the suggestion that 20% of all individual containers would require a dedicated return journey does not appear highly credible, and 50% as a base case is a bold assumption in light of the lack of data. Also, these assumptions contrast heavily with those of academic paper Hitt et al., where the base case assumes no additional journeys are made, meaning containers are returned when picking up more food. A more transparent approach would be to investigate how pooling and sharing across the whole sector can address the need of dedicated journeys by ensuring drop-off/collection points are optimised among all participant operators.

Parameterised Reuse Scenarios:

While both the EPPA and McDonald's studies analysed nine containers in their respective analyses, they do not provide specific details on how each container performs in the results, highlighting the need for more comprehensive information to assess their performance accurately.

The EPPA study appears to have 'stacked' the pessimistic reuse assumptions in the baseline scenario which achieves a favourable result for single-use.

Given the different assumptions and parameters present in both single-use and reuse systems, it is more rational to indicate how these parameters can be optimised rather than providing a verdict favouring single-use over reuse systems.

Material usage: the paper vs plastic debate:

Both the EPPA and McDonald's studies fail to provide insights into effectively addressing poor separate collection rates or the food contamination issues with single-use packaging that must be overcome to significantly improve recycling. The Confederation of European Paper Industries (CEPI) indicates that full saturation of paper with grease is considered unacceptable (which is often the case with fast-food).

In contrast, it is feasible for a well-designed reuse system to achieve much higher rates of recycling and yield better-quality recycled materials, albeit not without the challenges of recycling plastics into food grade applications.

Water Consumption:

Simply comparing water consumption (or use) across the entire lifecycle does not provide a sufficient environmental indicator and, unless the two comparative systems are treated the same, the results could be unfairly influenced. Without conducting fair and robust comparative assessments of water footprint, it is unwarranted to draw conclusive findings in this way.

Introduction

The objective of this discussion paper is to draw attention to some of the challenges associated with Life Cycle Assessments (LCAs) that compare reusable packaging with single-use options, specifically focusing on the demanding take-away sector, which presents unique complexities for implementing reuse practices.

It is important to note that this paper does not aim to provide a comprehensive meta-analysis of the evidence. Such analyses are only informative when comparing very specific scenarios. It is overly simplistic to examine a broad range of 50 reuse studies and make a definitive judgement of whether reuse is universally "good" or "bad." These are intricate systems that also involve behaviours that do not conform to our current linear models.

Instead, the following discussion aims to highlight examples of frequently cited studies that may possess flaws or lack clarity in their details. We offer guidance on what aspects to scrutinise, what questions to ask, and how to engage in critical thinking when evaluating such studies. This essential guidance can also be applied to the assessment of reuse in various sectors beyond take-away as well.

By comparing two recent studies commissioned by the European Paper Packaging Alliance (EPPA) and McDonald's—both of which aim to challenge the case for reuse in the take-away sector—with an academic paper, we illustrate how the analysis of the same issue can be approached differently to yield conflicting results. The key assumptions underlying these differences are identified, helping readers comprehend how these contrasting perspectives are achieved.

1.1 The Importance of Transparency

The primary reason why comparative LCAs in the public domain are required to undergo peer review, as mandated by ISO 14044,[1] is to ensure that the results are based on scientifically and technically valid methods. Transparency of data, methods and assumptions is also a key tenent of the reviewing process.

Assessing credibility becomes exceedingly difficult if the background analysis and assumptions remain obscure. Even if a study has undergone peer review, it is crucial for it to be published in its entirety rather than just an executive summary, as this allows for broader scrutiny, especially when the study aims to influence policy decisions.

In the case of studies that are not formal LCAs, such as discussion papers, white papers, or lobbying papers, it becomes even more imperative to transparently present a concise summary of the underlying data and assumptions.

As will be discussed in the following sections, there are some key aspects of LCA comparison studies between single-use vs reusable packaging that heavily influence its results and these need to be well documented and justified. **Behavioural aspects such as return rates, home washing and dedicated return journeys are particularly fraught with uncertainty and therefore need the most scrutiny.**

With this in mind, three studies have been chosen to represent the spectrum of transparency:

- ***EPPA - European Paper Packaging Alliance (EPPA Study)*** – a peer reviewed LCA.[2]
- ***No Silver Bullet, commissioned by McDonald's (McDonald's study)*** – a discussion/lobbying paper.[3]
- ***University of Michigan (Hitt et al.)*** – a journal article LCA.[4]

1.2 Asking the Right Question: "*Can* it?", instead of "*is* it?"

The challenge associated with interpreting the majority of published life cycle assessments (LCAs)—not limited to the reuse space—lies in their typical industry funding. Consequently, even if a study maintains methodological rigour, it can possess inherent biases rooted in the questions asked—and often those not asked—particularly in the context of reuse. Furthermore, only studies that align with a specific narrative tend to find their way into the public domain. Thus, **even with peer review, published LCAs seldom achieve true objectivity.**

As a result, we are confronted with a multitude of studies that primarily focus on existing conditions—a frequently suboptimal or poorly designed reuse system—instead of envisioning what could be achieved and innovating to solve the problem.

One of the biggest challenges to overcome is that we should not be designing systems only for today, but for the future. The barriers that exist today are a symptom of the linear systems that persist. These barriers will not be removed overnight, but should not be considered insurmountable or an excuse for inaction.

Life cycle assessment (LCA) is a methodological tool for assessing environmental impacts associated with all the stages of a product's life cycle from raw material acquisition, production, use, end-of-life treatment, recycling and final disposal.

1.3 Avoiding Static Assumptions

Analysing reuse systems is frequently accompanied by uncertainty, mainly due to the complex social and behavioural aspects that remain poorly understood. When utilising data from other studies, it is essential to provide clear citations, enabling readers to verify the information independently.

Nevertheless, a significant challenge arises from the fact that several key assumptions utilised in these studies lack empirical support. While this may not be inherently problematic, it is crucial to transparently state and rigorously test these assumptions. This becomes particularly important when the evidence base is weak, necessitating system trials to validate the findings. In such cases, presenting a range of 'what if?' scenarios can be highly beneficial in addressing the prevailing uncertainty.

Return Rates - the Exponential Benefits

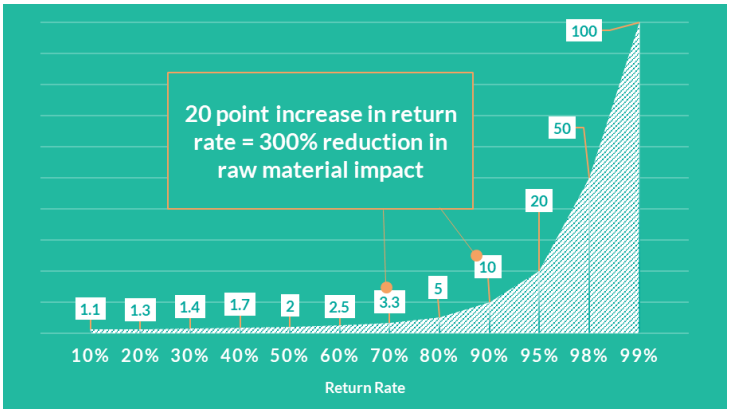
When evaluating systems for reuse in which the system operator owns the reusable packaging, it is crucial to determine the return rate, which differs from the number of reuse cycles—a vital metric for consumer-owned items like reusable bottles.

Due to the evolving nature of reuse in takeaway scenarios, it is challenging to ascertain the achievable return rate accurately. Consequently, relying on a static assumption in this context is not credible.

However, even a small variance in the return rate can have an exponential impact on the overall results.

Figure 1 illustrates the influence of the return rate on the number of times an item is reused. For instance, with a 70% return rate (as used in the McDonald's study), the item, on average, will undergo approximately three reuse cycles. Increasing the return rate to 90% raises this number to ten cycles. In simplistic terms this means that, from 70-90%, the impact associated with the raw materials is reduced by 300%. A 50% return rate as applied by the EPPA means that items will only be used twice which is evidently not a viable reuse system to aim for.

Figure 1: Reuse Cycles by Return Rate



Further increases in the return rate yield substantial differences, with a 98% return rate enabling up to 50 cycles, significantly diminishing the magnitude of material impacts. Therefore, determining the break-even points—where the return rate becomes favourable for reuse—is more informative than selecting a static figure whose reasons for choosing may become obscured during results presentation.

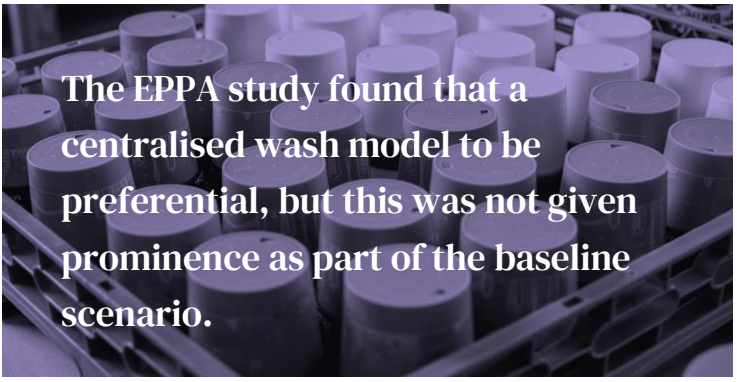
Undeniably, the return rate is an exceptionally critical assumption that should not be arbitrarily chosen. Even if there are existing instances of low return rates to draw upon, these may not necessarily represent well-functioning systems, **as a poorly designed and implemented reuse system will not outperform single-use alternatives.**

While high return/reuse rates can diminish the impact of raw material use, it is essential to consider the

overall system's environmental impact, including return logistics (transportation, washing, etc.). In certain cases, if the total impact of the system exceeds that of single-use options, increasing the return rate can paradoxically lead to a negative outcome, shifting the impacts from the manufacturing phase to the use phase. If such a trend emerges, it suggests fundamental issues within the system itself that necessitate exploration.

Washing Systems – Many Ways to Clean

Alongside the return rate, one other important aspect of reuse is the washing of the items. As this can be conducted in different settings (industrial, commercial, domestic) it is important to differentiate.



For reusable takeaway packaging there is the assumption that the item will be cleaned twice, once at home and once on return. The latter can be controlled within the system, but the at-home cleaning is another behavioural assumption. The items are likely to only require a cold water rinse to remove food debris, and Hitt et al. suggest that anything more should be considered "over washing", but provides several different washing scenarios in the results. The EPPA study assumes an 'average' of hot washing, dry wiping and cold rinsing will take place. Whilst averaging several behaviours might seem like a pragmatic approach given the uncertainty, it becomes harder to untangle the behaviours that should be encouraged to help the system perform optimally. Averaging is also a crude method that can be heavily influenced by data outliers. The McDonald's study provides no indication of the assumptions behind the washing process, so it is impossible to determine whether the results are based upon sound reasoning.

For takeaway containers, there is also the choice of whether the system is decentralised—with all items being returned to and washed at the take-away premises—or centralised, whereby they are returned and shipped to a large, dedicated wash plant. The latter also potentially allows for the containers to be returned to strategically placed drop-off points rather than specific fast-food outlets. Innovative ways of pooling and sharing across the whole sector could remove some of the barriers to individual restaurant managed systems.

Notably, the EPPA study found that a centralised wash model to be preferential (based purely on the wash plant efficiency), but this was not given prominence as part of the baseline scenario.

Use Phase Transport – Overstating Dedicated Trips

In returnable packaging systems, the responsibility typically falls on the consumer to find a way to return the packaging to the supplier, with various options available that differ in their reliance on the consumer's actions.

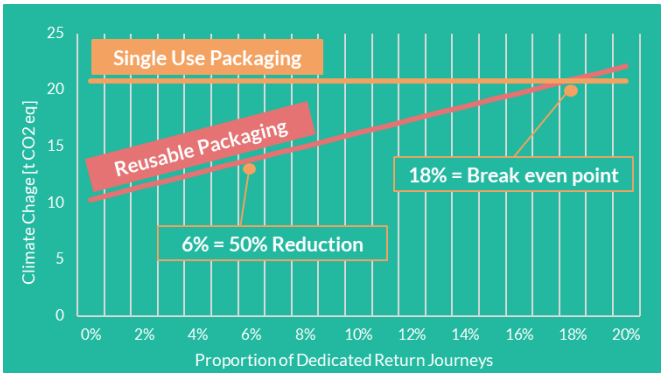
Another behavioural aspect that lacks sufficient data to support a single assumption is how consumers will react to the system. Of particular importance is the consideration of dedicated journeys—how frequently consumers will make a specific trip solely to return the packaging. Such journeys have the potential to negate the other benefits of the system entirely and may even result in higher costs for the consumer.

Due to the scarcity of published and transparent data on reuse behaviour, determining an appropriate assumption becomes challenging. For instance, the EPPA study assumes that 50% of return journeys are dedicated, with a "conservative" sensitivity set at 20%. These assumptions heavily contribute to more than 50% of the climate change impact in the study and strongly influence the resulting conclusions. In light of this, it would be more informative to identify a break-even point that indicates the threshold of consumer behaviour the system design should encourage.

However, considering the nature of convenience in fast food consumption, the EPPA suggestion that 20% of all *individual* containers would require a dedicated return journey does not appear highly credible, and 50% as a base case is a bold assumption in light of the lack of data.

Figure 2 illustrates a hypothetical scenario of how the EPPA results could change if the number of dedicated journeys is reduced. A break-even point is where single use and reusable packaging systems are considered to have the same impact. Notably, a reduction of just 2 percentage points (to 18%) reaches the break-even point, and if fewer than 6% of journeys are dedicated, the environmental impacts of reusable packaging are halved compared to single-use packaging in terms of climate change.

Figure 2: Dedicated Return Journeys Sensitivity – Recalculated EPPA Results[a]



Furthermore, the assumptions made by EPPA contrast with those of Hitt et al., where the base case assumes no additional journeys are made, meaning containers are returned when picking up more food. This disparity in assumptions between studies highlights the lack of consensus and should be a priority for investigation, given its impact on the results.

Dedicated journeys represent a type of behaviour that can potentially be discouraged through incentives while also considering the challenge of individuals hoarding multiple items, which can impede the effective operation of the system. In addition, the combination of a well-designed reuse system and pooling across the whole sector could address the need of dedicated journeys by ensuring drop-off/collection points are optimised among all participant operators.

Parameterised Reuse Scenarios

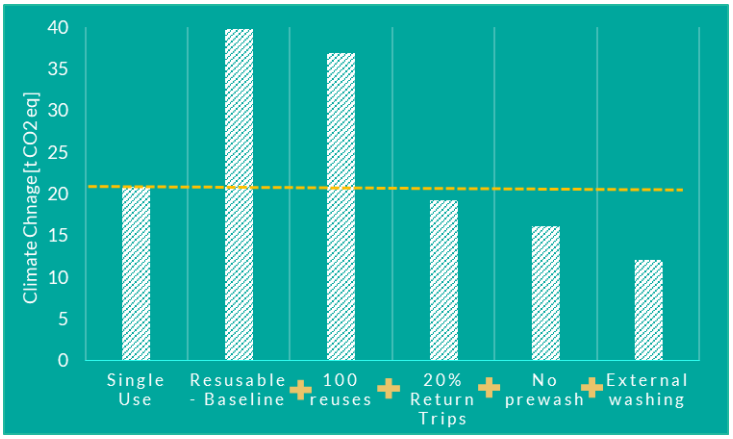
Based on the preceding discussion regarding the significance and variability of key assumptions, relying on a static model fails to adequately capture the complexity of the debate. It is crucial to identify and establish a range for these key assumptions or parameters to ensure a comprehensive analysis. A noteworthy example of implementing this approach is demonstrated in Hitt et al.'s study, which examines break-even points associated with different adjustments to return transport and washing. As a result, the study's conclusions offer a nuanced perspective that emphasizes the optimisation of parameters rather than presenting a conclusive verdict favouring one system over another.

It is important to note that different items present varying challenges in terms of reuse, making it inappropriate to generalise and categorise all reusable fast-food packaging as either inherently good or bad. Factors such as size, mass, and material composition significantly influence the transportation and cleaning methods required, subsequently impacting their viability within a reusable system. While both the EPPA and McDonald's studies analysed nine containers in their respective analyses, they do not provide specific details on how each container performs in the results, highlighting the need for more comprehensive information to assess their performance accurately.

It should also be recognised that often these parameters do not change in isolation. 'Stacking' the parameters to show how the results could change if more than one aspect varies can provide additional insight. **Error! Reference source not found.** shows h ow this might look in the EPPA study. In this case, the four sensitivities that reduce the impact of reuse are stacked together—rather than presented individually—to provide a result that has around half the climate change impact of single use.

The EPPA study appears to have 'stacked' the pessimistic reuse assumptions in the baseline scenario which achieves a favourable result for single-use. Without better data it is not possible to determine how likely either scenario is which makes it all the more important to be transparent around the lack of certainty and the limitations to avoid biased representations.

Figure 3: Scenario Stacking Example



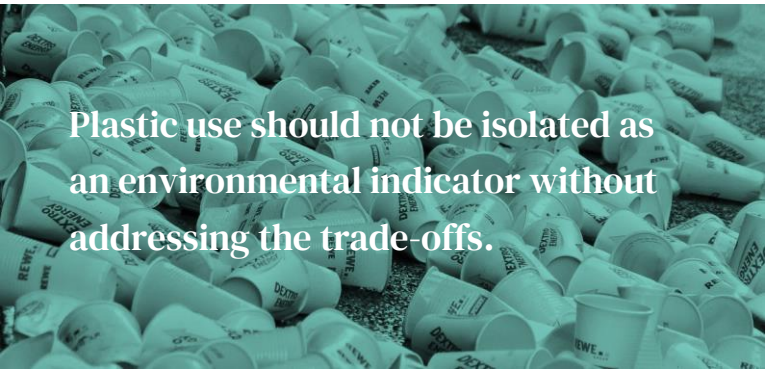
[a]It is important to note that the figure provided is for illustrative purposes only and does not endorse specific results due to limited access to the underlying data.

1.4 Challenges of Environmental Indicators

The Paper Vs Plastic Debate

In the food service sector, plastic items have largely been replaced with paper and card alternatives, accounting for approximately 93% of the sector (according to the McDonald's study).

Consequently, the use of plastic and its reduction is not a metric that is particularly meaningful for this industry. Importantly, burden shifting, such as replacing plastic with paper, comes with its own set of challenges and trade-offs. Plastic use should not be isolated as an environmental indicator without addressing these complexities.



For instance, the push to replace single-use plastic with paper alternatives will result in greater demands on forestry resources. While Europe currently fulfils a significant portion of these demands, imports of pulp from South America have been steadily increasing and now represent 15% of Europe's total pulp consumption.[5] The potential impacts on ecosystems in these environmentally sensitive areas raise significant concerns.[6] A more favourable approach may involve reforesting these areas permanently, leading to the long-term sequestration of carbon, rather than engaging in continuous harvesting for short-lived products.[7]

An alternative indicator to consider is the net reduction in plastic litter resulting from the implementation of a reuse system, along with an assessment of the net material requirement per use. This broader perspective allows for a more comprehensive evaluation of the environmental benefits associated with the reuse system.

Examples of how plastic is used as an environmental indicator in a misleading way in the McDonald's study are shown below:

> *"...a **multi-use** 16 oz Starbucks **coffee cup** with lid can **contain 9x more plastic than a single-use paper coffee** cup with a plastic liner and plastic lid."*
>
> ***"**Estimates suggest that a reusable cup needs to be reused between **50 and 100 times** to make it environmentally preferable to a single-use cup from a **plastic waste generation point of view..."***

Stating that a reusable item contains more material than a single-use item may seem obvious, but in this case, the two statements conflict: the reusable cup is said to use 9 times more plastic, which is inconsistent with the claim that it needs to be reused 50-100 times to lead to the same plastic waste generation.

Both paper and plastic encounter a common challenge in the fast food sector, namely, food contamination. This issue instantly diminishes the value of the material and renders recycling difficult from an economic standpoint. The EPPA and McDonald's studies assume relatively low levels of paper recycling in the current scenario, with percentages of 30% and 13% respectively, but neither are based on reliable data. However, the studies mentioned fail to provide insights into effectively addressing the contamination issues to achieve significant improvements in recycling rates. The McDonald's study suggests the use of digital watermarking as a means to track and enhance sorting, but this technology primarily focuses on identifying

different polymers in plastics, not paper.[8] Moreover, it does not offer a solution for the problem of contamination.

The Confederation of European Paper Industries (CEPI) provides guidance indicating that stains and trace amounts of food are acceptable in recycled paper, but full saturation of paper with grease is considered unacceptable.[9] However, it remains unclear how this guidance translates into practical terms for the fast food industry. Therefore, it is crucial to engage in discussions on how paper mills can potentially integrate recycled paper/card from the food service sector. This integration can help alleviate the pressures on forestry resources, particularly if single-use items continue to be utilised.

It is plausible that a well-designed reuse system can achieve much higher rates of recycling and yield better-quality recycled materials. In such a system, when each item becomes unusable, it can be collected, sorted, and cleaned as part of the normal process. However, the development of a recycling process that enables these items to become food-grade packaging once again remains uncertain and requires further exploration.

Water Consumption

Water consumption is commonly used as an environmental indicator, particularly in the context of reuse scenarios where items need to be washed. However, it is important to note that water consumption does not equate to water impact or scarcity. Simply accounting for the amount of water consumed in different systems does not provide a comprehensive picture. The location of water consumption plays a crucial role. In water-abundant areas, the impact of a certain amount of water consumption will be relatively low, while in dry regions, the effects will be more significant.

In the case of fast-food reuse, the burden of water consumption shifts from the manufacturing of paper to the water used during the cleaning process. Although paper production is highly water-intensive, with approximately 34,000 litres required per tonne[10], a significant portion of this water is returned to groundwater after use. Similarly, in the case of washing reusable packaging, the water used also has the potential to be recycled and returned to the system. Therefore the water *used* in the system is different from water *consumed* i.e. consumed water becomes a net loss from ground water.

As a result, determining the actual impacts of water use is not straightforward. Simply comparing water consumption (or use) across the entire lifecycle does not provide a sufficient environmental indicator and unless the two comparative systems are treated the same, the results could be unfairly influenced. It is not always clear in the underlying data whether this is the case. For example, whether water used in a wash plant is considered to be used or consumed.

The EPPA study utilises a basic water accounting method but acknowledges its limitations and the significant uncertainties associated with alternative methods. The McDonald's study, on the other hand, does not quantify water use but claims there will be added stress on water systems from washing. Without conducting fair and robust comparative assessments of water footprint, it is unwarranted to draw conclusive findings in this way.

In the context of reuse, the crucial aspect of water consumption to consider is not just the quantity of water itself, but also the fact that it needs to be heated. Therefore, accurate consumption figures are essential, as heating water constitutes a significant portion of the overall impact. The assumptions made in this regard play a crucial role in the analysis.

1.5 Asking the Right Questions

After considering the preceding discussion, several important questions arise when evaluating the credibility of a comparative study on reuse (applicable to all reuse, not just take-away). The table below presents an example assessment of the three studies discussed in this paper. It becomes evident that the EPPA study, despite undergoing peer review, is marred by a critical flaw: the creation of a baseline scenario that favours a particular outcome. By using the same underlying data, entirely opposite conclusions can be reached. Presenting the baseline case in lobbying or marketing literature without acknowledging the nuances discussed in the full report omits the uncertainty surrounding key assumptions, leading to misleading conclusions. On the other hand, the McDonald's study, while simpler and targeted at a non-technical audience, lacks significant important details necessary for scrutiny, thus lacking the credibility required for serious policy discussions. The Hitt et al. study addresses some of the transparency and objectivity issues observed in the other two studies, providing a more robust framework for constructive discussions.

In summary, the studies on this subject exhibit variations in quality and reliability. By equipping ourselves with important questions, we can better discern which studies deserve more attention in the policy domain.

Question	EPPA - Ramboll	McDonald's - Kearney	Hitt et al.
Is it produced as an industry lobbying piece?	Yes, by the EPPA who desire to continue selling single use paper items.	Yes, sponsored by McDonald's although this is not mentioned in the study itself.	No, and is not funded directly by industry.
Is it transparent in its assumptions?	A full LCA study with peer review, but with many key assumptions around behaviour given a confidential industry source.	Very few assumptions are presented. It is almost impossible to determine how the analysis was constructed. No peer review was undertaken.	All of the most important assumptions are provided, but the nature of a journal article means that not all data can be shown. However, the authors state it is available on request.
Does it vary the key assumptions?	Yes, provides some sensitivity analysis, but is very selective and the base case is presented as the clear conclusion.	No – it also assumes large and systemic improvements in recycling infrastructure, but no improvements on how reuse systems are designed and run.	Yes – all of the key parameters are varied and the break even points are determined.
Does it include specific and relevant trial data?	Supposedly, but this is kept confidential and unverified.	Unclear, but unlikely.	Limited
Are the results disaggregated by item	No – the study covers nine different container types but presents the results as one aggregated figure.	No – the study covers nine different container types but presents the results as one aggregated figure.	Yes, as the focus is on one single container type
Conclusion	Comprehensive study, but assumptions and scenarios are stacked in favour of single use. The conclusions therefore do not fully reflect the uncertainty, but are presented as fact, particularly in accompanying marketing literature.	A highly opaque study that cannot be fully critiqued due to the lack of clarity in critical areas. The conclusions and recommendations of the study also are not completely consistent with the presented analysis.	A useful addition that highlights some of the key parameters which are necessary to optimise for reuse to be beneficial. Presents the result in an objective manner and provides reasonable transparency given the limitations of the journal form.

References

[1] ISO 14044:2006
Environmental management — Life cycle assessment — Requirements and guidelines.
https://www.iso.org/standard/38498.html

[2] Ramboll for EPPA (2022), Comparative life cycle assessment (LCA) single-use and multiple-use tableware systems for take-away services in quick service restaurants. https://eppa-eu.org/wp-content/uploads/2023/05/news-40684-EPPA-ACV-emballages-vente-emporter.pdf

[3] Kearney for McDonald's (2023), No silver bullet: Why the right mix of solutions will achieve circularity in Europe's informal eating out (IEO) sector. https://nosilverbullet.eu/

[4] Hitt, C., Douglas, J., & Keoleian, G. A. (2023). Parametric life cycle assessment modeling of reusable and single-use restaurant food container systems. Resources Conservation and Recycling, 190, 106862. https://doi.org/10.1016/j.resconrec.2022.106862

[5] CEPI, KEY STATISTICS 2022, European pulp & paper industry
https://www.cepi.org/wp-content/uploads/2023/07/2022-Key-Statistics-FINAL.pdf

[6] Packaging Unwrapped Exploring The Environmental Impacts Of Global Material Flows Relating To The UK's Packaging Consumption
https://www.wwf.org.uk/sites/default/files/2021-12/UK_Global_Packaging_Materials_Footprint.pdf

[7] Duncan Brack (2019),Forests and Climate Change, Background study prepared for the fourteenth session of the United Nations Forum on Forests https://www.un.org/esa/forests/wp-content/uploads/2019/03/UNFF14-BkgdStudy-SDG13-March2019.pdf

[8] https://www.digitalwatermarks.eu/

[9] CEPI (2023), Design for Recyclability Guidelines 3rd Edition
https://thecpi.org.uk/library/PDF/Public/Publications/Guidance%20Documents/CPI_guidelines_2022-WEB.pdf

[10] Based on CEPI Key Statistics 2022 – 3,540 million m^3 water intake and 103 million tonnes of paper production.
https://www.cepi.org/wp-content/uploads/2023/07/2022-Key-Statistics-FINAL.pdf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