

Eradicating Plastic Pollution Globally by 2030

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Abstract

A world without plastic packaging waste by 2030 is achievable. But it will require significant change. It will require consumers to be connected to the packaging they use. It will require a marriage between economy, ecology, and society. And it will require a monetary, ecological (i.e., carbon credit), and social value to be assigned to packaging that is currently disposed of all too easily. And finally, it will require “Uberization of waste management.”

In this paper, a number of solutions and recommendations for creating a world without plastic packaging waste are presented – all are in harmony with the pace of change we are witnessing within the present age of the Fourth Industrial Revolution (4IR) aka Industry 4.0. The study explores how the plastics industry in general, and Food & Beverage (F&B) industry in particular can adopt the recommendations, thus transforming the industry, and crafting entirely new customer value propositions.

The findings from the yearlong qualitative study that commenced in 2018, in part were based on interviews of industry experts. They are condensed into nine strategic recommendations to help achieve the vision of a world free plastic pollution by 2030. The recommendations were chosen to be both achievable yet bold and strive to encourage all stakeholders to work collectively towards meeting the vision by 2030.

Keywords: digitalization; digital transformation; eradicating plastic pollution; green washing

Introduction

In the years leading to 2015, the world generated 6,300 million tonnes of plastic waste. At this rate, by 2050 roughly 12 billion tonnes of plastic waste will be in landfills or in the natural environment and the volume of plastic will outweigh all the fish in the ocean. Of this total, only nine percent was recycled, 12 percent incinerated, and 79 percent ended up in landfill or the natural environment (Geyer et al., 2017).

In January 2022, a new report by Environmental Investigation Agency (EIA) revised the year from 2050 to 2040 (EIA, 2022). The growth of emerging markets has quadrupled plastic consumption in the past 30 years, with plastic production and plastic waste generation doubling from 2000, reaching 460 and 353 million tonnes in 2019

respectively (OECD, Feb 2022). Plastics packaging constitutes 42% of this total waste, and of that portion Food & Beverage (F&B) packaging accounts for 55% (Mishra, 2018).

In 2019, the European Union (EU) launched a plastics strategy initiative (Europa.eu, 2019) that aims to fundamentally change the way plastic is used in Europe. The strategy was crafted to funnel approximately €350 million into research into modern methods of plastic production and collection. The initiative is to ensure that every piece of plastic packaging in Europe be either reusable or recyclable or compostable by 2030. A key driver of this initiative was China's ban on importing 45% of the world's plastics waste since 1992, which took effect in January 2018. (NPR, 2018).

Ellen MacArthur Foundation in collaboration with United Nation Environment Program (UNEP) has rallied together 1,000 signatories from businesses, governments, and other organizations behind a common vision where plastics never become waste. These signatories through the Global Commitment and Plastic Pact network account for more than 20% of the plastic packaging market. They have set an ambitious target to help achieve the vision by 2025 (Global Commitment, 2021).

In March 2022, 175 nations agreed to develop an internationally legally binding agreement by 2024, to end plastic pollution (UNEP, March 2022).

These initiatives have galvanized stakeholders from industry, government, NGOs and the public to act. Whilst there has been considerable goodwill and no shortage of discussion, plastic waste continues to leak in the environment. To date, there still seems no effective and workable solution on sight that can tackle the enormous volume of plastic waste and eradicate plastic pollution globally.

About this study

In 2018, at INSEAD we embarked on a research study to explore what does a world without plastic packaging waste mean to stakeholders, and how that vision could be realized. The research attempted to paint such a picture from the perspective of consumers, retailers and industry partners, with a wide range of stakeholders interviewed including plastic producers, NGOs, brand owners, researchers and policy makers. The research consisted of three main stages.

In the first stage, eleven senior executive stakeholders from various organizations were interviewed to help us understand what they mean by a world without plastic packaging waste. The team then developed a framework for the vision to highlight key findings, challenges, and opportunities for change that built on each interviewee's focus, experience, and expertise.

In the second stage, twenty-five additional senior executive stakeholders from a variety of relevant fields, including public policy, sustainability, technology, academia,

and industry were interviewed. They provided input on how the desired outcome of a zero-waste vision by 2030 could be tangibly achieved and what concrete steps the industry needs to embrace in order to achieve it. These were further discussed with a group of more than thirty hands-on technical experts who worked within the F&B industry. Their views, concerns and suggestions helped refine those steps, leading to development of the recommendations and map the way forward.

In stage three, the findings from stages 1 and 2 were then blended with secondary research to outline the changes needed and identify areas for investment to help the F&B industry achieve the goal of zero packaging waste by 2030.

The Research Methodology

In Stage 1, interviewees were asked to imagine a blank canvas, paintbrushes, and different colors to paint a vision of a world without plastic packaging waste by 2030. In long-format interviews, lasting 45-60 minute, they articulated their desired future, highlighting issues, problems, challenges and barriers along the way. The data collected was analyzed following the principles and practice of thematic analysis of interview data (McCracken 1988; Gillham 2000) and integrated into Vision 2030.

Stage 2 interviews had two objectives. First, to get a reading from the both executives and technical experts to put in perspective, refine, and/or alter the vision and the strategic recommendations. Second, to develop pathways to achieve these by 2030. Interviewees were invited to expand on the problems, challenges and barriers, as well as explore ideas and potential solutions.

In Stage 3, the findings were then presented to 30 senior industry executives and technical experts from various fields at a roundtable discussion. They were asked to form discussion groups, develop an action and the way forward for each strategic recommendation.

Key findings

The negative externalities of plastic waste (and single-use packaging in particular) include environmental pollution, depletion of natural resources, health and safety issues, economic loss and an increase in carbon footprint. Just as the challenges are very diverse, so too are the potential solutions, ranging from new plastic materials that are edible, compostable and degradable, to new mechanical and chemical recycling technologies powered by digital technologies, and reusable and refillable containers embedded with RFID chips.

Systematic research and analysis of published data and the interviews conducted for this study revealed three dimensions of the waste challenge that make it difficult to tackle: (i) the magnitude and volume of plastic waste, (ii) the fragmented nature of

applying scalable solutions to meet the sheer volume of waste, and (iii) the current industry and consumer norms viewing plastic packaging as waste.

Dimension 1: Magnitude

The sheer size and magnitude of the problem given in the introduction calls for solutions that can be scaled rapidly, adopted economically, and implemented effectively. However, no company can solve the problem on its own, nor can there be any viable solutions without the active participation of a broad cross-section of society.

Dimension 2: A Siloed & Fragmented Ecosystem

Producers, retailers, research institutions, NGOs, and waste management entities invest a great deal of funding in Research and Innovation (R&I) to tackle plastic waste (Iema.net, 2018), although this investment pales in comparison to spending on plastic manufacturing (Taylor, 2017). What's more, interview analysis revealed that there is insufficient interaction or collaboration between key stakeholders in the plastics value chain, resulting in fragmented and duplicated effort that often failed to address the systemic challenges faced by the industry. As the innovation charity NESTA reminds us, true systemic change can only occur when stakeholders work together towards a common purpose (NESTA, 2013).

Dimension 3: No-value Waste

Consumers and industry players view single-use plastics, which were initially promoted as efficient and convenient, as a waste product with no inherent value, whether in financial, psychological or social terms.

However, the interviews suggest the need to challenge this assumption and therefore offer the prospect of altering existing design and business models to build value for single-use plastic packaging and especially F&B packaging waste after-use.

The Nine Strategic Recommendations

Nine strategic recommendations emerged from the two rounds of interviews as well as the roundtable discussion with stakeholders in London in November 2018. They reflect the means for the F&B industry to translate the vision into practice.

The interviewees urged that these recommendations need to be tackled collectively by the industry. As such, it was vital that the recommendations be viewed in unison. Beyond addressing the "no plastic packaging waste" vision, the recommendations also speak to how the F&B industry has to embrace disruptive and digital technologies such as blockchain, AI, and IoT, taking center stage in the 4IR to transform how packaging is thought of as well as managed.

1. *Championing The Change*

Just as change projects within organizations benefit from having a champion who can provide support, help to overcome hurdles and drive through change, so too do large, systemic problems like this. Indeed, change of this nature, and of this level of difficulty, requires a committed, courageous, and bold champion(s).

The champion(s) need to be an active member of the change initiative at all stages (Thompson et al., 2006). They play a crucial role in establishing the vision for change, facilitating the change, and supporting stakeholders in integrating the change (Jisc, 2014). Whilst it's common to believe these champions need to be the biggest members of the industry, this need not be the case (Warrick and Mueller, n.d.). Whomever steps forward to take on this role however, they will be fundamental to the success of this vision (Porter Lynch, 2019).

The value in doing so is evident. China's government has made the sharing economy a national priority so that it has thrived like nowhere else in the world, and by 2016, was reported to represent \$500bn in transactions (Larmer, 2017). According to Jeremy Rifkin, writing in the *Economist*, "It is the first new economic system to enter the world stage since capitalism and socialism in the 19th century." Key to the sharing economy is the real-time information (data) in our pockets powered by software platforms - the glue that connects the sharing economy. The potential champion has the opportunity to do just that: *connect packaging to consumers*.

2. *Making Systemic Changes*

Wharton Business School's Russell Ackoff famously described the nature of systemic change as a "focus on the interactions of the parts rather than their behavior taken separately," (Emery and Ackoff, n.d.).

This marks a shift from more traditional forms of change that look to tackle individual parts of a system, usually in isolation from all that surrounds them. Systemic change doesn't wish away the interdependencies between those parts of the system but instead tackles them head on.

Given this complexity, it is perhaps no surprise that successful change is rare. Systemic change can indeed be challenging for executives honed on traditional theories of organizational change (that themselves have failure rates of approximately 70%), and it can be tempting to fall back on the familiar.

Nonetheless, the interviewees remarked that traditional theories of change will not be sufficient to solve a challenge as complex and wide reaching as removing plastic waste from the F&B industry (New Philanthropy Capital, 2015). Such theories are insufficient because the industry as a whole, is not at the center of this picture, but are instead merely

actors within it; the cause and effect equations that underpin how waste is managed are anything but linear and straightforward; the plans that arise at the outset of this initiative will almost certainly change upon “first contact with the enemy” (Moltke, 1996). Thus, adaptability is more important than rigid strategies; and the change required will revolve around people and relationships rather than rigid inputs and outputs.

Indeed, Fritjof Capra, physicist, systems theorist and ecologist, argues that true and lasting change can only occur when the four dimensions of life are tackled in unison (Capra and Luisi, 2016) and forge a network of inseparable relationships:

- biological impact (e.g., health and safety issues associated with plastic packaging),
- cognitive impact (e.g., reasons for one-time use-and-dispose habits),
- social impact (e.g., littering of the living environment),
- ecological impact (e.g., impact of waste on natural resources and the animal kingdom).

By taking all of these four dimensions into account, the F&B industry not only has a better chance of achieving enduring change, but also has a number of ways to assess and analyze the *ecological*, *social*, *economic*, and *political* implications of the integrated, sustainable ecosystem discussed in the strategic recommendation: Create Open Innovation & Entrepreneurial Ecosystem.

3. Collaborating With Key Stakeholders

Almost every interviewee emphasized the importance of collaboration in delivering the vision. At the same time, the interviews revealed that collaboration is often hampered by politics, competition, self-promotion, shortage of trust, and marketing, resulting in a collaboration limited to paper rather than practice (Nidumolou et al., 2014).

The success of collaborations will depend largely on how effective industry leaders, as champions of change, are in removing the barriers to collaboration, for example by creating transparency and, more crucially, trust and converging interests. Interviews revealed that a common purpose already largely exists among the stakeholder community, and the challenge now is to encourage and support that community in working together towards a common goal.

4. Unifying & Sharing Diagnostics

Back in 2011 the White House launched the Materials Genome Initiative to support the development of advanced materials. The project attempted to provide a common way of measuring and understanding the materials we use today so that materials-based innovation can thrive.

For packaging innovation to occur in the kind of packaging used in the F&B industry, it is vital that a similar level of consistency is applied when discussing the materials used in that packaging. Achieving consistency requires forging a new multidisciplinary governing body, comprising key actors from various industries as well as NGOs, public, and private entities.

These should come not just from the plastic packaging or F&B industry or sustainability domain, but from technology, finance, the arts, and the sciences, with the likes of the Linux Foundation, set up to standardize Linux, support its growth, and promote its commercial adoption, a good role model.

One of the top priorities for the new governing body should be to come up with a standard for single use plastic for example, beverage packaging that can be adopted globally. This standard, through a material passport, should include the plastic bottle, the cap, the label, the shrink wrap, and reflect best practices - for an example of selection, categorization, and classification for sustainable metrics in the soft drinks industry, see (Demartini et al., 2018).

The potential of such standardization is highlighted by a recent MIT based project that used AI and was able to propose new materials having been trained on large quantities of data (Kim et al., 2017). Such projects can only work if there is a shared understanding of what packaging actually is.

5. Optimizing Sorting & Collection

One of the key areas for innovation is the need for more effective collection and sorting of plastic packaging waste. Achieving a truly circular economy requires that 100% of plastic packaging is collected, with none of it leaking back into the environment. This will require not only an adaptation of processes, such as the sorting, separating and disposing of various types of plastic packaging waste at source, but also the cooperation on all levels, including government, industry, retail, and end consumer.

Incentives-based systems

Traditional means of collecting plastic packaging, including DRS, while necessary, has already proved not to be sufficient to achieve 100% collection. For example, whilst deposit return schemes for single-use beverage packaging have been one of the most successful collection routes, they achieve at most 95% collection in some countries (Albrecht et al., 2011).

However recent plans by the UK Government to implement a deposit return scheme originally received only a lukewarm reception from the UK retail industry, which expressed concern about a potential implementation cost of over £1bn in England alone (Monaghan, 2018).

Therefore, many of those interviewed as part of the research indicated that whilst welcomed, deposit return schemes for beverage packaging may not be the ultimate solution to the challenge of plastic waste. Not only do such schemes just target beverage packaging, they provide no guarantee that collected waste is in fact recycled. They can also encourage responsibility to be passed to others in the value chain rather than encouraging collective action responsibility.

Improving existing collections systems

In many markets, the wide variety of collection schemes adopted across municipalities are fragmented, resulting in confusion of citizens, and impeding effective collection (Law, 2017). There is even a wide variability of collection and pre-sorting rules within organizations themselves, local authorities, collection companies, and regions.

Collection should not be taken to mean that it is the end of the road for packaging waste. On the contrary - it is an intermediate stage in the transformation of the packaging that occurs in the after-use process for reusing, recycling, or repurposing. Packaging waste is also a social problem, and it requires social as well as digital technologies to solve it. That said, 100% collection of plastic packaging waste is the first imperative step to *close the leakage tap of packaging after use in the environment*.

Optimum after-use sorting and collection schemes are not in widespread use at the time of writing this paper, however it is nonetheless likely that digital technologies will have the potential to underpin just that. "The Internet of Things (IoT) will have a great impact on the economy by transforming many enterprises into digital businesses and facilitating new business models, improving efficiency and increasing employee and customer engagement." Mark Hung, Gartner Research (Gartner, 2017).

Many types of smart bins embedded with IoT chips have emerged in the recent past and many more are emerging. Some are designed to compact waste, others to read the packaging barcode for sorting. They communicate status to an online application, a desktop or handheld, offering intelligent remote monitoring solutions for collection of waste and recycling. For example, Smart Bin, claims on its website that their system can "optimize logistic resources while reducing collection and delivery costs by up to 50%." (www.smartbin.com). Smart bins have the potential to change how consumers treat and dispose waste, resulting in change of consumer behavior as time goes by (Accenture, 2019).

Digital tracking of waste

The future of packaging is fast moving towards smart/intelligent packaging, using digital technologies. For example, in November 2018, Stora Enso introduced a paper-based RFID (Radio Frequency Identification) tag technology called ECO, produced on fully

recyclable 100% fiber-based paper label. They will be used for automatically tracking and tracing the packaged products along the supply chain as well as authenticating the packaging after use of the product (www.storaenso.com, 2018).

The biggest barrier to digital tracking technology is creating a universal system that can be easily accessed by everyone in real-time across the entire industry. Accessibility can be as simple as providing the type of the packaging, for example a PET bottle, or a broad spectrum of end-to-end services, e.g., material composition of the packaging, potential to take payment or verify payment information, suitable recycling methods, connecting the packaging to the consumer, geo-positioning so drones can collect from remote areas, best repurposing applications recycling, and so on.

Digital solutions need to be coupled with incentives, awareness marketing and education programs to help nudge citizens towards the right kind of behaviors, as well as instituting rigorous policies in order to optimize sorting and collection. A feasible disruptive, adaptive, and global solution - as a digital / entrepreneurial startup idea using QR code / IoT chip and blockchain technology - is discussed in (Peshkam, 2019).

6. Transforming Consumer Behavior

Consumer behavior was identified by participants as one of the biggest barriers when striving to achieve a world without plastic packaging waste, even in the presence of an effectively functioning recycling infrastructure. Building on cross-cultural differences in sorting/collecting waste and transforming habits will be paramount to achieving zero-waste vision by 2030.

The key to transforming consumer behavior is transforming the consumer mindset, and the last few years have seen approaches such as behavioral economics married with technology-driven gamification to drive tangible behavior change in a wide range of domains, not least in areas such as recycling and energy conservation (Peshkam & Dubois, 2020).

For instance, waste startup Recyclebank has shown what can be achieved with their social and gamified approach. They fitted recycling bins with RFID chips to weigh the amount of recyclable waste users generated each week. This was then converted into points that could be converted into rewards from retailers.

These points, which are analogous to frequent flyer points from an airline or loyalty points from a grocery store, proved effective at changing user behavior, with one community in Bridgeport, Connecticut citing a 67% increase in recycling rates over a two-year period after adopting the Recyclebank awards scheme.

In consumer markets, implementing new consumption or business practices (e.g., collecting or recycling bottles) requires convincing consumers to change behavior. There are three main pitfalls when it comes to new product or policy adoptions:

1. *The understanding gap*: people do not understand the value proposition associated with the new policy because its benefits are not clearly perceived or communicated.
2. *The attitudinal gap*: people understand the policy's value proposition, but attitudes towards the change are not positive, so they are unlikely to change.
3. *The behavioral gap*: because customers are being asked to do "too much" (Dubois and Haumont, 2018)

The first two typically stem from a failure to effectively communicate the value created by a new policy. The third involves changing current habits on an everyday basis (the frequency and depth of change).

To effectively change consumer behavior, players in the F&B industry need to leverage "reward toolboxes" that nudge consumers in the desired direction, e.g., greater collection (Thaler and Sunstein, 2009). These rewards could utilize the following:

- *Positive and negative reinforcements* (e.g., points added or subtracted). In practice, joint rewards (rather than only using either type) tend to be the most effective.
- *Financial and non-financial benefits*. Each type of financial benefit yields different types of behaviors: most monetary rewards increase compliance, while social badges are most effective at producing creative behavior (Mehta and Dahl, 2017).
- *A mixture of visible and invisible nudges*. Social norms motivate environmentally-friendly behaviors (Mehta and Dahl, 2017). For instance, emoticons inserted directly into consumers energy bills have been shown to reduce energy usage (Goldstein et al., 2008). What's more, consumers innate competitiveness can be harnessed by allowing people to see how they compare with others in their community (Ordabayeva and Chandon, 2011).

7. Driving Entrepreneurial Opportunities

Sun Microsystems' co-founder Bill Joy famously said that "no matter who you are, most of the smartest people work for someone else," and what became known as Joy's Law has come to typify the appeal of open innovation. It's a truism that underpins recent research showing that most big companies today interact with startups and academics in some way, shape or form (The European Academic Network For Open Innovation, 2015).

In 2017, the Kauffman Foundation in the US launched the Moonshot program to deploy \$1 trillion dollars in new businesses over the next ten years. The program was

based on the realization that the foundation needs to contribute to a new economic model, one that infuses entrepreneurship into the economy (Kauffman, 2017).

Today, the biggest barrier to entrepreneurial start-ups in this domain is the near-zero value of packaging waste. The economics simply do not make sense, and unless the F&B industry is prepared to make systemic changes, we think it will be hard pressed to make progress on this strategic recommendation.

Systemic changes on this front need to happen on three fronts a) create startup investment fund(s), b) create value for waste, and c) forge partnership with key players in the entrepreneurial world such as accelerators, incubators, NGOs, and government authorities supporting startup businesses.

In a year in which the Royal Statistical Society selected “90.5%” – the percentage of plastic that has never been recycled - as its statistic of the year (Royal Statistical Society, 2018), it was estimated that the value of that waste was over US\$7 trillion (Fast Company, 2019). In other words, it’s enough to buy *“Apple, Amazon, Google, Microsoft, Walmart, Exxon, GM, AT&T, Facebook, Bank of America, Visa, Intel, Home Depot, HSBC, Boeing, Citigroup, Anheuser-Busch, all the NFL teams, all the MLB teams and all the Premier League Football teams.”*

The F&B industry should take a leadership role in creating a startup investment fund for eco-innovation and eco-entrepreneurship, working closely with multinational development banks, international organizations investing in Research & Innovation (R&I) and the environment, and other private venture capital as well as angel investors.

Creating value for after-use packaging waste, in particular for plastics, would require the industry to either change the material specifications of plastic packaging, making them far more valuable than they currently are, or come up with an entirely new idea, borrowing from the deposit-return scheme model (Peshkam and Dubois, 2019).

8. Developing a Digital Network

Digital technologies powered by AI and blockchain can serve as the brain of the system to achieve the vision. Smart technologies will allow data to be gathered from bottles at all stages of their journey, and when connected to the consumer will unlock a market that will apportion appropriate value to the packaging itself.

This “material passport” could create a wealth of data without which the vision of a 100% circular “world without plastic packaging waste” may be improbable. With a network containing vast quantities of data, AI will play a key role in making fast and efficient decisions based upon that data, whilst blockchain will help to ensure the data is reliable, transparent and portable.

Blockchain enables every piece of data to only have one owner. The technology has two advantages. Firstly, once an individual becomes the registered owner of a piece of data, it cannot be duplicated by anyone. Secondly, the owner of the data, and the owner alone, can transfer ownership to anyone else - without an intermediary or a third-party interjecting. In a market where value is determined by the data within it, this kind of functionality will be key. Blockchain can enable greater transparency in tracing packaging within and outside the company.

For producers, this technology can reliably track resources, whilst for consumers and collaborators, novel credit systems can provide monetary, ecological, and social incentives to encourage sustainable behavior. It can also encourage and facilitate collaboration with stakeholders who are willing to share data openly, prototype and test business models for resource efficiency, accurately track reuse, recycling, design, feedstock flows, and much more.

AI can then sit on top of this data, learning from the patterns that exist within the data and making smart predictions. Indeed, University of Toronto researchers argue that more efficient predictions will be the main benefit delivered by AI in the short to medium term (Agrawal, et al., n.d.).

The combined power of AI and blockchain technologies can enable the creation of an “innovation space” where the actors in sustainability and the circular economy invent new products and services, tilting the playing field in favor of long-term, sustainable, smart, green growth.

To fulfill the promise of such a powerful digital network involves disruption across the entire F&B industry, business model, and in-house technologies. All three are inextricably linked and present major barriers - albeit surmountable. Incumbents should include each area as part of a holistic, enterprise-wide digital transformation, embracing the systemic change discussed earlier with a collaborative, open mindset.

9. Creating Open Innovation & Entrepreneurial Ecosystem

Having emerged in the 1960s, the principle of open innovation – that people outside the company have the expertise to make positive contributions – is increasingly embraced by leading brands such as P&G, PepsiCo, Lego and Unilever. For instance, P&G started producing more than 35% of its new products with elements from outside the company, up from about 15% in 2000 through its Connect + Develop open innovation platform, increasing its R&D productivity by nearly 60% (Huston & Sakkab, 2006).

To date, most open innovation approaches have either consisted of (1) interactions with other institutions, via approaches such as licensing, proof-of-concepts and innovation challenges or (2) interaction with citizens, which has involved activities

such as crowdsourcing, crowdfunding and citizen science. For instance, nearly 100 innovation ecosystems have emerged around the world, with cities scrambling to replicate the magic observed in Silicon Valley (Startup Genome, 2018).

However, despite US\$2.3 trillion invested in the global startup economy between 2015 and 2017, many of these ecosystems still fall short of what is needed to deliver the change required to tackle plastic waste, with challenges in scaling up solutions and integrating them with industrial stakeholders (e.g., Kolympiris and Klein, 2017). More generally, many open innovation approaches fail because they focus on partnerships with other institutions or intensified interactions with consumers, but not both.

Realizing the zero-waste vision requires F&B industry to embrace an open innovation ecosystem that encompasses both partnerships among competitors and industry players (B2B) and small, more agile startups and citizen initiatives (Williamson & De Meyer 2012). This approach echoes the European Union's Open Innovation 2.0 (or OI2) initiative that calls for new ways to innovate to improve quality of life and sustainability with the formation of coalition, collaboration and co-creation across the industry (Peshkam 2014) inclusive of businesses, universities, government and citizens (European Commission Open Innovation 2.0, Yearbook from 2013 to 2018).

The way forward

This study highlights that change is overwhelmingly needed in order to prevent plastic waste from destroying our environment, but that enacting such a change is also incredibly hard. This can form a kind of paralysis of action, where even the best will in the world will produce more talk than activity, and as a result, very little happens - a situation memorably referred to as the "knowing-doing gap" (Pfeffer and Sutton, 1999).

The study urges the F&B industry to take a higher risk approach than it might ordinarily make in developing workable solutions suitable for the digital economy. The solutions must be innovative, digital, sustainable, and scalable. One solution that was considered "*very feasible*" by the interviewees is "connecting packaging to consumers" using blockchain. This simple yet powerful idea was thought by the interviewees to be disruptive, which can readily be adopted across the industry globally.

The key to this idea is to connect the packaging to the consumer (for example via a QR code printed on a label) either via manually scanning the QR code with a smartphone using a specific app, or the app automatically credits the consumer, which provides "crypto-credit" to the consumer. The credit can be monetary, eco, and social forms.

The social credit can be similar to financial credit for which individuals are responsible for. Maybe the time is right to create a suitable social credit in the form of ecological credit. With the right incentives and value attached, it could be a viable way to

marry economy with ecology and society: c-credit (e.g., carbon-credit). Imagine a world where c-credit is used by individuals to measure their own positive/negative contribution – of their household and the neighbors on the block - to climate change and compare themselves with their peers and fellow professionals. This could become another way of “keeping up with the Joneses”.

Combining social and monetary credit provides the means to the consumers and the citizens alike to actively engage and participate in creating a world without plastic packaging waste.

This simple yet powerful idea, similar to the microcredit concept, can potentially open the floodgates to a massive entrepreneurial drive around the world focused on collecting, sorting, recycling, repurposing, innovating new materials and processes and much more. “There are roughly 160 million people all over the world in microcredit, mostly women. And they have proven one very important thing: that ‘we are all entrepreneurs’” said the Noble peace prize laureate Muhammad Yunus (*The Guardian*, 2017).

This is just an example of how change might begin to emerge. This study is not intended to be prescriptive, but rather to shift the conversation from knowing things need to change, to driving action to make the world better.

As David Attenborough poignantly says, “many individuals are doing what they can, but real success can only come if there is a change in our societies and in our economics and in our politics.”

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