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Mapping unchartered waters: Towards a Design methodology for researching the feasibility of circular economy practice adoption in the Ready-To-Cook fish product value chain.

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Abstract:
For stakeholders across the Ready-to-cook fish product value chain to adopt novel circular economy methods, new shared knowledge infrastructures must support changes in practices. Existing literature indicates that these cannot be imposed in a generalised manner. As an alternative, we propose that Participatory Design-informed infrastructuring could provide a means of developing them with stakeholders through exploring existing practices and feasibility for adopting prototypical methods, practices and products. Using the Seafood AGE consortia as a case study, we have developed two facilitative methods using accessible digital platforms in a remote and distributed manner, for collaborating with stakeholders to map and analyse practices and responses to speculative products. This paper reports on method development. It has implications for design research academics interfacing across industries to support transition to circular economies.

Keywords: Seafood; Circular Economy; Infrastructuring; Research Methods

1. Introduction

This paper reports on the development of design methods to research feasibility for adoption of novel circular economy methods within the Ready to Cook (RtC) fish product value chain. It describes the social and environmental challenges in the European fish and seafood industry, and the call to bring about resilience through new knowledge infrastructures shared between stakeholders along value chains. However, literature reveals a considerable gap on how to transition from circular economy concepts to practical adoption in industry. We believe Design could play a vital role in bridging this gap which we are looking to achieve through the methods we are developing within this case study.

The case study is derived from Seafood AGE, a transnational and transdisciplinary consortium tackling a common social and economic challenge in the European Atlantic Area (EAA): an ageing population at risk from illbeing through increasing food-insecurity. In response, the consortium is developing a prototypical RtC product that exploits the maritime dimension of the EAA regions to adopt circular economy concepts including novel eco-packaging, smart labelling, as a means of providing accessible nutrients.

The concept of infrastructuring in this paper is taken from Participatory Design. Through infrastructuring we can design prototypical means of understanding, communicating and reconfiguring practices within the context of organisations and wider influences including sector, policy, environment and so on (Ehn 2008). In this paper we report on steps we have taken towards a methodology for infrastructruring using digital, remote workshop-based means to generate and share data in a way that aims to be easy to grow, translate across different regions, access, and use for all stakeholders. These prototypical design methods remain in development and here we discuss our findings in relation to progress. By sharing our progress at the EAD conference, we are looking to gain vital, critical feedback on our approach from our peers working at intersections of design, food, industry and novel circular economy method adoption.

2. Storms at sea: Four key challenges to the European seafood industry

As human populations grow, fish and seafood are seen increasingly as a vital source of protein (McCarthy et al, 2019; Fletcher et al, 2021). European seafood industry actors must find ways to balance production needs with the need to sustain and even regenerate the health of ocean ecosystems (Laso et al, 2019). Existing industry configurations based on linear, Capitalist growth models fail to deliver nutritional security and contribute to environmental degradations that destabilise the sector in turn (FAO, 2009). Based on these circumstances, academics describe four, key, interconnecting challenges that the sector must address: 1. Reliance on fish and seafood outweighs production, 2. Existing growth models cause overfishing and other supply problems, 3. Linear interventions based on growth do not deliver sustainability, 4. The sector must develop resilience in the face of volatility. Each is outlined below.

2.1 CHALLENGE 1: Reliance on fish and seafood as a source of protein

outweighs production

Seafood currently accounts for approximately 17% of the world's animal-derived protein intake (Laso et al, 2018). As population increases and ages in Europe, seafood is seen increasingly as key to healthy and nutritionally secure diets. (Fletcher, St Claire and Sharmina, 2021). Fish and shellfish proteins have long been understood to have healthful properties compared to other animal protein sources (Thurstan and Roberts, 2014). They are lower in saturated fats than red meat, and oily fish is an excellent source of essential fatty acids (Calder, 2004; Thurstan and Roberts, 2014). Fish also provides a good source of micronutrients including calcium, selenium and zinc (Sheeshka and Murkin, 2002; Beveridge et al, 2013; Thurstan and Roberts, 2014). Together, these properties are thought to lower the risk of cardiovascular disease and support brain development and cognition (Thurstan and Roberts, 2014). As a result, recommendations for fish and seafood intake around the world ranges from 97g to 550g per week. However, richer nations currently aspire to consume more than they produce (ibid.). For example, UK government body, the Foods Standards Agency, recommends we eat 280g per week (Food Standards Agency, 2010; Thurstan and Roberts, 2014) but total supplies of fish from domestic UK landings and aquaculture only meet 64% of the recommended intake. This rises to 77% when UK landings abroad are included but drops to just 19% if imports and aquaculture are not included (Thurstan and Roberts, 2014). The next challenges describe how this came to be.

2.2 CHALLENGE 2: Capitalist growth models problematise supply and cause overfishing—the UK example

In 1976, beleaguered British fleets lost access to Icelandic waters after losing the final of three confrontations with Iceland over fishing rights in the Northern Atlantic, known as the Cod Wars (1958-1976) (Cabinet Papers; Kaiser, 2016). Until then, the UK fishing industry relied heavily on the lucrative catch they made in the Northern Atlantic. Once they lost access, British fleets, ports, and surrounding industries dependent on cod went into steep decline for several decades (Kaiser, 2016). To make up the shortfall, between 1970 and 2012, imports rose by 305% (Thurstan and Roberts, 2014), much of which was either cod and haddock from Northern Europe or shrimp and prawns from Thailand and the surrounding region (Marine Management Organisation, 2013; Thurstan and Roberts, 2014). This decline in landings by UK capture fisheries domestically and abroad comes down in part to other countries extending their national waters (Kerby et al., 2012; Thurstan and Roberts, 2014), and in part to the fact that 73% of UK landings made abroad are exported and not made available to UK consumers (Thurstan and Roberts, 2014). The UK is not alone. Collectively, the European Union now imports 60% of the fish it consumes for the same reasons (ibid.). US and Russian imports are higher still (ibid.). The other significant cause is falling or migrating fish stocks. For example, by 2013, UK landings had fallen 51% below their peak recorded 100 years earlier (ibid.). Global wild fish catches are at or close to the limits of what aquatic ecosystems can provide (FAO, 2012a; UNHRC, 2012; Beveridge et al, 2013).

Overfishing brought about by global Capitalist growth and competition in the kind of complex import and export market arrangements described here, and the marine debris they cause, are all contributing factors in fish stock depletion as well as growing environmental and subsequent political volatility (Jones and Comfort, 2018; Ruiz-Salmón et al, 2020). In the meantime, changes in water temperature brought about by climate change are thought to cause some fish to migrate to waters outside the regions in which countries can legally catch them (Kaiser, 2016).

2.3 CHALLENGE 3: Aquaculture might stem plummeting fish stocks but it does not deliver sustainability

Globally, aquaculture (farmed fish) has grown rapidly to stem the shortfall since the 1950s to the point that it has increased overall international fish stocks by 10% (Beveridge et al, 2013; Thurstan and Roberts, 2014). Subsequently, in recent times farmed fish have been marketed to consumers as 'sustainable'. However, several important environmental and social factors greatly undermine sustainability claims. For example, the feed used in farmed fish increases water temperature and acidity which harms local marine and freshwater ecologies (ibid.). The lipids farmed fish produce are significantly reduced because of intensive farming, meaning that they only produce a fraction of the nutrition wild fish provide. This makes farmed fish numerous but insufficient contributors to food security (Beveridge et al, 2013). Unethical working practices such as child labour and absence of workers' rights noted both legitimately and unfairly in large, opaque global supply chains likewise compromise claims to social sustainability such as Fairtrade certification (Bush and Duijf, 2011; Ruiz-Salmón et al, 2020). It is noted that for as long as these practices are labelled 'sustainable', publics who increasingly value social and environmental sustainability in the fish and shellfish they consume[1] are misinformed, and true sustainable development is inhibited (FAO, 2016; Tlusty and Thorsen 2017; Ruiz-Salmón et al, 2020).

2.4 CHALLENGE 4: The call to develop resilience in the seafood industry

Together, these challenges demand that businesses in the seafood industry become more resilient to withstand sudden change and upheavals brought about by overfishing and plummeting fish stocks while also meeting social and environmental, dematerialisation and waste reduction goals (FAO, 2009; FAO, 2016; Ruiz-Salmón et al, 2020; Fletcher, St Claire and Sharmina, 2021). To foster resilience, frequently the seafood industry is called on to bring together all stakeholders in and around the sector including businesses, policy makers and citizens to work together to generate sustainable policies and practices through transition to a circular economy (Ruiz-Salmón et al, 2020).

3. Creating resilience in the seafood sector: infrastructuring for transition to a circular economy

3.1 The gap between ideological discourse and practical application inthe seafood industry

Actors in and around the seafood industry recognise and acknowledge the need to transition to a circular economy (Jones and Comfort, 2018). However, there is currently a chasm between academic debate and application of ideas to practices throughout the value chain (Kirchherr et al, 2018). Known factors believed to influence this gap include disagreement over circular economy definitions (McCarthy et al, 2019), general absence of circular economy literature specifically related to the seafood industry (Schöggl et al, 2020), lack of clarity over how to apply generalised models and guidelines, and absence of incentive to shift away from dominant profit-making models (Jones et al. 2011; Jones and Comfort, 2018). Therefore, understandings and applications of the circular economy remain vague, aspirational, niche and locked into fringe policies like corporate social responsibility

[1] Between 2010 and 2019 in Europe and North America, food and drink products claiming sustainability credentials like organic or fair-trade practices, local sourcing and short ingredients lists grew from 9% to 17% of the total purchased. In addition, 30% of adults surveyed in the UK in 2019 reported that they considered sustainability claims when purchasing fish and shellfish products (Ruiz-Salmòn et al, 2020)

rather than central defining business activity (Fletcher, St Claire and Sharmina, 2021). Subsequently, consumer interest and awareness remain low (Kirchherr et al, 2018). This is particularly important for retailers who are seen as key influencers of consumer behaviour (Jones and Comfort, 2018). That said, new, progressive policy, such as the 2021 single-use plastics ban in the EU and policy to return discards to the sea are slowly taking effect (Harte et al, 2019; Ruiz-Salmòn et al, 2020). Technical solutions are also transforming practices in the seafood industry including life cycle assessments (Guillard et al, 2018; de la Caba et al, 2019), value-adding (Haldén et al, 2019; McCarthy et al, 2019), and creating novel food packing from sea-by products (Guillard et al, 2018; Ruiz-Salmòn et al, 2020). Therefore, overarching knowledge infrastructures need to be created that enable seafood industry actors to view their own practices and how they effect and are affected within the nexus of overlapping and changing practices, inclusive of those people buying and eating the food (ibid.). Across disciplines, the call for knowledge sharing and a trans-disciplinary approach between actors in and around the sector, in infrastructring activity has long since been called on as key to transformation and building resilience (Patterson and Glavovic, 2013; Thurstan et al, 2014; Fraser et al, 2016; Irani and Sharif, 2018; de la Caba et al, 2019; Ruiz-Salmón et al, 2020 et al).

3.3 What could it mean for seafood industry actors to participate in knowledge infrastructuring activity?

Rather than stymying the seafood industry with the realities of adopting generalised, conceptual models for circular economy transition, infrastructuring enables industry actors to iterate towards systemic change through adoption of smaller scale artefacts, products or opportunities (Herrero et al, 2020). Sharing knowledge is believed to support stakeholders to build trust through transparent knowledge sharing infrastructures to change mindsets and generate capacity and feasibility for change (Watson and Meah, 2012; Herrero et al, 2020). As a pro-social approach, it is vital that publics buying and eating fish are integrated into a knowledge sharing infrastructure to: shape the design of new products, address anxieties around preparing and eating fish and seafood, and generate public investment in novel practices (Watson and Meah, 2012; Lusk et al, 2014; Camacho-Otero et al, 2018; Chamberlin and Boks, 2018; Herrero et al, 2020). Informed by Elizabeth's Shove's thesis on social practices, what we eat, when we eat, how we eat, how we prepare food are as Shove et al say 'partly constituted by, and away embedded in material arrangements' (2015). By investigating them, we have a way of seeing, analysing and reconfiguring the infrastructures intersecting and shaping those practices, often many at a time, making such an approach especially pertinent in the realm of sustainability (Skene, 2021).

4. Progress on infrastructuring method development

4.1 Our approach

Our approach is rooted in overlapping Co-Design and Participatory Design (PD) practices. This approach enables us to explore knowledge infrastructuring as it is broadly understood in the field of PD through workshop style interactions designed to use different mediums to share, generate and exchange information (Bennett, 2020). It offers participating individuals the space to reflect on their practices in relation to fish and seafood production and consumption through the different kinds of knowledge generated and presented within the workshop 'crucible' (Heron and Reason, 2008). This is intended to support and prompt participants (members of the public of varying ages), stakeholders such as fish product manufacturers, retailers, policy makers, nutritionists, etc., to document the broadest possible diversity of ideas, perspectives and other contributions in 'their own voices'. In other words, contributions are unfiltered and unaggregated by the facilitators alone, and unimpeded by barriers as far as possible. As Cruickshank, Perez and Galabo (2020) describe the purpose of generating a high volume of contribution is thought to be conducive to democratic, co-constructed, jointly owned, and ultimately, better synthesised design responses.

Taking time from stakeholders relevant to this work would be challenging at the best of times. Lockdown and social distancing during the Covid-19 pandemic further complicates matters. Therefore, our goal has been to develop two remote methods that afford as many strengths of a workshop as possible whilst enabling us to work one-to-one with stakeholders to co-construct a picture of Seafood Age fish RtC product feasibility across the value chain. To generate the richest data possible, while our approach is mediated by digital platforms, we purposely keep the researcher central to guide participants and facilitate dialogue and exchange.

The notion of access to digital technology has been a long-standing challenge to PD (for example Le Dantec and DiSalvo, 2013), but this has now gained prevalence in the absence of alternatives. Several practitioners recently have reviewed remote and digital alternatives to workshop facilitation in physical environments (Bennett, 2020; Galabo et al, 2020; Wareing, 2020). Each have described using one or a combination of sophisticated online platforms for video conferencing and remote collaboration that are free or cheap to access and bring a wealth of opportunities for remote collaborative data generation and analysis. Regardless, these reviews demonstrate that the technology and interactions all need to be planned, prepared and tested beforehand. Stakeholders may well need training and support to use the software before and during engagement. For instance, Tabassum cited that prior to the Covid-19 pandemic 47% of people aged 75 and over had never used the internet according to 2019 ONS figures on Internet users in the UK. Given this new reliance on the Internet, we saw that added value could be generated if the research method was designed in a way that was simple to use and supported the development and familiarisation with digital and online skills.

4.2 The two methods

The various elements of the Seafood-AGE prototype product are being developed in parallel by the different partners. This includes: profiling the nutritional content of different fish discards throughout the seasons; producing and forming the fish patty for heating at home; growing the algae for the sauce and packaging; producing prototypical packaging; generating tests for listeria and other health and safety concerns; and developing the smart labelling. All of these elements will be brought together to present to potential stakeholders for adoption. The methods developed here are intended as both a means of identifying and helping to generate feasibility among stakeholders for adopting this product. The data they generate are intended to bring valuable evidence for where in the market such a product could be placed, an at-a-glance picture of how the novel circular economy methods could be applied to practices, and how those new practices relate to those of other stakeholders across the value chain.

We have created two methods broadly described as facilitated conversation mediated by two digital

platforms respectively: Facebook for data generation with members of the public— the would-be consumers of fish and seafood; and Miro for data generation with stakeholders across the RtC fish and seafood value chain. The two methods have been developed side by side. The Facebook method has been tested and data is now being generated. Findings from of the Facebook data will be included in Miro, when it comes to be tested, to include their responses to fish and seafood RtC product consumption practices. The use of these platforms is outlined below.

Miro

Miro (www.miro.com) is an online private, password-protected a whiteboard platform that can be used to map and save ideas with collaborators. It is a space where collaborators can move around and interact with the space and each other in real time.

On 6th November 2020, we carried out a one-hour, semi-structured interview with the Manager of Technical Innovation at a leading UK supermarket to explore their views relating to process feasibility, challenges, opportunities and risks in manufacture, retail, and marketing of a Ready to Cook (RTC) fish product—inclusive of algae-based packaging and smart labelling—linked to the following areas:
- Product innovation and development for an older market
- manufacture and distribution of an RTE food product
- circular economy method adoption
- health, safety and nutrition
- convenience and relevance of the product in the market

In each of those areas, we asked:

- What stakeholders see as the opportunities and risks associated with new processes and CE methods, product innovation and development?
- What would they design in and out of them, and why?
- How do they see new CE methods, processes and so on applied to existing practices and what would be the barriers to application and what would support adoption?

The data from that interview was transformed into a mindmap on Miro. Using its functionality to create dynamic connections between objects, data was transposed into ‘cards’ that were tagged with emerging themes and coalesced around developing key ideas across boards that corresponded to the discussion areas as listed above. See figures 1 to 4. Having now established and recorded this first iteration of the map, we will next use it in conversation with one stakeholder at a time. We will first work with them to generate responses in conversation to the discussion areas, and then ask them to add their cards to the existing map so that individual responses and the collaborative map exist alongside each other. Conversation will be mediated by video conferencing platforms, MS Teams or Skype, while both the researcher and participants work together in the Miro platform space. Given that Miro has restricted access and is password protected, the stakeholders interviewed will be able to return to the document at any time after our discussion should they wish.

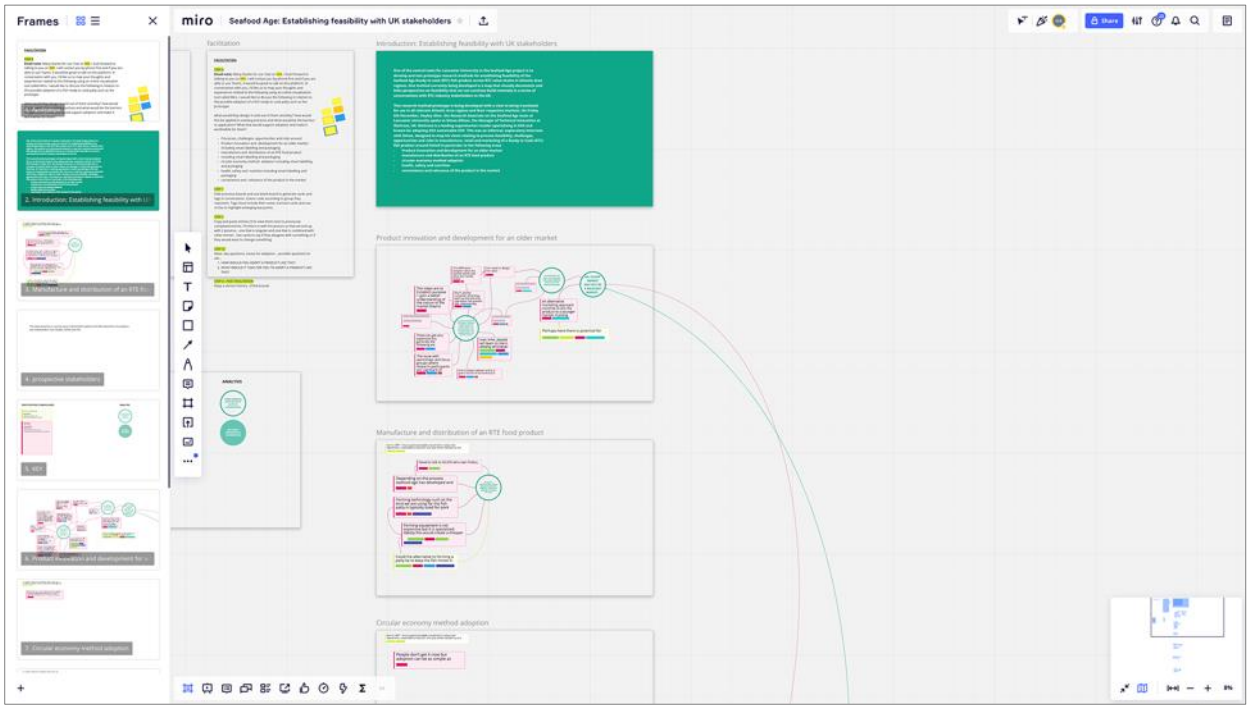

Figure 1- overview of discussion boards on Miro

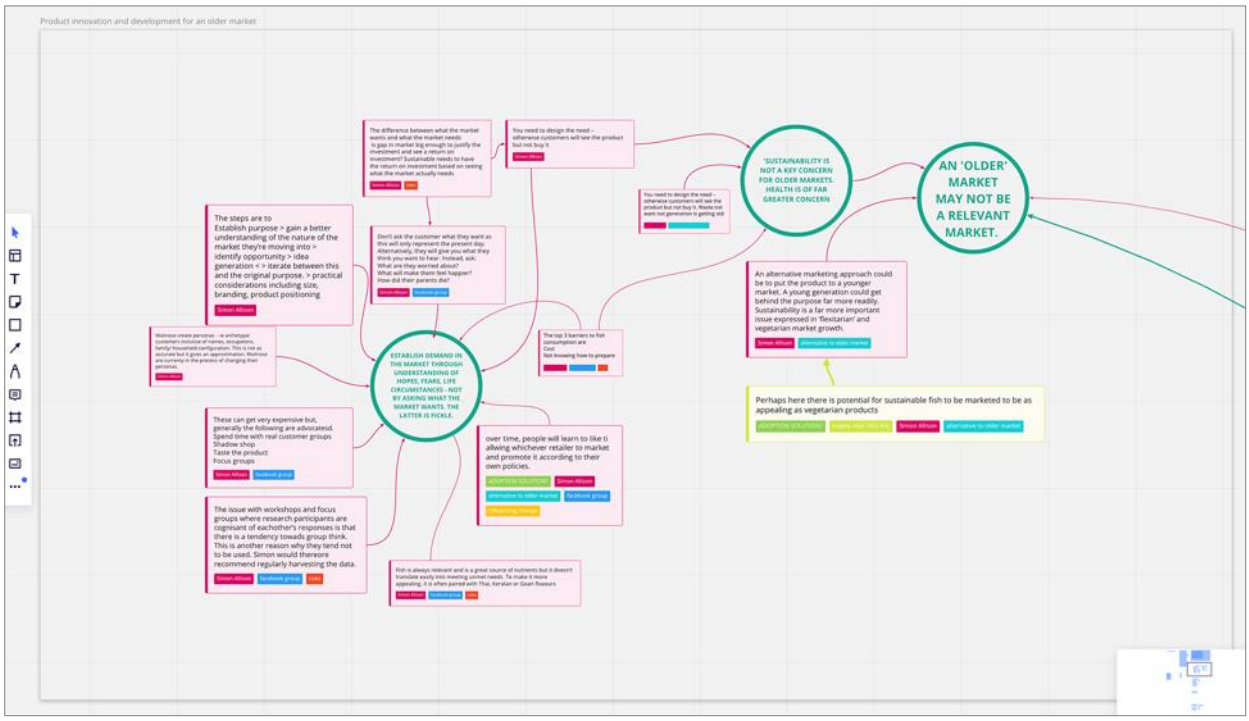

Figure 2- Board 1 topic detail (product innovation and development). Illustration of cards attached to key themes using dynamic arrows that keep objects attached no matter where you move them to across the boards.

Figure 3 - detail of a card documenting a note or data point raised in discussion). The different-coloured blocks are tags associated that can be added to each card enabling a second axis of themes to emerge

Figure 4- detail of expanded note card

Facebook

The second method is a private Facebook 'Social Learning' Group designed to support would-be RtC fish product consumers to reflect on and exchange their thoughts and experiences around fish and seafood product consumption through responding in comments to posts and potentially other participants' comments. Insights emerging from the data we generate though the Facebook group will feed into feasibility mapping work, providing additional data points for stakeholders to consider upstream. This method is designed to be used by people who have a Facebook account. Provided they are a member of the group, they can add their own responses, see and respond to each other's comments. However, used as a conversation tool in conjunction with the facilitator screen sharing on video conferencing software, including Zoom, Skype, FaceTime or Microsoft Teams, the participant does not necessarily need to have a Facebook account, nor do they need to become a member of the group as the facilitator can write comments on their behalf if needed.

The Facebook group is divided into six 'guides'. See figs 5 to 17. The first three guides are designed as a visual prompts or cultural probes to support conversation about the practices of fish and seafood RTC product buying, preparing and eating day-to-day. Guide 1 uses images of products to spark response, memories, experiences and so on. Guide 2 uses engaging images and questions to prompt recollection of the last fish meal the participant had. Guide 3 asks the participant to describe the fish products they have in their kitchen including whatever they anticipate they might need to discard. Guide 4 explores general values that may be reflected in how participants shop and eat. Guide 5 is a design speculation, presenting a realistic fictional version of a new RtC fish 'fillet' that new circular economy methods being developed by the Seafood AGE consortium including algae-based packaging and smart labelling. The speculation is designed with a dual purpose. First, to generate response to the product as close as possible to an experience of encountering it at the supermarket in real life. Second, to promote awareness around the circular economy methods used. The final guide asks participants to evaluate their experience of engaging with this research method.

On the 28th March 2021, the Facebook tool was tested with three members of the public in the UK, known to the designer (one woman aged 33, two men aged 70 and 36 respectively). None of them had previous experience with the Facebook site. With the first, we used WhatsApp and were on our computers at the same time. This conversation lasted 1.5 hours. The woman and man aged 36 lived together and participated together. It lasted 2 hours. Both interactions were too long. This has now been refined to facilitate a much shorter, 30-minute conversation.

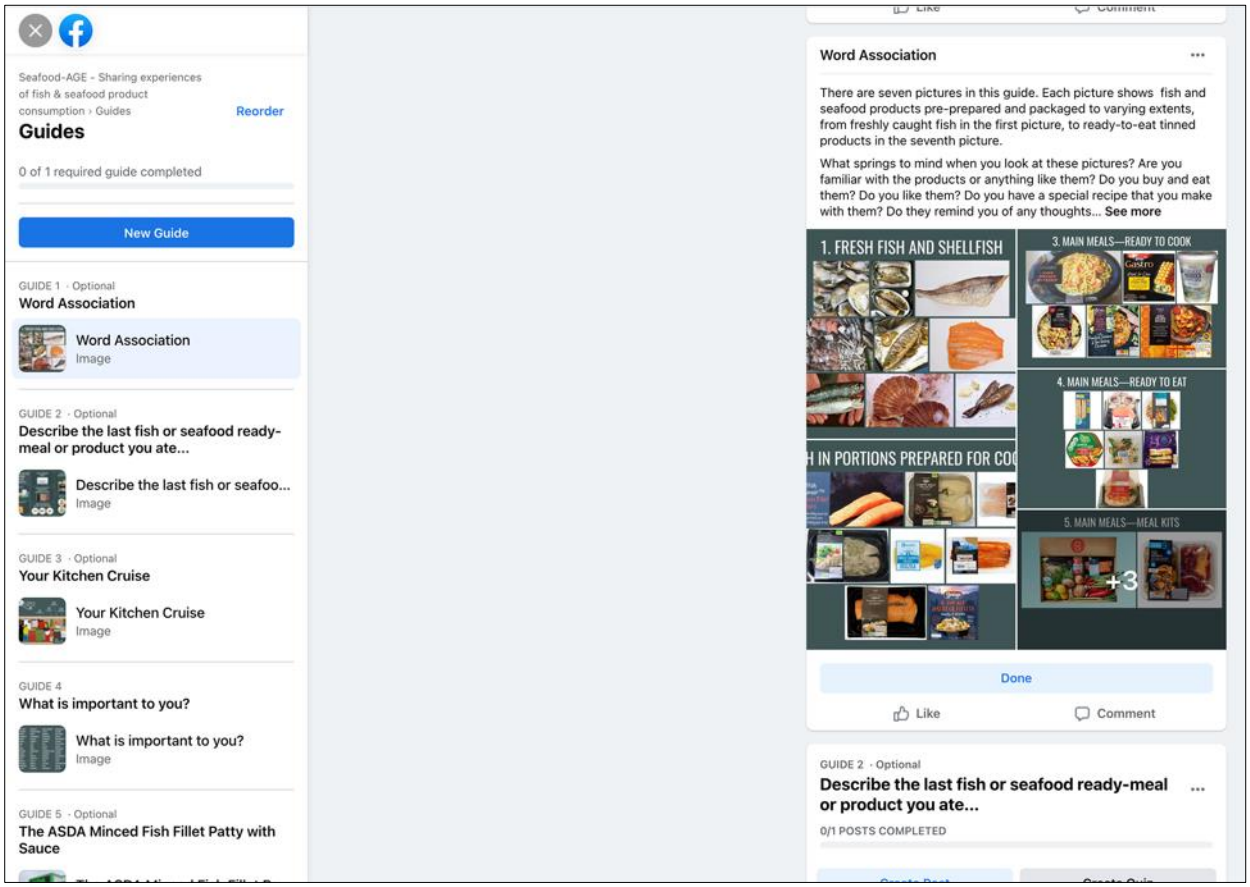

Figure 5- overview of Guides tab in the Facebook Social Learning Group. Guide 1 is selected here

Figure 6- Example of post in guide 1

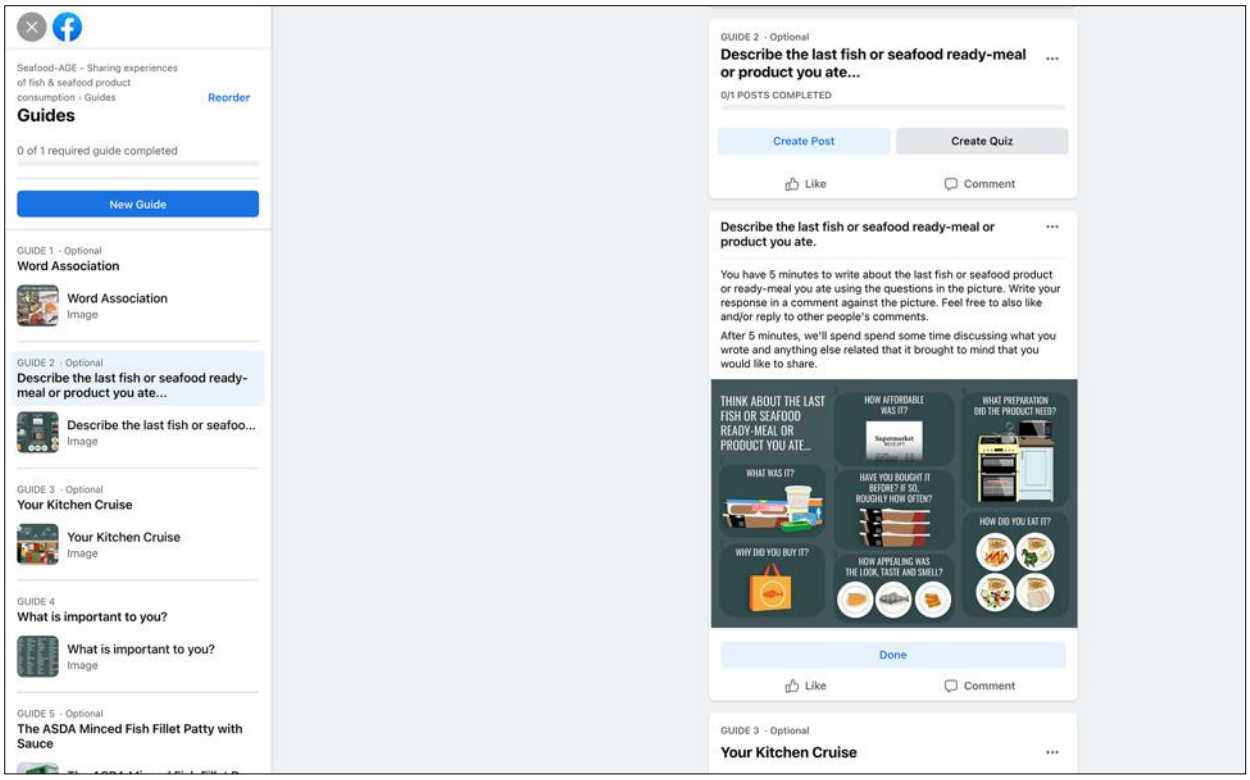

Figure 7 - Guide tab view of Guide 2

Figure 8 -Guide 2 post

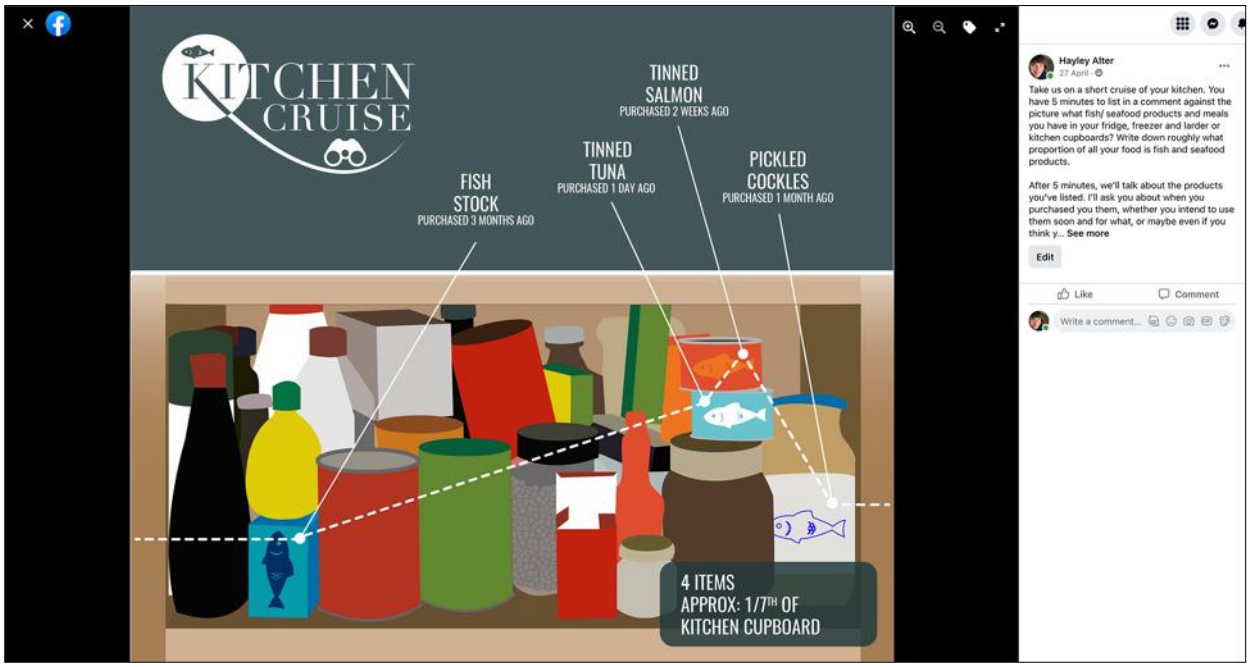

Figure 9 - Guide 3 post

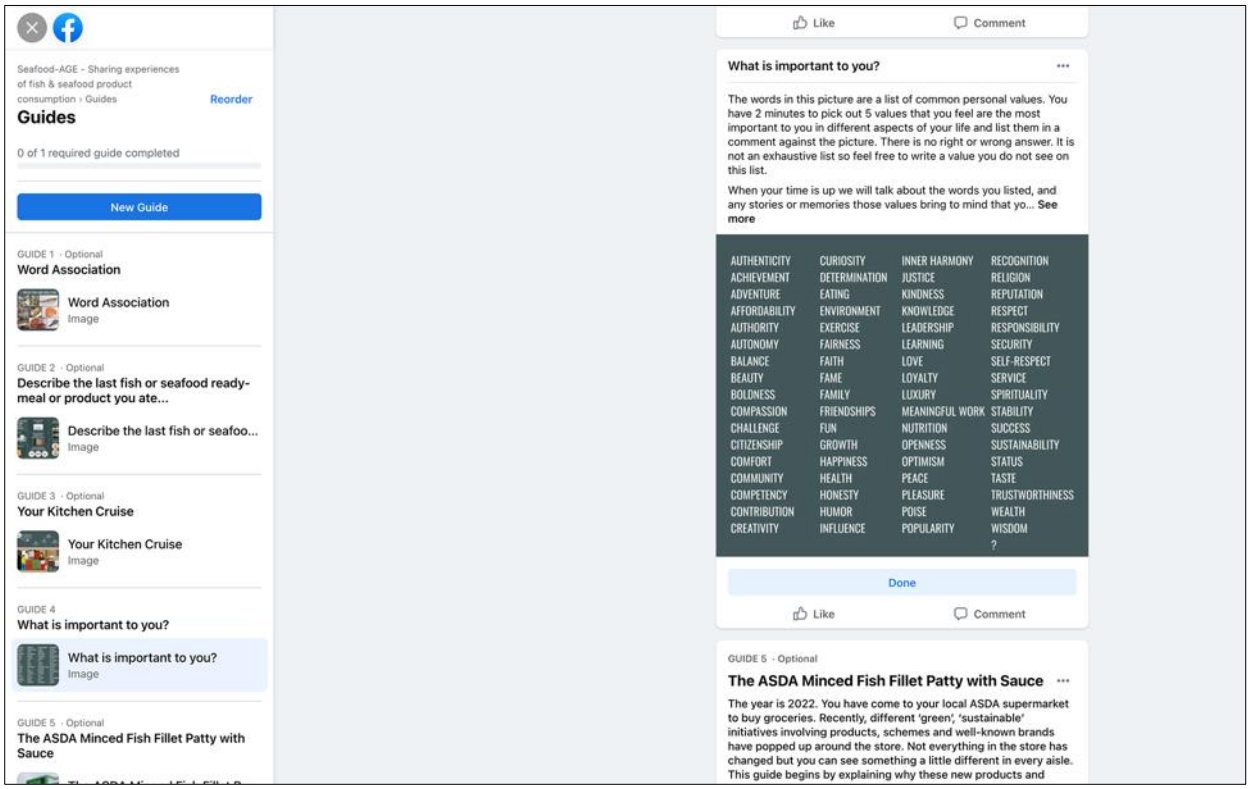

Figure 10 - Guide 4 post

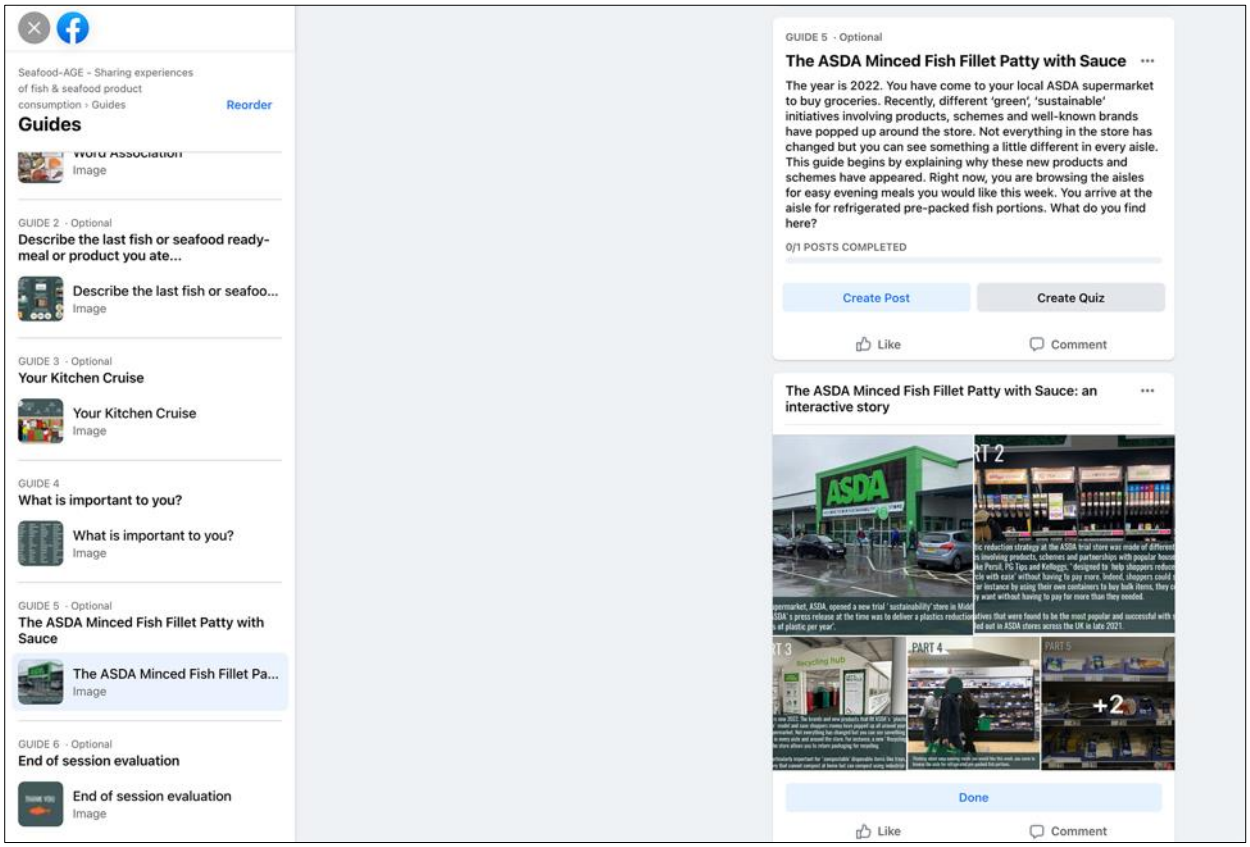

Figure 11 - Guide 5 overview from Guide tab

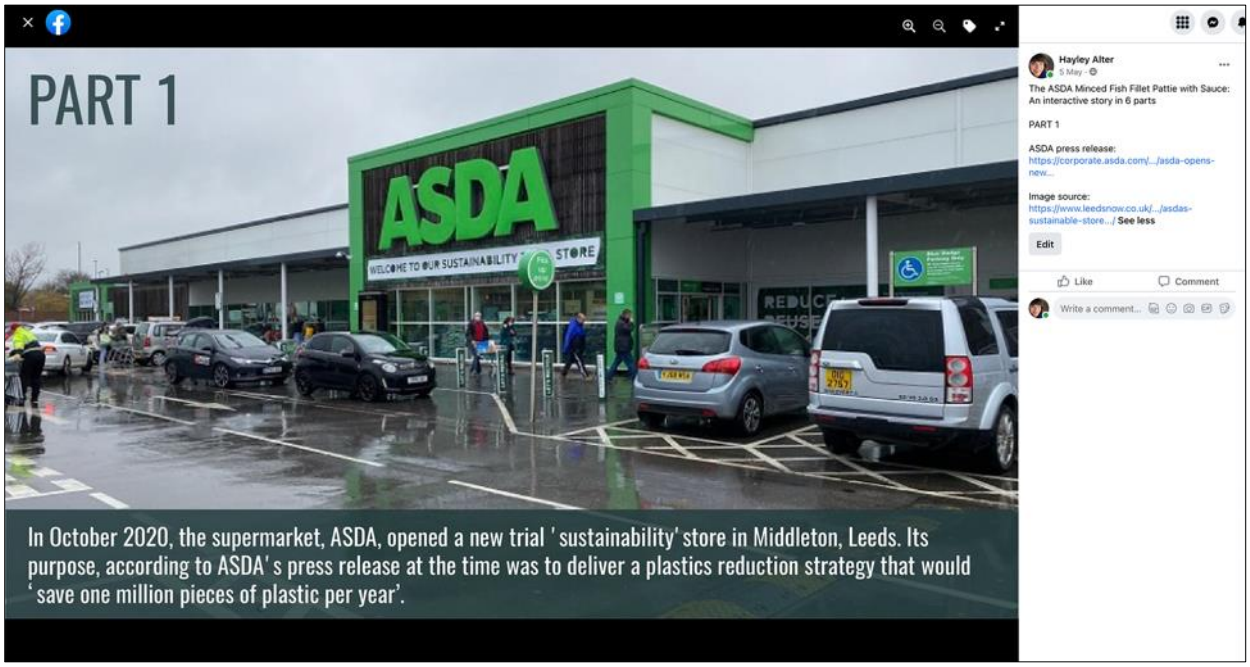

Figure 12 - Guide 5, post 1

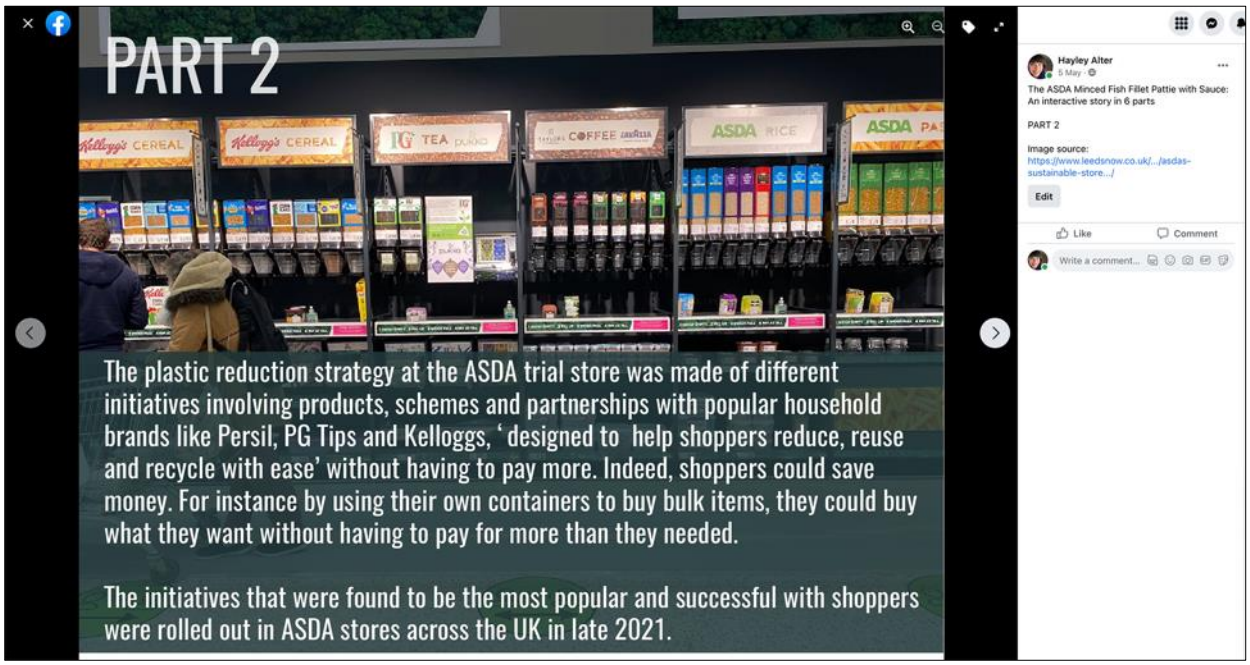

Figure 13 - Guide 5, post 2

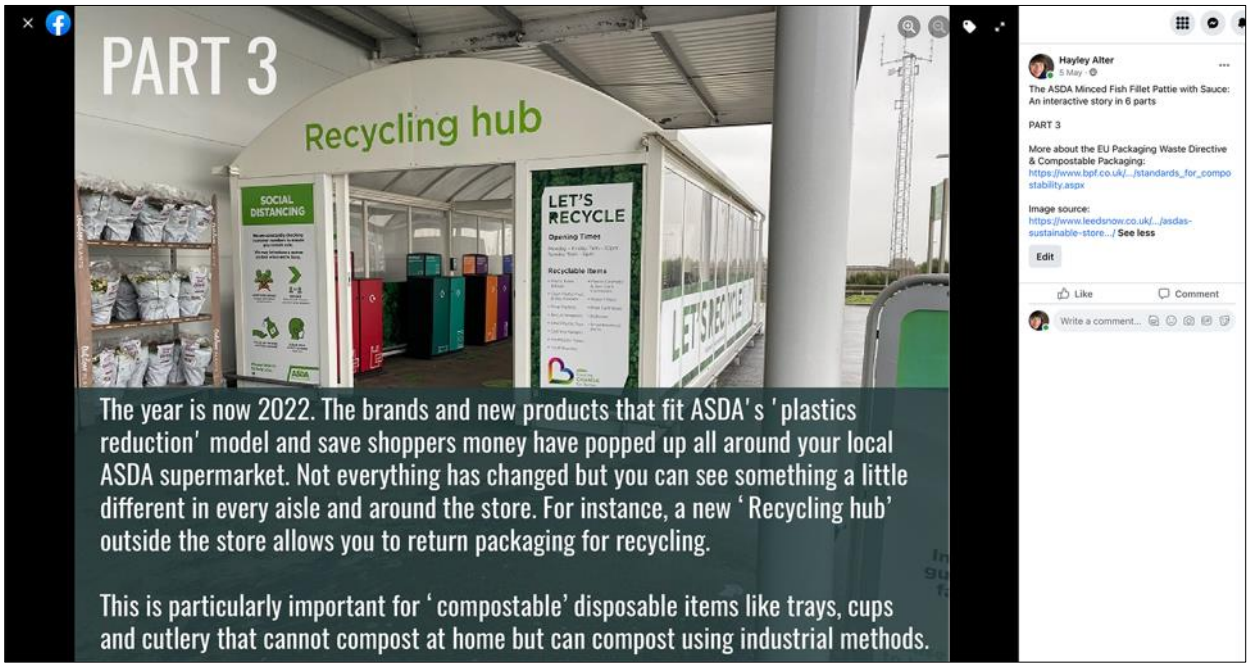

Figure 14 - Guide 5, post 3

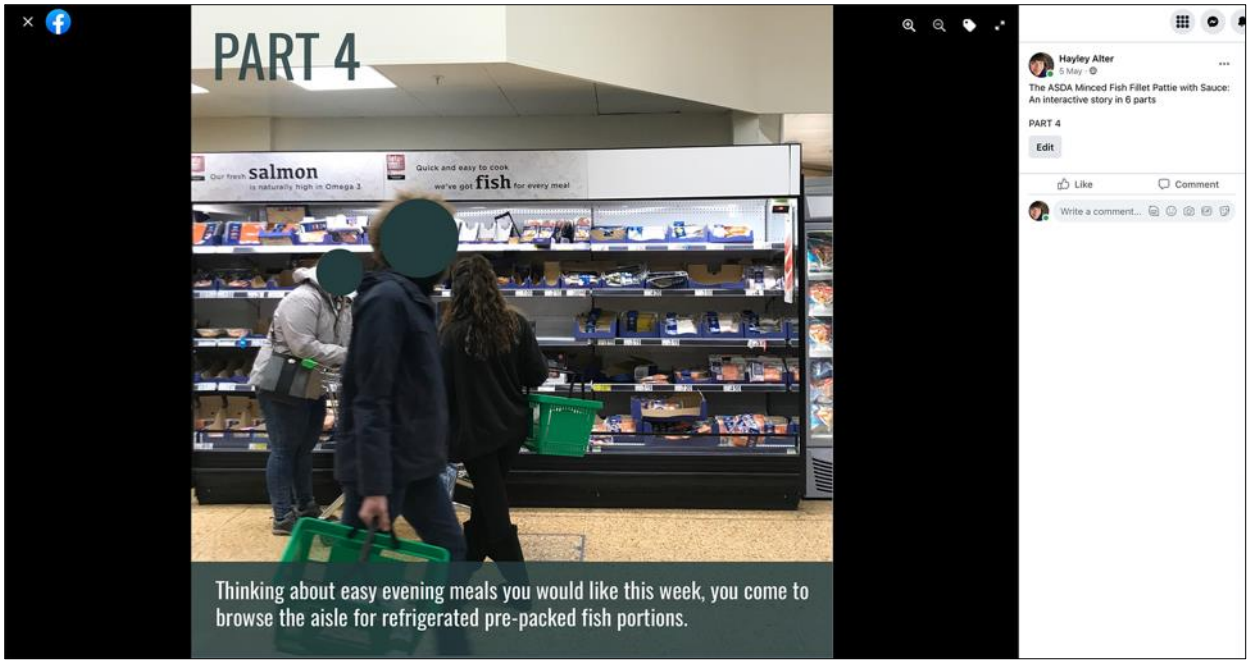

Figure 15 - Guide 5, post 4

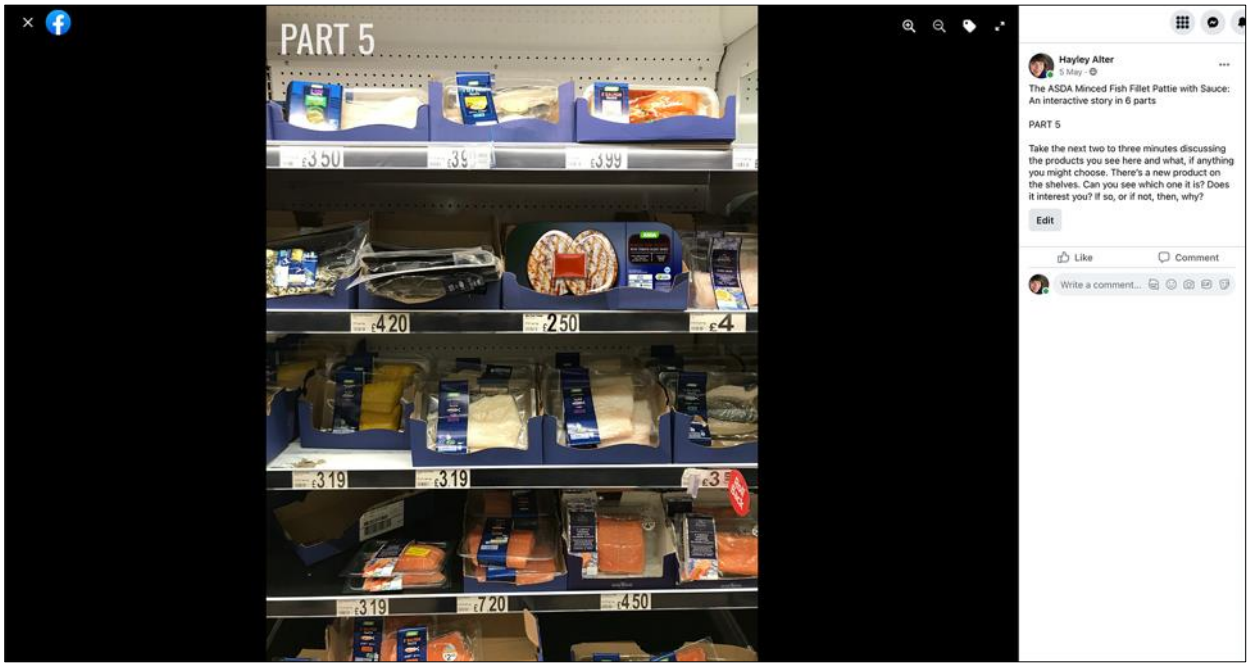

Figure 16 - Guide 5, post 5

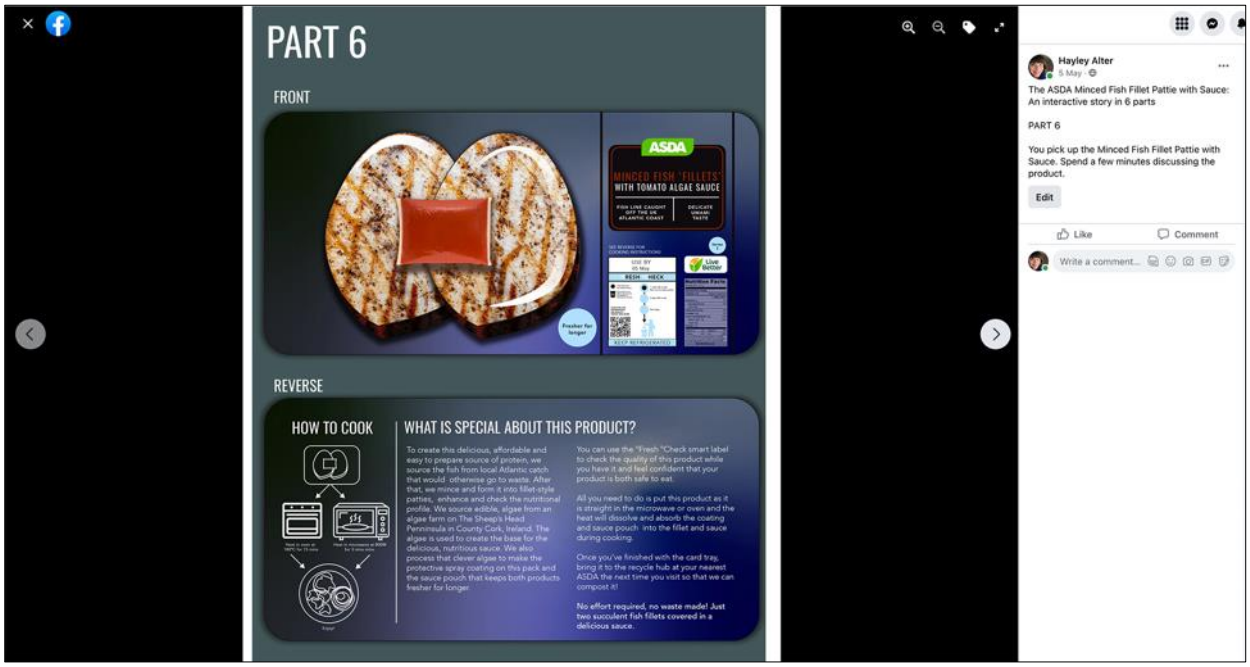

Figure 17 -Guide 5, post 5

5. Conclusion

In this paper, we have described why the European fish and seafood industry needs to develop resilience through creating new knowledge infrastructures shared between stakeholders along value chains based on circular economy method adoption. We have proposed how a Design-based infrastructuring approach could support this development, designed to explore and map existing practices across value chains inclusive of would-be consumers. Using the Seafood AGE consortium RtC fish product as a case study, we have presented the development of two prototypical design research methods. Given the considerable absence in literature of how and when industries practically apply academic circular economy concepts, we look, at this stage in our progress, to our peers at EAD working at intersections of design, food, industry and novel circular economy method adoption to gain vital, critical feedback on our approach. We look forward to the discussion we hope it will prompt.

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