



Restaurant menu design and the place of environmental sustainability: Head chefs' perspectives

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ABSTRACT

There are calls for restaurants to support the global sustainable development goals and improve their environmental performance. The ongoing challenges of labour shortages and operating costs also underline the need for sustainable practices to fulfil the financial objectives of businesses. This study aimed to gain a better understanding of chefs' knowledge, awareness and practices related to menu design and the extent to which environmental sustainability is considered and influences the menu design process. Individual interviews were conducted face-to-face with fifteen chefs of small-and-medium sized restaurants in Northern England. Discussions were recorded, transcribed, imported into NVivo 14, where an inductive thematic approach was employed and provided three themes: 1) Underpinning principles influencing what chefs put on the menu, 2) Changing the menu, and 3) Communicating the menu to the customer. In this study, chefs prioritised seasonal produce, cooking from scratch using fresh ingredients, and buying local food which supports local economies. This study also revealed how chefs preferred to design small and agile menus with clear and concise dish descriptors, and recognised the importance of minimising food waste by monitoring the popularity of dishes, as well as repurposing, preserving or utilising all parts of an ingredient. Findings emphasise how chef decisions about what food to put on the menu are influenced by produce cost and availability, operating costs, and business resources. Therefore, any changes to improve the environmental credentials of the menu must be financially sustainable and protect the bottom line.

1. Introduction

The United Nations Sustainable Development Goals (SDGs) demonstrate the scale and ambition of the global sustainable development agenda (United Nations, 2015). An important aspect of sustainable development is environmental sustainability, defined as the "maintenance of natural capital" (Goodland, 1995), and incorporating the management of natural resources, as well as responsible production and consumption (United Nations, 2015). Environmental sustainability is distinct from, but connected to, economic and social sustainability. It is a key objective for businesses in the tourism and hospitality industry (Jones, 2023). The food supply chain, specifically, is responsible for over 25 % of global greenhouse gas (GHG) emissions (Poore and Nemecek, 2018), with the hospitality industry being a major contributor through the provision of food service.

Eating out in restaurants has long been a cornerstone of British

culture and UK households spend, on average, £655 in restaurants and cafés annually (ONS, 2023). However, the food service industry in the United Kingdom (UK) is facing considerable challenges, from supply chain issues and labour shortages to increasing food and energy costs (ONS, 2022) and in the 12 months to May 2022, 1406 UK restaurants permanently closed (Spotlight, 2022). Despite the number of larger restaurant chain units being down 9.9 % on pre-COVID levels, the number of smaller, independent restaurants, i.e. small and medium-sized enterprises (SMEs), were up 9.7 %, making up over 99 % of total businesses in the industry in 2023 (UKHospitality, 2023). This reflects the continued appetite for dining out, despite the economic climate.

There are calls for restaurants to improve their environmental performance (Jacobs and Klosse, 2016) in light of challenges from climate change, including food availability which can increase food prices (Gomez-Zavaglia et al., 2020). Restaurants can offer a menu with strong

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environmental credentials, to support an environmental sustainability agenda and ultimately, contribute to the SDGs on climate action (SDG 13) and responsible consumption and production (SDG 12). Crucially, sustainable practices in restaurants must also improve business performance (Jones, 2023). For example, adopting a nose-to-tail philosophy, by using all parts of an animal or vegetable can reduce food waste and support environmental sustainability (Nitzko and Spiller, 2019) whilst providing economic benefit (Filimonau et al., 2023).

Growing numbers of UK consumers are adjusting their diets and food habits for environmental reasons; in 2022, one in ten people followed a vegan or vegetarian diet, with 63 % of these having done so since 2017 (You Gov, 2022). Almost four fifths (79 %) of UK vegans and just over half (52 %) of vegetarians adopted these diets for environmental reasons (You Gov, 2022), highlighting the link between pro-environmental behaviours and plant-based diets (Krizanova et al., 2021). Restaurants have been adjusting their menus accordingly, with almost a third (31 %) of main dishes on chain restaurant menus being vegetarian in 2023, up from 26 % in 2022, and 19 % vegan, up from 15 % (Lumina Intelligence, 2023). This is noteworthy, as meat is often the least sustainable ingredient on a menu (Biermann and Rau, 2020) and having more vegetarian options can increase their selection (Parkin and Attwood, 2022). This also highlights the importance of work to reduce meat consumption in restaurants (Reinders et al., 2020), particularly given that eating meat has been found to be more dominant when eating out (Biermann and Rau, 2020), the attachment that some consumers may have to meat (Wang and Scrimgeour, 2021), and the lack of awareness for some consumers, of the environmental impact of meat consumption (Pohjolainen et al., 2016).

Research into sustainability in the restaurant sector is growing, and it is recognised that restaurants must transition to triple bottom line sustainability, with a commitment to focusing on the social and environmental impact of their businesses, alongside profit (Thu Bui and Filimonau, 2021). Sustainability for restaurants is complex and any interventions to address triple bottom line sustainability must be viewed holistically, i.e. from raw material production through to food consumption and waste disposal/recovery (Takacs and Borrión, 2020). Research has shown the importance of providing information about the traceability of food (Vu et al., 2023) and following a farm-to-fork approach using local food (Donaher and Lynes, 2017; Riccaboni et al., 2021), key to food sustainability (Vargas et al., 2021).

A systematic review of restaurant menu design (Ozdemir and Caliskan, 2015) highlighted how four dimensions (item position, item descriptor, menu labels, menu design characteristics) can have a substantial effect on customer perceptions and item selection. For example, having a vegetarian dish at the top of the menu can decrease the share of meat dishes sold (Andersson and Nelander, 2021). Indulgent or attractive names have been found to increase dish sales (Greene et al., 2024; Ohlhausen and Langen, 2020; Turnwald et al., 2017), and labelling dishes as low emission (Buratto and Lotti, 2024) can also increase sales, provided these are alongside explanatory statements. Menu size, appearance, or typeface can also improve customer satisfaction and impressions about the restaurant (Chen et al., 2020; Johns et al., 2013).

Although menu design is often undertaken by trial and error (IP and Chark, 2023), a formal model or process to follow can be a valuable tool for chefs during menu planning (Ho et al., 2021). These include the menu management process model, which covers the planning, pricing, design, operating and analysis of a menu (Nebioğlu, 2020), and stage-gate model, where each stage of the menu design is separated, and key decisions are signed off before moving to the next stage (Howieson et al., 2014). Likewise, menu engineering evaluates the popularity and profitability of dishes (Bergman et al., 2021) and time-driven menu engineering, captures the cost of labour as well as food to calculate the profitability of a dish (Özgür Göde and Ekerçil, 2023). However, these models focus on profitability rather than environmental performance (Bergman et al., 2021; Özgür Göde and Ekerçil, 2023).

Previous research on menu design and sustainability has included

studies involving Michelin-starred chefs. One study highlighted how chefs felt it was important that luxury restaurants have high-quality plant-based menu items (Batat, 2020) to encourage customers to embrace sustainable eating in restaurants. Other studies have revealed a lack of sustainability innovation, owing to insufficient legislation or incentives (Mrusek et al., 2022), and that whilst local food was crucial for menu design, it is difficult to capitalise on, owing to food supply availability, quality, and prices (Fusté-Forné and Noguer-Juncà, 2023). It is important to note that these studies were with Michelin-starred chefs from luxury restaurants (a small proportion of the restaurant sector), and concern for ingredient costs may differ by restaurant. There is a lack of evidence from chefs outside the luxury restaurant sector, and in particular mid-range restaurant SMEs and therefore this study focused on these types of restaurants. The aim of this study was to gain a better understanding of chefs' knowledge, awareness and practices related to menu design and the extent to which environmental sustainability is considered and influences the menu design process.

2. Material and methods

2.1. Study design and recruitment

A qualitative research methodology was chosen, given the focus on exploring chefs' knowledge, awareness and practices related to menu design. Semi-structured interviews were selected to acquire information on participants' lived experiences and encourage them to talk freely (Henriksen et al., 2022). Interviews with head chefs took place face-to-face in the restaurants (during non-trading hours) to build a rapport and make chefs comfortable. An inductive approach to the analysis was employed, allowing the themes to be generated rather than fitting into a pre-determined coding frame (Braun and Clarke, 2006).

The participants were head chefs of restaurants selected according to the inclusion criteria (Table 1). These were utilised so that participating restaurants were similar in size, characteristics, and location, and supported findings related to a specific restaurant market segment. Restaurants were not limited to a specific cuisine due to the heterogenous nature of restaurants, where it can be difficult to classify the cuisine (Parsa et al., 2020), and chefs are influenced by their personal culinary experiences. Derbyshire, South Yorkshire, and West Yorkshire were geographically convenient for data collection, and restaurants were restricted to areas, excluding the most and least deprived. Restaurants with a minimum 4 out of 5 food hygiene rating (FSA, 2023) were selected, followed by a manual check to disregard businesses that were not restaurant SMEs (e.g. national restaurant chains). Emails were sent

Table 1
Inclusion criteria for the restaurants and their location.

Inclusion criteria	Method of confirmation
Derbyshire, South or West Yorkshire location	
Categorised as a restaurant Food hygiene rating minimum 4 out of 5	UK Food Standards Agency data (FSA, 2023)
Population density ≥ 1000 people/km ²	Office for National Statistics regional data (ONS, 2020)
Index of Multiple Deprivation decile 4-7	Indices of Multiple Deprivation data (ONS, 2021)
Meat-based options on the menu, i.e. not exclusively vegan or vegetarian Individually selected dishes, i.e. not exclusively tasting menus	Menu on restaurant website/social media
Table service and ordering Dinner service, i.e. open on evenings Mid-range price category	TripAdvisor platform (with relevant filters)
Small and medium-sized enterprise (SME) Head chef responsible for menu design "Cook to order" dishes	Initial phone call with head chef

to eligible restaurants inviting them to participate. Initial phone calls with head chefs (showing interest in participation) confirmed the restaurants met the inclusion criteria.

2.2. Development of the interview schedule

The interview schedule was developed to explore chefs' knowledge, awareness and practices related to menu design, including with respect to environmental sustainability, specifically. The schedule comprised topics and questions, as well as prompts, and acted as a guide for the researcher conducting the interview. Questions were open-ended to encourage participants to share their experiences freely. The initial question was designed to allow chefs to give an overview of their current role, to establish rapport and make them feel comfortable. This was followed by three main sections: 1) how chefs decide what food to offer; 2) the process of designing menus; and 3) the relevance of environmental sustainability. When it came to the section on environmental sustainability, chefs were asked to comment on its meaning in their own context and/or that of the business e.g. *To what extent or not is environmental sustainability relevant to your work as a chef? What sustainable food practices in restaurants are you aware of? Where do you, as a chef, access*

information on what is or is not environmentally sustainable? At the end of the interview, chefs were given the opportunity to add anything else that they felt relevant to the study that had not already come up.

The schedule was reviewed by three academic experts in hospitality and culinary management, and changes were made, e.g. a new question on apps and QR codes to access menus was introduced. The schedule was then piloted with two head chefs of restaurant SMEs (not from those included in the final sample). Questions were streamlined, consolidated, and reordered, to improve flow and to enable the interview to be conducted within an hour, to accommodate chefs' busy work schedules.

2.3. Procedure

Fifteen interviews with head chefs were conducted face-to-face between January and June 2023 (Eighteen head chefs confirmed interest, however three later decided not to participate, due to work commitments). The anonymisation of transcripts was highlighted at the start of the interview to try to promote participants' freedom to explore challenging subjects, such as food ethics, and rising food and energy costs. Interviews lasted between 45 and 60 min and Microsoft Teams was used to audio record the interview and provide an initial transcript.

Table 2

Demographic details of the chefs participating in the interviews, and features of the respective restaurants' main menus.

Chef							Menu					
Chef ID	Age (yrs)	Education level	Region of training	Time as chef (yrs)	Time as head chef (yrs)	Prior experience	Style of cuisine	Type of menu	No. of main dishes	No. of vegetarian main dishes	Placement of vegetarian dishes	Highlighted dishes (boxed on menu)
CHEF1	45–54	Degree	Europe	15+	10+	AA rosette; Casual dining; Gastro pub	British	A la carte	4	1	Incorporated	–
CHEF2	35–44	A-level/ equivalent	Europe	15+	5–10	Michelin starred; Casual dining; Gastro pub; AA rosette	Italian	A la carte	48	9	Incorporated	Profitable dishes
CHEF3	45–54	GSCE/ equivalent	North America	15+	10+	Casual dining	Mexican	Small plates	15	5	Incorporated	–
CHEF4	55+	GSCE/ equivalent	Europe	15+	10+	Casual dining; Regional - Mediterranean	Mediterranean	A la carte	23	4	Incorporated	–
CHEF5	55+	GSCE/ equivalent	Europe	15+	10+	Regional - Italian	Italian	A la carte	39	10	Separated	–
CHEF6	55+	GSCE/ equivalent	Europe	15+	10+	AA rosette; Fine dining; Casual dining	British	A la carte	9	2	Separated	–
CHEF7	45–54	A-level/ equivalent	Europe	15+	10+	Casual dining; Gastro pub; AA rosette	British	A la carte	11	2	Incorporated	–
CHEF8	55+	College	Europe	15+	10+	AA rosette; Fine dining; Casual dining; Gastro pub	British	A la carte	13	3	Incorporated	Sharing plates
CHEF9	45–54	GSCE/ equivalent	Asia	15+	10+	Other fine dining	Indian	A la carte	21	9	Incorporated	Chefs' favourites
CHEF10	55+	GSCE/ equivalent	Europe	15+	10+	Regional - Italian/Spanish	Mediterranean	Small plates	5	1	Separated	Specials
CHEF11	25–34	College	Europe	15+	5–10	Michelin starred; AA rosette; Fine dining; Pub/ gastro pub	British	Prix fixe	4	1	Incorporated	–
CHEF12	35–44	A-level/ equivalent	Europe	15+	10+	Fine dining; Casual dining	British	A la carte	8	2	Incorporated	–
CHEF13	35–44	College	Europe	15+	10+	Casual dining	Italian	Small plates	22	4	Incorporated	Fresh pasta
CHEF14	35–44	Degree	Europe	15+	10+	Fine dining; Casual dining; Gastro pub	British	A la carte	18	7	Incorporated	Sharing plates
CHEF15	45–54	Master's degree	Europe	15+	10+	Michelin starred; AA rosette; Gastro pub; Pop up/street food	British	A la carte	15	4	Separated	–

Demographic data were also collected through a short questionnaire and a copy of the restaurant's main menu was obtained. Data were collected until it was felt data saturation had been reached, and no new topics were coming up during the interviews. The initial transcripts generated in Microsoft Teams were checked against the audio recordings and revised accordingly, before being anonymised.

2.4. Data analysis

Inductive thematic analysis was employed to provide a rich and detailed account of the data (Braun and Clarke, 2006). Transcripts were imported to NVivo 14 software (Lumivero, Denver, CO, USA), and initial codes were generated by systematically reviewing the transcripts. Initial sets of codes were reviewed and refined where necessary. A further round of analysis was undertaken, and codes were finalised and grouped into categories and three final themes identified. Reflexivity was practised through memoing, to mitigate against researcher bias (Cairns-Lee et al., 2022). The restaurants' main menus were also reviewed to provide background details, e.g. menu layout and type, cuisine, and number of main dishes.

3. Results

A total of fifteen chefs participated in the study (Table 2). All were male, had over 15 years' experience as a chef, with thirteen chefs having over 10 years' experience as a head chef. The chefs had diverse prior experience including casual dining, Michelin starred, and gastro pub, reflecting the diverse nature of the restaurant sector. The style of cuisine at the restaurants was varied, with just over half being British orientated. The majority of menus in the restaurants were traditional a la carte e.g. starter/main course, with a few offering small plates and one offering a prix fixe (fixed price) menu.

The number of main menu dishes ranged from 4 to 48 (median 15), and the number of vegetarian main dishes ranged from just a single item to 10. The proportion of vegetarian dishes varied, from 4 out of 23 to 9 out of 21 (median of one in four). Only four menus separated out the vegetarian dishes, with most incorporating vegetarian dishes into specific sections, e.g. main courses, with relevant labelling (V symbol). Six menus highlighted specific dishes using boxes, accompanied by labels such as "chefs' favourite" or "sharing plates". Most of the restaurants had specials supernumerary to the main dishes.

Three themes from the research data (Fig. 1) were: 1) Underpinning principles influencing what chefs put on the menu; 2) Changing the menu; and 3) Communicating the menu to the customer.

3.1. Underpinning principles influencing what chefs put on the menu – the food offer

The chefs referred to key principles that influence the type of food they offer at their restaurants. These included a preference for using local produce and cooking from scratch using fresh ingredients. Chefs did, however, recognise the challenge of managing costs associated with operating a small business, and they felt that this impacted on their ability to purchase produce locally, which was often seen as more expensive.

3.1.1. Using local produce and supporting the local economy

For chefs, using local produce was a way to ensure fresh, and higher quality products. Chefs also referred to a sense of pride in the way restaurants can support the local economy and community of food producers.

So, this [naming suppliers on the menu] is really important to me, this is something that's been a bit of a USP [unique selling point]. I list all my lovely suppliers [on the menu] just to give them a bit of a ... to champion them, but also to show that it is really important that we get everything local. CHEF15

Ingredients' provenance was seen as a key indicator of the environmental sustainability of food served, and foraging was also utilised by some chefs, reducing food miles and costs.

We know the way they've [cattle from our suppliers] been raised and reared, we know they've been looked after and that shows in the products. Fish comes from Cornwall. We get it on a day boat, so it's not trawled, and we know it's sustainable. CHEF15

We'll pick a lot of Hen of the Woods (foraged mushroom) around here. It's really expensive to buy, but it doesn't cost anything foraged ... I think it's poor that chefs are fetching all kinds of stuff from Japan. There's enough stuff round here. CHEF11

However, there was recognition that it is challenging to source all produce locally, particularly where chefs have been influenced by international experiences in other countries (where they adopt international methods and fashions) or in international restaurants requiring specialist ingredients.

It's difficult, obviously; being Mexican we have to get some speciality ingredients in, that have been flown in or whatever ... it wouldn't be true to say that we just try to source everything local – because it's kind of impossible. CHEF3

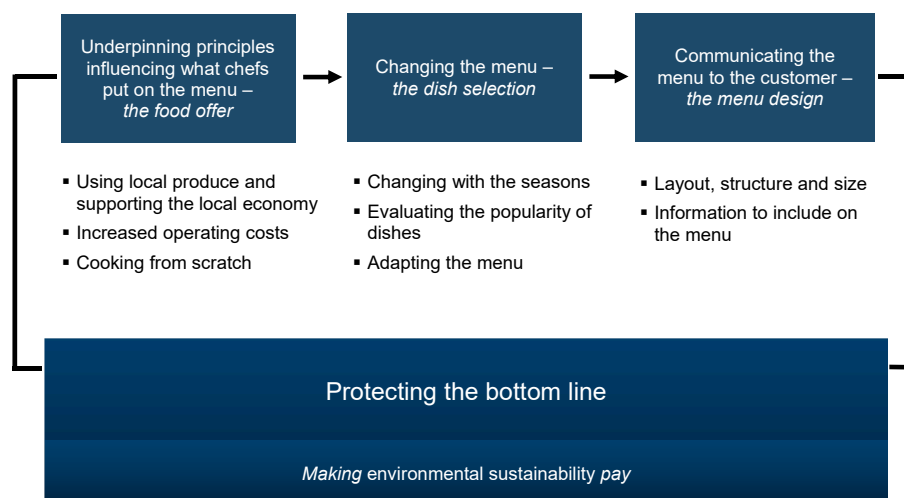


Fig. 1. Restaurant Menu Design: key themes and sub-themes and the place of environmental sustainability.

3.1.2. Increased operating costs

Most chefs felt that the rising cost of ingredients and energy had a significant impact on the available food budget. These costs, coupled with an increase in the cost of labour, made cost control more important to the business.

If we can save the [food] wastage, we can reduce the cost. Tomato: one case before, we can get it £7 - now it's £15. Wastage has become unaffordable. CHEF9

The overheads for here are absolutely astronomical. The gas, the electric, the water, everything you know. And then obviously the staff ... that's going up again next month. Minimum wage went up. CHEF6

Although local produce was preferred, there was a recognition that some local produce is more expensive. Furthermore, chefs felt that customers expected ingredients to be available all year round and this drives up food costs.

... they expect to have some ingredients available all the time ... One of the main problems is the price of UK products because, I think it's not so much sustained by how it's been made or farmed or produced; it's the people that need to be educated. CHEF1

Sustainability was also seen as a way to reduce costs, in turn improving both the environmental and financial sustainability of the business.

... sustainability is very fashionable. Is sustainability actually about people trying to save our planet or trying to save money? ... Customers love sustainability. You're saving money. You're saving food going in the bin, and you're making something taste good. So, for me it's three tick boxes. CHEF11

However, some chefs also felt that being sustainable comes at a cost, for example, referring to the premium of using organic products. Some felt this could be a significant barrier to businesses adopting more sustainable practices.

You can look for organic but then you have to pay a huge premium and not all our customers are wanting to pay that extra premium. CHEF10

3.1.3. Cooking from scratch

Chefs talked about cooking from scratch using fresh ingredients and avoiding buying in food products, such as sauces and meat analogues. Chefs also considered how ingredients could be utilised effectively to increase yield and reduce waste. A few referred to nose-to-tail cooking (i.e. using as many of the edible parts of an ingredient as possible), and others referred to preservation methods, such as pickling and fermenting, and using the same ingredients in multiple dishes. This relates to the previous sub-theme of increased operating costs, as chefs felt this was an effective way to mitigate against the rising costs of ingredients by making these go further.

I prefer to use all parts of the food that I buy. I try to throw away nothing, even, you know, the skin and the bones. CHEF13

What we try and do is: if we've got an abundance of stuff, we'll preserve it - pickle or ferment. So, for example, beetroot because there's so much of it, we will pickle it and use it through the sandwiches and salads. CHEF15

You can repurpose ingredients across different dishes, and that again, it helps with the waste. CHEF8

In the context of plant-based and vegan dishes, chefs questioned the use of meat analogues or processed products, and their sustainability and price.

If you read ingredients on plant-based sausage, burger, there is a lot of ingredients, which I will never use in my restaurant ... we have some burgers, but we make (these) by ourselves. We're using beans, chick-peas

and lentils, sun-dried tomatoes, olives, capers to make the vegan burgers. CHEF2

I don't think it's sustainable in my eyes, and the prices of those [meat analogue products] ... I don't think they are as healthy. I think down the line, that will be a bit of a diet watch out [health concern] if I'm being honest. CHEF7

3.2. Changing the menu – the dish selection

Chefs explained how they decide on the number and type of dishes on their menus, and specifically the importance of having popular dishes that change with the seasons and have low food waste.

3.2.1. Changing with the seasons

Most chefs preferred to change their dishes on the menu with the seasons; this was to ensure ingredients were available, and also supported their preference for using fresh, local ingredients.

So, things change as the seasons go. So right now, we've got amazing spring summer vegetables coming through; so, we started to use more of those now. CHEF15

However, rather than having a full menu change every season (e.g. 3-month rotation), chefs tweaked menus if dishes were not selling or if the season of a specific ingredient was ending.

We're not really tied down – like being part of a chain; so, if something's not working, things [on the menu] can change ... Being an independent (restaurant), you can just change stuff whenever you want. CHEF12

3.2.2. Evaluating the popularity of dishes

It was emphasised that dishes must sell to stay on the menu, with an even sales mix (with all dishes equally popular), a key indicator of a successful menu. Chefs prioritised keeping food waste to a minimum, thereby increasing gross profit and contributing to the bottom line. Some chefs talked about dishes having become so popular that they are always included on the menu, acting like a signature dish for the restaurant.

For me, I do like the varied split [sales mix]. If something's not selling on there, there is no point in being on there - apart from the vegetarian dishes - but everything else, we get a good sales mix and a good spread across all the board. CHEF7

Specials (special dishes not included on the main menu) were seen as an opportunity to test new dishes and evaluate their popularity, as well as use up excess stock or ingredients (in too few quantities to warrant a main menu item). The chefs that employed nose-to-tail cooking and bought in a whole carcass referred to using the parts of the animal with low yield (e.g. kidney, heart) for specials. Chefs also talked about suppliers who may provide a competitive price for products in surplus stock, and that is often used as a basis of a special dish, reducing food waste across the supply chain, and increasing the gross profit margin of the dish.

I'll try use the specials as a bit of an experiment for future menus, to test dishes out ... But a lot of it is just what I've got left up to use, to cut down on wastage. That's what most chefs use specials boards for. CHEF12

3.2.3. Adapting the menu

Chefs knew how to adapt the menu to cater for dietary requirements and understood the importance of designing a menu that met the needs of a growing proportion of the consumer market. Chefs also emphasised the importance of vegetarian dishes appealing to all diners (not only vegetarians). However, some chefs accepted that this was difficult to achieve, with vegetarian dishes not as popular; the importance of having an even sales mix and ensuring that all dishes sold was emphasised.

The menu designs these days: you have to be open to people with allergies, dietary requirements, and being vegan. So, we try to plan the menu where we can adapt dishes for all these people. We try to be gluten-free and coeliac as much as we can. CHEF1

Chefs talked about dietary requirements and adapting the menu, so that diners (with dietary requirements) did not feel that they were being treated like an afterthought.

We use plant-based cream in the mushrooms [dish], and we do a plant-based burger, a mushroom burger, and we even changed all the mayo to vegan. I mean, there's no difference in the price. CHEF7

3.3. Communicating the menu to the customer – the menu design

Several ways in which the restaurant's menu can be communicated to customers were referred to by chefs, including its layout, size, and the type of information included.

3.3.1. Layout, structure and size

Although chefs preferred to offer more dishes, they highlighted how limited resources, such as the size of the kitchen or the number of chefs on duty, might constrain the size of the menu. Chefs recognised that, whilst menus must offer enough choice, larger menus can be tricky for the customer to navigate, and smaller menus can also help with minimising food waste. Chefs also felt smaller menus encouraged frequent menu changes and ensured currency and interest for customers.

We think something very small means customers will enjoy, and they don't have any confusions. They don't want it to waste the time to read the menu as well. My opinion is small menu is good because we need to change [regularly]. CHEF9

Chefs talked about how menus printed in-house have financial and environmental benefits, as chefs can print what they need each day and make changes when, for example, price or availability of specific ingredients fluctuate. Layout was also considered, notably to give vegan and vegetarian dishes prominence, make the menu navigable, and make certain dishes easy to find.

What we're trying to do with our vegan section ... because it used to be down here somewhere out the way forever ... and I said, "Why don't we just incorporate it in the main menu?" And then people think you're thinking about them. CHEF8

Interestingly, one chef specifically referred to how the layout can be used to influence and promote the selection of specific dishes.

I'm dividing by section and I'm trying to put on different sides what I want to sell more and what I want to sell less because of the [gross profit] margin, or because it's harder to make this kind of dish, I'll put somewhere else. Less popularity, high margin needs to go somewhere else ... like a puzzle. CHEF2

3.3.2. Information to include on the menu

There was a reluctance to provide full allergen information on the menu, with most chefs choosing to add a statement regarding the availability of full allergen information.

We do what most places do - and just put a statement across the bottom, "if you have any queries speak to the waiting staff", because, otherwise, you know, it's just all the symbols. It's just ridiculous; celery seeds, dairy, gluten and on and on and on. CHEF4

Specific labels (e.g. gluten-free, vegan) were used primarily to help diners. Chefs referred to the menu communicating information about specific dishes and managing customer expectations, such as how dishes are prepared and cooking times, when working with fresh ingredients, cooked to order. Chefs expressed how they preferred short and concise

descriptors identifying the primary dish ingredients. Chefs perceived this as a contemporary, upmarket way of writing menus and differentiated them from larger, chain restaurants.

If I looked [at] a menu and it said like "Cajun Chicken", then below, it said "Panéed [breadcrumbs] chicken, corn-fed chicken from blah blah ... in a delicious this - delicious that" ... I'd have said it was like a cheap pub. I've found lately, maybe last four of five years, they [restaurants] just put stuff like this [points to short descriptor on menu]. CHEF11

I don't want all of this M&S kind of ... I want it to be abrupt and to the point. You know I don't want 'in a lovely rich, red wine gravy' like you know, 'this is not just food it's M&S food'. CHEF6

Interestingly, chefs reported that descriptors were not used to relay a dish's sustainable credentials, as this would make the menu too long, and customers would "get bored". This also corresponded with chefs' preference for smaller menus which they felt were easier for customers to navigate. Instead, many chefs talked about service staff providing additional information to customers. This was seen as an efficient way for customers to have meaningful and interesting interaction with service staff.

Realistically, we could say hand-dived scallops from X, UK grown red grapes, baby gem lettuce from my garden, cucumber from York and pears from my mum blah blah ... it would just turn into this long thing, you will just get bored of it. CHEF11

We tend to have a more verbal explanation from the waiter because at the same time we try to educate the customer ... and especially terminology [on menus] these days is crazy. CHEF1

3.4. A transversal theme: protecting the bottom line – making environmental sustainability pay

A transversal theme, protecting the bottom line (and making environmental sustainability pay), tied all the other themes together. It was evident that, for the chefs, protecting the bottom line was pivotal to all decisions made, including those related to environmental sustainability. The bottom line influenced what chefs put on the menu, e.g. foraging for ingredients that would be expensive to purchase, designing specials to use surplus ingredients. Chefs also preferred to print menus in-house, and only the number needed for a given day. Decisions about the food offer, the dishes for the menu, and the design of the menu itself, needed to be financially sustainable, with often complimentary environmental outcomes. For example, chefs talked about repurposing ingredients to reduce the types of ingredients needed, which also reduced food waste, and pickling or fermenting products to extend their shelf life. These practices which were highlighted by chefs were primarily driven by financial interests, although chefs themselves also recognised the positive environmental benefits, making environmental sustainability pay.

4. Discussion

This study explored head chefs' knowledge, awareness and practices related to menu design and the extent to which environmental sustainability is considered and influences the menu design process. Findings revealed significant challenges when designing menus, and steps taken to improve the performance, profitability, and environmental sustainability of menus. Chefs made complex decisions about their menu, and these were influenced by the cost and availability of produce, increasing operating costs (such as energy and labour), and the resources available within the business.

On the relevance of environmental sustainability, findings emphasised the importance of changing dishes according to seasonal availability of produce, and ensuring all menu items sell, as unpopular dishes waste food and time in preparing the ingredients. Chefs explained how they prioritised cooking from scratch using fresh ingredients and looked

to prevent food waste by repurposing or preserving ingredients, foraging, or by utilising all parts of an ingredient through nose-to-tail cooking. Whilst many of these actions, that were discussed by chefs in their interviews, were driven by financial factors, some chefs recognised the added environmental benefit. Findings also highlighted the importance of communicating dishes effectively with customers, through menu structure, layout, and the information included. Chefs were cognisant of offering plant-based as well as vegetarian and vegan dishes, and catering for other dietary requirements. The results of this study add to the existing research base on the restaurant menu offer (Fusté-Forné and Noguer-Juncà, 2023; Parkin and Attwood, 2022), dish selection (Johns et al., 2013; Nebioğlu, 2020; Özgür Göde and Ekerşil, 2023), and menu design (Andersson and Nelander, 2021; Chen et al., 2020).

Chefs in the presented study felt that customers expect certain ingredients to be available all year round and this conflicts with chefs' desires to use local and seasonal produce. Likewise, chefs perceived that local, sustainable food can be more expensive. Restaurants have been reported to be wary of placing too much emphasis on the provenance or locality of certain ingredients, considering the concerns over food availability and prices (Gomez-Zavaglia et al., 2020). This may be related specifically to organic produce, which often comes at a price premium (Donaher and Lynes, 2017), unaffordable for many SMEs. What is clear, however, is the importance chefs placed on local food and their role in supporting local communities of food producers, and their responsibility to promote a farm-to-fork value chain (Riccaboni et al., 2021), enhancing the transparency and traceability of ingredients (Vu et al., 2023). It is important to acknowledge, however, the challenges of offering a fully localised menu, given the international nature of some restaurants and international influences, as found in this study. This is supported by literature where the role of local food can be challenged, as customers increasingly expect global influences to enhance their restaurant experience (Fusté-Forné and Noguer-Juncà, 2023).

Chefs in this study referred to being flexible when changing dishes, either on a complete, seasonal menu cycle or a rolling rotation of dishes. This reflects how SMEs can be agile and adaptable, with timely changes to reflect the needs of the business, such as changes in consumer demand or fluctuations in food prices. This study highlighted this advantage over larger, chain restaurants, which typically lack the agility to tweak or adapt menus in response to, for example, the popularity of dishes or changes to the availability of ingredients.

It has been recognised that having a specified process or model is crucial to chefs knowing what needs to be done during menu planning (Ho et al., 2021). For example, the stage-gate model, commonly used in the restaurant industry for product development, proposes well-defined stages with clear decision making (Azanedo et al., 2020). During this study, however, chefs referred to tweaking dishes and menus as and when they felt it was needed. This is consistent with other studies, where the stage-gate model was more like a philosophy than a formal process (Howieson et al., 2014), and another study which referred to chefs approaching menu design more by trial and error than in any systematic way (IP and Chark, 2023). When it came to evaluating menu item success, chefs in this study prioritised the popularity of dishes and mitigating food waste. Chefs managed the menu in an intuitive way, being flexible in changing dishes whenever they wanted to, and with no apparent structured process. There was consensus from the interviews that smaller menus were easier and cost-effective, whilst helping customers to navigate and not "get bored". This perspective reflects research relating to the ideal number of dishes per course (e.g. starter, main course) on a menu to be 7–10 (Johns et al., 2013). Interestingly, only five of the restaurants had fewer than ten dishes, with the remainder having more.

A few chefs in this study discussed how they attempted to give vegetarian dishes more prominence on the menu, for example by moving these dishes to the top. Restaurants can improve the environmental sustainability of their business by providing and promoting sustainable dishes. Positioning of dishes on a menu has been found to be important,

with previous work investigating how placing a vegetarian dish at the top of the menu can decrease the share of meat dishes sold by up to 11 % (Andersson and Nelander, 2021). The median percentage of vegetarian dishes in restaurants in this study was 25 %, lower than the 31 % found in chain restaurants (Lumina Intelligence, 2023). Meat eaters have been found to be significantly more likely to choose a vegetarian meal when at least 75 % of the dishes are vegetarian (Parkin and Attwood, 2022).

Chefs in this study felt that vegan and vegetarian dishes must appeal to all customers and contribute to an even sales mix. They also felt it was important to label vegan and vegetarian dishes (for example with VE and V, respectively) so that these could be easily found. Interestingly, replacing a vegan label (VE) with a low emission label (LE) was found to increase sales of plant-based dishes, provided labels are accompanied by an explanation (Buratto and Lotti, 2024). Other research found that using appealing dish names in place of names such as *vegan burger*, for example, can increase the appeal for some market segments, in this case, environmentally and health-oriented meat-eaters (Greene et al., 2024).

Menu descriptors created much discussion and there was a preference from most chefs for short, concise descriptors. Chefs did not feel that descriptors were the best means to inform customers of the sustainable credentials of dishes and were concerned about having too much information on their menus and overwhelming customers. This emphasises the importance that chefs place on customer experience in any menu design decision. This is also consistent with a previous study where, rather than overloading menus with information, dedicated apps or smart diagrams could be used for information related to environmental sustainability (specifically carbon footprint), which could be available on request (Filimonau and Krivcova, 2017). It is interesting that the chefs in the presented study did not feel that descriptors were the best way to present information on sustainability, particularly considering how menu item descriptors can influence customer selection of dishes. For example, one study reported that describing vegetables in an indulgent way can increase both selection frequency and amount consumed (Turnwald et al., 2017). Similarly, descriptive labels such as 'traditional style', 'regional' or 'organic' can increase the selection of more sustainable dishes (Ohlhausen and Langen, 2020). With the preference for shorter descriptors, as emphasised in the present study, additional information was often provided to customers by service staff. This relayed the story of the menu, for example, the pride of using local suppliers to serve seasonal, sustainable produce – and chefs felt that this helped customers make informed decisions about what to order and helped to educate customers on the food offer.

What was clear from the chefs in this study is how they overwhelmingly prioritised financial sustainability in menu decisions, protecting the bottom line. This emphasises how improving the environmental credentials of menus must be cost-effective, as financial resources are often in short supply, highlighted by previous studies (Jones, 2023; Thu Bui and Filimonau, 2021). Further research should be undertaken into how chefs can design menus to promote environmental sustainability, whilst safeguarding financial sustainability, and meeting customer expectations.

Dimensions of sustainable food experiences in restaurants have been previously categorised into five pillars: pleasure, plate, place, people, and planet (Batat, 2020). The presented study builds on this theory, focusing specifically on the menu itself. For example, chefs highlighted local produce – and although this may have a limited impact, with transportation accounting for 11 % of food GHG emissions (Weber and Matthews, 2008), there is a substantial social and economic benefit in supporting local farmers and food producers, building relationships in the local community, and improving the local economy (Riccaboni et al., 2021; Vargas et al., 2021). This reflects restaurants helping local suppliers, farmers, and producers (the 'people' pillar). Chefs in this study also highlighted reducing food waste by repurposing or preserving ingredients, foraging, or by utilising all parts of an ingredients, and highlighted meat which is seen as the most expensive and unsustainable of commodities (Biermann and Rau, 2020). In the presented study, some

chefs explained how they adopted a nose-to-tail philosophy in dishes; this corresponds to the 'plate' pillar, which can be an effective way to improve the environmental sustainability credentials of a restaurant (Mrusek et al., 2022; Nitzko and Spiller, 2019) and also has positive financial returns. The findings from this study emphasise how sustainable practices can also improve business performance (Jones, 2023) and chefs' resourcefulness can help restaurants to stay competitive (Filimonau et al., 2023), for example through foraging or fermenting ingredients to prevent food waste, practices that arose in some interviews. Chefs in this study apparently prioritised reducing food waste to save costs; whilst environmental sustainability may not have been the primary driver in adopting food waste management procedures, this still addresses the environmental and social responsibilities of the business (Thu Bui and Filimonau, 2021). This corresponds to reducing food waste being crucial to supporting sustainable food service (the 'planet' pillar).

This study extends the evidence on how chefs approach menu design (IP and Chark, 2023; Nebioglu, 2020; Ozdemir and Caliskan, 2015; Özgür Göde and Ekergil, 2023) as well as the implications of menu design on the environmental sustainability performance of their restaurants (Batat, 2020; Takacs and Borrión, 2020). Findings reveal the significant challenges for chefs when designing menus. Findings from this work also point to practical steps to improve menu performance, profitability, and environmental sustainability. This can include practices such as evaluating how ingredients are utilised across a menu to avoid single purpose ingredients, using all edible parts of an ingredient, pickling and fermenting ingredients to increase shelf life, and foraging. Further, smaller and more agile menus, and shorter supply chains dominated by local produce, can also enable businesses to better respond to potential changes in the operating environment, such as food prices and availability. Chefs highlighted the relevance of having popular dishes across the menu but, interestingly, did not use sales data to evaluate the popularity of dishes, instead relying on their own perception of sales. This may be a potential missed opportunity to ascertain popularity and also reduce subsequent food waste from unpopular dishes; further work to explore this is recommended. Likewise, customers' experiences were paramount when chefs considered their menu design, and for example, they avoided overwhelming customers with excessive information, specifically related to environmental sustainability. Therefore, further research into customers' perceptions around menus and the relevance of the environmental sustainability of food to their dish selections when eating out, is needed.

4.1. Limitations

This study was undertaken in the context of restaurant SMEs in Yorkshire and Derbyshire, UK, and findings may differ to other areas (for example, a greater emphasis on sustainable fish and seafood from chefs based in coastal regions), and at larger, chain restaurants. In terms of study participants, there were no females, indicative of the underrepresentation of female chefs in the UK, (15 % (ONS, 2019)). Also, there was only one chef under the age of 35. It is therefore difficult to understand if female or younger chefs may have different perspectives, illustrated by two chefs referring to themselves as "old school". Researcher bias (Cairns-Lee et al., 2022) is a limitation of the data collection process, as the interviewer was a former chef responsible for menu design. However, reflexivity was employed to mitigate against this, with memoing throughout the data collection and analysis. Another limitation of the study is social desirability bias, where participants may describe themselves or actions in socially favourable ways, for example, relating to environmentally sustainable behaviour (Zhu et al., 2024). There was an attempt to mitigate against this by emphasising to the chefs to speak freely and that there were 'no right or wrong answers'.

5. Conclusion

The complex decisions chefs in this study made about what food to

put on their menu were influenced by the cost and availability of produce, increasing operating costs, and the resources available within the business. Chefs recognised that being in restaurants that were SMEs was advantageous, in that they were able to adapt to changes in the availability of seasonal produce by cooking from scratch using fresh ingredients, keeping supply chains short and buying local food, which supported local economies. Chefs also revealed their resourcefulness in repurposing ingredients or pickling or fermenting ingredients to extend their shelf life. Monitoring the popularity of dishes, particularly vegetarian dishes which chefs reported must appeal to all diners, was also used to minimise food waste and ensure small and agile menus. Clear and concise dish descriptors helped to keep menus interesting and easy to navigate for customers, with additional information being provided by service staff. Any changes to improve the environmental credentials of the menu must be financially sustainable and protect the bottom line, thereby improving the performance, profitability, and environmental sustainability of restaurant SMEs.

Practical implications of this study correspond to designing menus with respect to aspects of environmental sustainability, including utilising ingredients across a menu, using all edible parts of an ingredient, and foraging. Further, small and agile menus, alongside short supply chains dominated by local produce, have a role to play in environmental sustainability. This may be particularly relevant given the ongoing need to respond effectively to changes in food prices and availability.

This study, conducted with restaurant SMEs in Yorkshire and Derbyshire, UK, may not reflect the perspectives of chefs in other regions or larger chain restaurants. Additionally, the underrepresentation of female and younger chefs, and researcher and social desirability biases are acknowledged as limitations. Research to explore customers' perceptions around menus and the relevance of environmental sustainability to their choices when eating out, is recommended. Likewise, work to understand how restaurant sales data can be effectively used (e.g. identifying unpopular dishes to reduce food waste) has a role to play in supporting environmentally sustainable practices in restaurants.

CRediT authorship contribution statement

C. Jones: Writing – review & editing, Writing – original draft, Methodology, Investigation, Formal analysis. **C.W. Young:** Writing – review & editing, Methodology, Formal analysis. **H. Ensaff:** Writing – review & editing, Methodology, Formal analysis.

Ethical approval

This study was given approval by the Research Ethics Committee at the University of Leeds (AREA 21–161). Informed written consent was obtained from participants before the interviews.

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Declaration of competing interest

None.

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Data availability

Datasets are not available because consent from participants to share

data was restricted to the research team.

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