EasyChair Preprint

№ 15957

A Rapid Review on Research Linked to Chefs, Greenhouse Gas Emissions and the Food System

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March 31, 2025

A RAPID REVIEW ON RESEARCH LINKED TO CHEFS, GREENHOUSE GAS EMISSIONS AND THE FOOD SYSTEM

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ABSTRACT

Chefs have been targeted as actors of change in the food system for sustainable and healthy diets. Yet we know little about chefs' skills required to reduce greenhouse gas (GHG) emissions associated with menus.

A rapid review (RR) carried out in January 2024 explored peer-reviewed research linked to chefs, GHG emissions and the food system to develop an understanding of potential pathways chefs influence the food system and to map their position in it.

RR found an increasing number of publications linked to chefs, food systems and GHG emissions. The synthesis of 25 peer-reviewed academic papers suggests that research has been carried out on different dimensions and that Bronfenbrenner's Ecological Systems Theory could be applied as a framework. Some papers suggest that chefs have various forms of influence on changes in their immediate micro-food system and that these ripples if observed over longer periods, can be far-reaching and impact the wider food system. However, no clear connection between GHG emission reduction in the sector and chefs has been made in spite increasing interest of stakeholders to get chefs engaged in reducing food-associated GHG emissions.

KEYWORDS

chef, greenhouse gas emissions, food system, Bronfenbrenner's ecological systems theory

- Keywords (six to eight, in lower case where possible)

INTRODUCTION

Food and drink are estimated to be responsible for 35% of UK territorial GHG emissions [1]. The Hospitality and Food Service (HaFS) sector is an economically significant contributor to the UK food system [2] and has a role in shifting its environmental impact.

Eating out has become prevalent in the UK with an estimated 8.67 million people saying they have visited restaurants two to three times a month in 2020 [3]. The recovery of the catering sector since the Covid closures suggests this trend is likely to increase [4]. So, the HaFS sector should take an active role in reducing its GHG emissions and other environmental impacts.

GHG emission contributions can be assessed as part of Environmental Social Governance reporting in line with the UK Net-zero strategy [5] this includes reporting scope 1 and 2 emissions and estimating scope 3 emissions. WRAP [6] reports 5% of the UK food systems' GHG emissions are associated with the HaFS sector. A progress report [7] indicated a 12% reduction in GHG emissions between 2019 and 2020 for the sector when substantial closures occurred due to the Covid pandemic. Research on different HaFS businesses shows that the contribution towards scope 3 emissions

varies between food-led hospitality businesses and those which focus on accommodation or events [8], [9], [10], [11], [12].

Some of food-led businesses in the sector i.e., Compass Group [13], Sodexo [14] or The Restaurant Group [15] are reporting publicly on scope 3 emissions, and those are the proportionately highest contributions to their total business carbon footprint. Food procurement and food waste are larger contributors.

When tackling food waste and GHG emissions in food-led HaFS, stakeholders increasingly see chefs as an important group of employees who could help to reduce both. That is because in many organisations' chefs take an active role in writing menus and procuring food.

Beyond the role in businesses, there might be other pathways to how chefs influence the food system. Research suggests chefs are often linked to food media partnership contracts helping food producers to test and promote novel ingredients and foods [16]. Some argue that if these early test recipes are picked up by food media and social media profiles with large followings early pilot ideas become mainstream. An example of this is the rise of the Nordic Cuisine [17].

These pathways of chefs' influence on culture and heritage as well as the importance of understanding how chefs as actors of the hospitality industry influence society are relevant to food systems research. However, how and if chefs are indeed in positions to do that has not been well evidenced.

Thus, this paper aims to map where chefs sit in the food system and explore pathways and dynamics in which chefs accelerate the move of the sector to reduce its environmental impacts.

A RR was carried out in January 2024 exploring peer-reviewed research linked to chefs, GHG emissions and the food system; developing an understanding of those pathways and dynamics; and mapping their position in the food system based on the review. The findings of this scoping work are shared here.

METHODOLOGY

A Boolean search on six academic databases (Green File, ProQuest, EBSCO, Science Direct, PubMed and Scopus) was carried out using the following search terms: 'chef?', 'food system', 'food systems map', 'scope 3', 'greenhouse gas emission?', 'green restaurant', 'environmental impact'. Limiting criteria were set as follows: only English language, peer-reviewed, full-text documents between 2004 and 2024.

In the first round of review, all abstracts were screened. Any articles which did not match the above criteria were removed. A nine-point relevance Likert scale (1= high relevance; 1.5; 2; 2.5; 3; 3.5; 4; 4.5; 5 = low relevance) was applied and any articles rated 5 were omitted.

In the second round of the review, the remaining articles were fully read, categorised by publication source, publication date, research lens and the relevance scores were re-rated. The content was thematically coded and relevant data was extracted for further analysis and synthesis.

RESULTS

DESCRIPTIVE RESULTS

The Boolean search delivered 100 documents. Due to time constraints, a peer-reviewed book chapter [18], a thesis [19] and a research article containing 154 research abstracts [20] were removed for review at a later stage. After the first review stage 30 articles were included for further critical appraisal.

The timeline of articles in Table 1 shows an increase in publications since 2004 for the selected search terms.

Publication Year	2008	2011	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
EBSCO	1	1	1			1	1	1	1		2	
Green File				1					1			
ProQuest				1					1	4	3	2
Science Direct		1	1		1		2			1	2	
Total	1	2	2	2	1	1	3	1	3	5	7	2

Table 1 Number of publications per year and database included in the first review

During the second review round articles were read in full and the relevance was adjusted considering the evidence quality. Five further articles were downgraded to score 5 (the lowest relevance score) and are not included in this review.

QUALITATIVE RESULTS

The critical review of twenty-five articles in Table 2 uncovered several research dimensions exploring the HaFS sector and chefs' role in the food system. We have chosen the conceptual framework proposed by Bronfenbrenner in the ecological systems theory [21] to classify the articles. Through this framework, these articles can be mapped into macro, exo, meso, and microsystems approaches.

	Systems dimension	**Paper**
1	Exosystem	Batistela dos Santos, E., da Costa Maynard, D., Zandonadi, R.P., Raposo, A. and Assunção Botelho, R.B., 2022. Sustainability recommendations and practices in school feeding: a systematic review. Kompass Nutrition & Dietetics, 2(2), pp.83-102. [22]
2	Exosystem	Chiffoleau, Y. and Dourian, T., 2020. Sustainable food supply chains: is shortening the answer? A literature review for a research and innovation agenda. Sustainability, 12(23), p.9831. [23]
3	Exosystem	Givens, G. and Dunning, R., 2019. Distributor intermediation in the farm to food service value chain. Renewable Agriculture and Food Systems, 34(3), pp.268-270. [24]

4	Exosystem	Hoolohan, C., McLachlan, C. and Mander, S., 2016. Trends and drivers of end-use energy demand and the implications for managing energy in food supply chains: Synthesising insights from the social sciences. Sustainable Production and Consumption, 8, pp.1-17 [25]
5	Exosystem	Nicastro, R. and Carillo, P., 2021. Food loss and waste prevention strategies from farm to fork. Sustainability, 13(10), p.5443. [26]
6	Exosystem	Some, S., Roy, J., Chatterjee, J.S. and Butt, M.H., 2022. Low demand mitigation options for achieving Sustainable Development Goals: Role of reduced food waste and sustainable dietary choice. Journal of Cleaner Production, 369, p.133432. [27]
7	Exosystem	Sovacool, B.K., Bazilian, M., Griffiths, S., Kim, J., Foley, A. and Rooney, D., 2021. Decarbonizing the food and beverages industry: A critical and systematic review of developments, sociotechnical systems and policy options. Renewable and Sustainable Energy Reviews, 143, p.110856. [28]
8	Mesosystem	Bux, C., Aluculesei, A.C. and Moagăr-Poladian, S., 2022. How to monitor the transition to sustainable food services and lodging accommodation activities: A bibliometric approach. Sustainability, 14(15), p.9102. [29]
9	Mesosystem	Chawla, G., Lugosi, P. and Hawkins, R., 2021. Food waste drivers in corporate luxury hotels: Competing perceptions and priorities across the service cycle. Tourism and Hospitality, 2(3), pp.302-318. [30]
10	Mesosystem	Gössling, S., Garrod, B., Aall, C., Hille, J. and Peeters, P., 2011. Food management in tourism: Reducing tourism's carbon 'foodprint'. Tourism Management, 32(3), pp.534-543 [31]
11	Mesosystem	Jakubiak, M., 2015. An exploratory study on sustainable practices implemented in food supply chain management of the five star hotels in Bangkok. AU-GSB e-JOURNAL, 8(1). [32]
12	Mesosystem	Martin-Rios, C., Demen-Meier, C., Gössling, S. and Cornuz, C., 2018. Food waste management innovations in the foodservice industry. Waste management, 79, pp.196-206. [33]
13	Mesosystem	Pirani, S.I. and Arafat, H.A., 2014. Solid waste management in the hospitality industry: A review. Journal of Environmental Management, 146, pp.320-336. [34]
14	Mesosystem	Prag, A.A., Abrahams, J.B., Daniele, F., Dodhia, M.S., Feng, C., Hahn, K., Kristiansen, S., Leitner, A.M., Mendez, J.P., Mohr, M. and Møller, S.F., 2023. Scenarios for Reducing Greenhouse Gas Emissions from Food Procurement for Public School Kitchens in Copenhagen. Sustainability, 15(17), p.13002. [35]
15	Mesosystem	Reznar, M.M., Brennecke, K., Eathorne, J. and Gittelsohn, J., 2019. A cross-sectional description of mobile food vendors and the foods they serve: potential partners in delivering healthier food-away-from-home choices. BMC public health, 19(1), pp.1-11. [36]
16	Microsystem	Brouwer, B.O., Murphy, K.M. and Jones, S.S., 2016. Plant breeding for local food systems: A contextual review of end-use selection for small grains and dry beans in Western Washington. Renewable Agriculture and Food Systems, 31(2), pp.172-184. [37]
17	Microsystem	Chesbrough, H., Kim, S. and Agogino, A., 2014. Chez Panisse: Building an open innovation ecosystem. California management review, 56(4), pp.144-171. [38]
18	Microsystem	De Guzman, A.B., Mesana, J.C.B. and Roman, J.A.M., 2022. Examining Chefs' Social Responsibility (CSR) during the COVID-19 pandemic. Anatolia, 33(3), pp.404-414. [39]
19	Microsystem	De La Lama, R.L., De La Puente, S. and Valdés-Velásquez, A., 2020. Bringing sustainable seafood back to the table: exploring chefs' knowledge, attitudes and practices in Peru. Oryx, 54(4), pp.520-528. [40]
20	Microsystem	Firth, J. and Passidomo, C., 2022. New Orleans' "restaurant renaissance", chef humanitarians, and the New Southern food movement. Food, Culture & Society, 25(2), pp.183-200. [41]
21	Microsystem	Gomez, M.L. and Bouty, I., 2011. The emergence of an influential practice: Food for thought. Organization studies, 32(7), pp.921-940. [42]

22	Microsystem	Koponen, S. and Niva, M., 2020. New Nordic upmarket bistros and the practical configurations of artful dining. *Food, Culture & Society*, *23*(1), pp.30-45.[43]
23	Macrosystem	Fry, J.P., Stodden, B., Brace, A.M. and Laestadius, L.I., 2022. A Tale of Two Urgent Food System Challenges: Comparative Analysis of Approaches to Reduce High-Meat Diets and Wasted Food as Covered in US Newspapers. Sustainability, 14(19), p.12083. [44]
24	Macrosystem	Mapes, G., 2018. (De) constructing distinction: Class inequality and elite authenticity in mediatized food discourse. Journal of Sociolinguistics, 22(3), pp.265-287. [45]
25	Macrosystem	Troncoso-Pantoja, C., Cáceres-Rodríguez, P., Amaya-Placencia, A., Lataste-Quintana, C. and Valenzuela, R., 2023. Exploring the Meanings of Food Sustainability: An Interpretive Phenomenological Analysis. Sustainability, 15(18), p.13548. [46]

Table 2 Summary of reviewed papers and systems dimensions

EXOSYTEMS APPROACH

The exosystems research dimension takes a view which incorporates the whole food system. These papers ([22], [23], [24], [25], [26], [27], [28] describe how the supply chain of the HaFS sector operates. Nicastro and Carillo's [26] review has inspired the exosystems dimension model in Figure 1. It shows food flows between different [26] stakeholders and is useful for tracing hotspots of food waste and GHG emissions in foods. Retail and Food Service are envisaged by Nicastro and Carillo [26] as one stakeholder because both share similarities in how they procure and sell. Chefs are invisible in this research dimension, but if all dimensions are understood as part of one nested system, chefs would be included without being detectable.

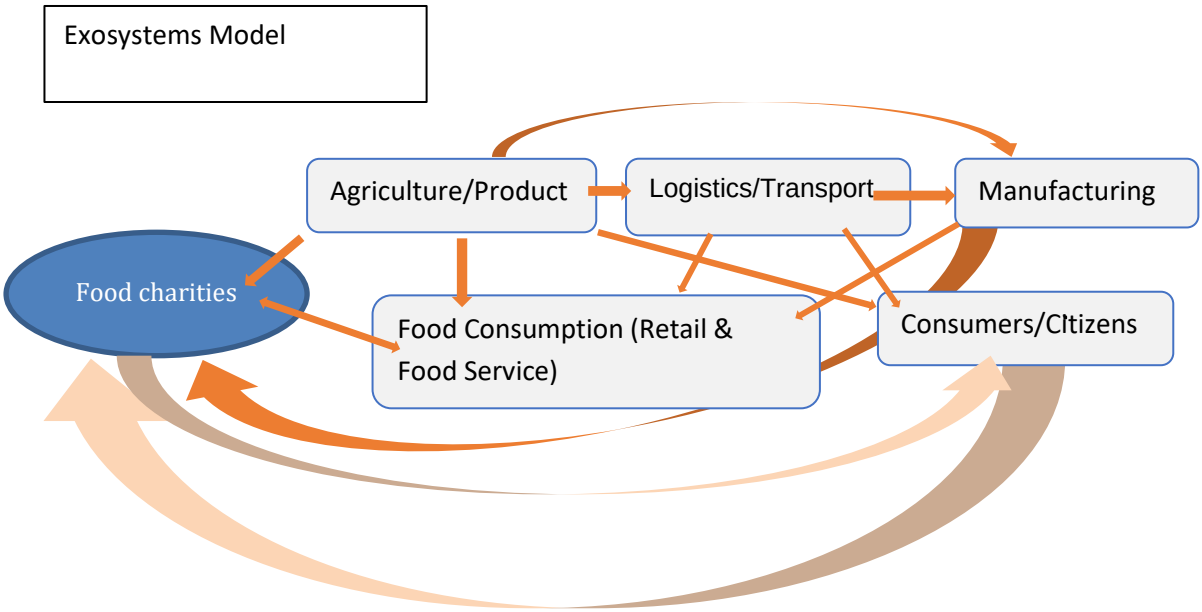

Figure 1 Exosystem Model developed by Nicastro and Carillo [26]

MESOSYSTEMS APPROACH

The mesosystems research dimension [29], [30], [31], [32], [33], [34], [35], [36] brings about more granularity and acknowledges differences in food consumption. Pirani and Arafat [34], and Gössling et al. [31] are notable examples of the mesosystems dimension in the food service industry. Pirani and Arafat [34], reviewing hospitality waste streams state that waste streams vary depending on the business type. Their research focused on the for-profit sector in the food service industry and shared strategies for waste management alongside recommending similar assessments for other business types of the food service industry. Their work inspired Figure 2 which depicts frequently used categories of the food service industry visualising boundaries that have the potential to influence impacts on the food system. Therefore, research projects should identify where possible which area of the food service sector is researched. The model is limited to four layers but there are other differentiations.

Similar to the exosystems approach chefs' actions remain invisible but are referred to in the papers.

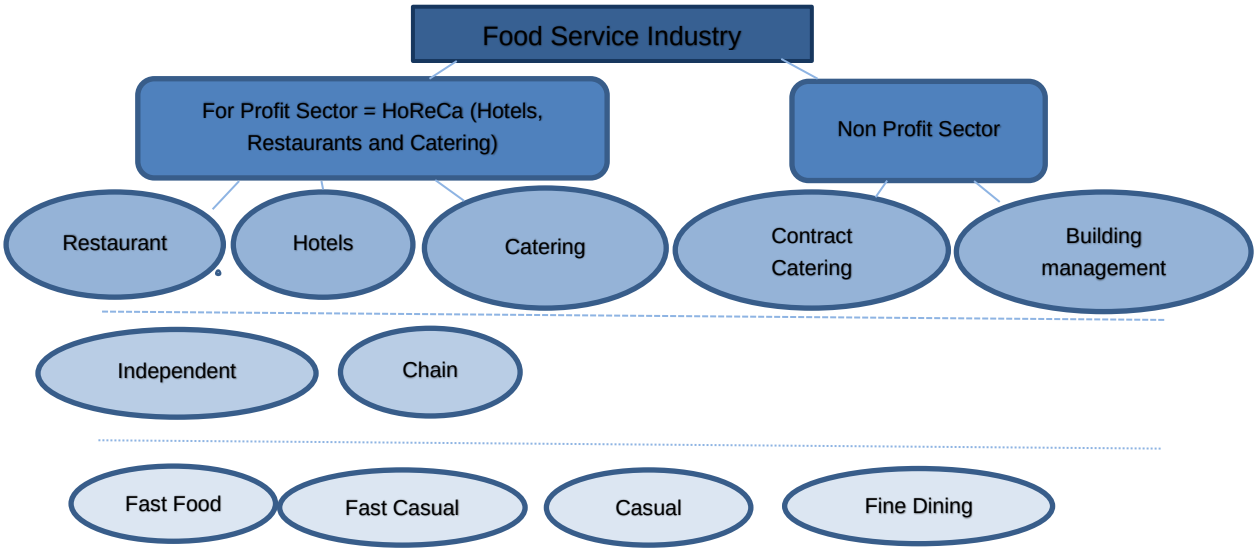

Figure 2 Mesosystem of the Food Service Industry

MICROSYSTEMS APPROACH

The microsystems research dimension [37], [38], [39], [40], [41], [42], [43] makes chefs the centre of the research enquiry. These papers explore the direct relationships chefs have in the food system and what happens between actors in that sphere.

Three papers stand out: Brouwer et al. [37]; Chesbrough et al. [38] and Gomez and Bouty [42] all three papers propose different pathways for how chefs influence their direct food environments. Brouwer et al. [37] and Gomez and Bouty [42] do so by taking a longitudinal case study approach and evidence that systems change processes are based on influence, position and power in the food system, are accumulative and temporal which is something Bronfenbrenner has proposed as the chronosystem [21].

Chesbrough et al. [38] differentiate fields of influence in a case study of the creation of an ecosystem of innovation at a Californian Restaurant. They map the

Areas of influence as:

- Social networks (personal linkages chefs built and reinforced over time)
- Business networks (collaborations between food producers, researchers and artists)
- Media (emergence of food media and the restaurants' linkages to food writers)
- Economic relationships (economies of scale when demanding specific produce and willingness to take financial risks allowing farmers to develop products only for the restaurant)
- Advocacy (set-up of philanthropic foundations).

Gomez and Bouty [42] refer to specific forms of capital in haute cuisine: Michelin stars, ability to innovate, mastery of cooking techniques (technical capital), media coverage, networks, relational forms (social capital), and economic capital. All of these were utilised by a French chef to make vegetables a more prominent component in haute cuisine.

The approach of Brouwer et al. [37] is taken through an agroecological lens and explores participatory farmer–breeder–chef collaborations and whether they support

the breeding of plants in culturally diverse ways and supporting agricultural resilience by broadening germplasm in commercial plant species.

These microsystems approaches give a glimpse into how chefs' influence might move into the meso, exo and macro dimensions of the food system.

MACROSYSTEMS APPROACH

Three research articles [44], [45], [46] took research perspectives which were exploring discourses around food and food sustainability these fit into the macrosystems perspective proposed by Bronfenbrenner [21]. They examine worldviews and meanings of the public discourse around food. They use the work of chefs as a lens to access information on this discourse.

DISCUSSION

The RR reveals a growing body of literature concerning chefs, food systems, and GHG emissions. Synthesizing these papers reveals researchers are exploring various dimensions within the food system. These systems dimensions aid researchers in defining study boundaries and understanding interconnections. The conceptual models, though simplified, offer starting points for investigation.

The systems dimensions have limitations as Neal and Neal [21] highlight because they are simplified versions of reality and do not capture complex interactions between the

systems' dimensions. Boundaries are porous, exemplified by restaurants functioning as both producers and consumers, blurring distinctions between meso and exo-dimensions.

Microsystem research evidence refers to chefs who have worked throughout their lifespan as a chef. People may only work for some part of their lives as chefs but can shorter periods influence the microsystem. Chesbrough et al. [38] for example point out that there were many spin-offs and spin-ins during the business history due to chefs leaving and returning, which would also be difficult to map into the models.

Microsystem research on chefs' careers highlights diverse forms of capital influencing immediate stakeholders, with potential long-term impacts on meso, exo and macro dimensions. While some studies depict positive contributions to food system sustainability [37], [38], [42] others challenge this notion [41]. Additionally, research acknowledges chefs' supportive roles during crises like the COVID-19 pandemic [39], yet questions persist regarding motivations and broader societal benefits.

CONCLUSION

When the food system is studied multiple dimensions must be taken into consideration. This review has used Bronfenbrenner’s Ecological Systems Theory to map chefs into the food system. It helps to explore if and how their actions influence other

stakeholders and food system dimensions. To the authors' knowledge, this has not yet been done through systematic academic research and thus this paper opens the opportunity to link the exo, meso, micro and macrosystems research dimensions to chefs.

Within the reviewed papers no clear connection between GHG emission reduction in the HaFS sector and chefs has been made in spite increasing interest of stakeholders to get chefs engaged in reducing food-associated GHG emissions. This suggests the microsystem in which chefs make sense of the transition towards lower GHG emission food offers and reduced food waste operations is not yet researched. It is also unclear if and how chefs may influence the wider food system and citizens' food choices.

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