

Meta-Engineering Sustainable Food System by Panoramic Co-Configuration as a Developmental Tool

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ABSTRACT

The paper draws upon evidence of the environmental, social and economic threats perceived within the modern food system. The need for change towards sustainability pertains to consumers' eating habits, both within households and in out-of-home settings, conveying to further structural changes upstream the supply chain. This dynamics presents a huge systemic challenge in free market environment, in need of powerful infographic tools about sustainable food choice and its implementation by learning, negotiating and decision making by committed actors within the food system. This paper takes as its point of entry towards the systemic change the catering industry, serving a large proportion of population. The paper presents a panoramic tool for co-configuration of environmental impacts and nutritional aspects of meals, based on bottom-up (contextual) and modular life cycle analysis of staples and existing nutrition information. The tool applies puzzle design, which allows planning of sustainable meals piece by piece, both by playful as well as informed planning of more sustainable ingredients into the meals. The open access tool enables learning, implementation and dissemination of new sustainable food culture.

Keywords: sustainable food system, bottom-up life cycle analysis, infographic, panorama, co-configuration, catering industry, Finland

1. INTRODUCTION

“The era of choice is over” thundered Tim Lang of City University London at preclimate Foodprint conference in Copenhagen 2009 [12]. This ‘free choice’ of food, to suit any (negotiated) consumer preferences and convictions [3], [8], [20], enabled by most extensive retail selections, is the result of long development of the western food system [2]. Goodman and Redclift [10] suggest that compatible and sequential build-up by science, technology, capital investment and industrial structures, as well as changes in the labour market and every-day eating behaviour, created the current modern western food system [2]. However, in the middle of this amazing achievement, the simple (or unreflexive) modernity almost unnoticed turned into reflexive modernity, revealing the risk character of the modern society and the western way of living [4]. Lang [12] condenses his critiques of the unsustainable features of the modern food system in three main aspects. First, environmental impacts featuring climate change and several additional environmental issues [24], [25], [26], including energy availability in the future, make it absolutely necessary to address the energy supply and the environmental impacts of food production. Second, eating habits connected with poor nutrition and diet related diseases seriously threaten the health of western population [27], calling for immediate corrective actions. Third, remedy is required for the new problems of malnutrition, even hunger, which

relate to access to and affordability of food among part of the western population [12].

The perceived sustainability deficit of the current western food system calls for profound changes towards sustainability. However, sustainable food system is an inherently abstract and ideal concept, in need of concrete approach and contextual implementation [18]. The socio-economic and environmental 'betterment' is thus to be understood in normative terms, entailing technical specifications, rather than leaning on them in the first place [18]. The promotion of sustainable food systems is, however, most unlikely to build up by itself; it only can take place by negotiations between system actors and their agreements about the concrete measures needed [9], [18]. Therefore, eventually both the atomized and chain-connected actors across the system levels, from consumers to producers, would need to commit themselves in free market environment to negotiated re-organisation of the food system towards sustainability. Hereby the problem of moving towards sustainable food system allows itself to be split into two sub-problems: which actors within the food system would undertake the task of building more sustainable food system, and by what kind of understanding could they accomplish the task?

This paper suggests that catering industry, serving a vast array of customers by more or less centralised food procurement, would offer an effective entry point by its actors for the change towards sustainability. Furthermore, catering also features celebrities and as a public service, it enables context specific learning of new tastes and food habits [18]. As for the technical specifications, local and organic food have often been presented as epitomes of sustainable food system [18]. However, so far ambiguous and critical views remain about the assumed environmental friendliness and fairness of local and organic food as a scale-bound phenomena [18]. An optional approach for further specification of environmental impacts of food production, independently of scale and distance, is offered by life cycle assessment (LCA) of food. At large, top-down LCA work tends to outline the broad environmental impacts of the entire food system, enabling support for food policies [24]. The bottom-up LCA work takes its departure in detailed supply chains, describing their particular status in terms of environmental impacts [6], [7], [19]. This application suits for improvement activities within particular supply chains, to be negotiated by the actors. However, the socio-economic relations within supply chains remain beyond the reach of LCA, but as they are acknowledged as an essential sustainability aspect, they need to be considered but remain beyond the scope of this paper.

Leaning on the layered, inter-contextual and directed concept of sustainability, this paper aims to analyse strategies for change towards sustainability across food system [9], [12]. The paper offers evidence about

emerging societal and business conditions towards sustainability within the Finnish food system and continues to propose a prospective open access LCA based panoramic tool to be used as an 'environmental infographic' for co-configuration of sustainable food choices. This panoramic tool is proposed to be used by caterers, for whom the tool offers data-rich technological knowledge in open access, web-based form. The tool enables both learning of and planning for the changes of the meals representing the new sustainable food culture, building up contextually by demand based negotiations and agreements as well as procurement behaviour within the supply chain.

2. SOCIETAL AND BUSINESS CONDITIONS FOR SUSTAINABLE FOOD SYSTEM

The extensive societal discourse regarding sustainability has not gone without reflections and efforts by food system actors. On the most generic level, there seems to emerge support and benevolence towards change for sustainability within Finnish food system. Existing "sustainability discourse" [16] among food system actors stresses that producers, industry, retail, state agencies, education, food 'authors' and consumers need to find adaptive measures in order to develop together more sustainable "new food culture", overcoming the weaknesses of the current one [12], [16]. The "market discourse" as well recognizes individual consumers' and businesses' positive evaluation of environmental aspects of food, while "bioregion discourse" insists the inclusion of regional producers' and industrial interests within change into more sustainable food systems [16]. Educational developments offer some evidence about food education for sustainability, whereby schools use several educational methods in order to promote understanding of sustainable food choices [14], [21]. Furthermore, there appears to be individual professional identification with goals of sustainable food system and hence, a social force to further the ends of sustainable food systems among Finnish caterers, very much alike with the British and American ones [13], [18]. Additionally, the caterers, as responsible professionals, also seem to be able to raise their professional esteem by sustainability orientation as well as feel professional and social satisfaction of this approach; correspondingly, the caterers unable to promote sustainability in their work may feel stressed and unsatisfied in this respect [15]. However, the caterers downstream the food chain often express limited understanding of the 'real situation' in terms of life cycle status of foods they procure [13], [22]. Additionally, they seem to experience to some extent 'isolation within the kitchen walls' without contacts with LCA research [13], [22]. Therefore, it seems that more detailed and profound support is needed by catering professionals (and consumers), in order to enable them to exert demand for more sustainable food system in terms of LCA characteristics of food.

On the level of food businesses, actors' networks committed to sustainable development have been tentatively identified [17]. These actors were engaged in 'critical co-operation', where the chains' 'internal' economic actors negotiated about more sustainable arrangements among themselves [17]. This kind of 'quiet' [18] and invisible networking for sustainability within food system may turn out to be an important resource, as the supply chains will be upgraded in terms of sustainability by reorganising their chain activities. This kind of working way also deviates from the label based, 'fixed' approach as well as the individual and independent approach of particular businesses, which may both upgrade their position but may also lead into ever cheaper operations and thereby to downward spiral in terms of environment and socio-economic developments [17]. Lang [12] also reports of common initiatives of large retailers such as Tesco, Marks & Spencer, WalMart-Asda and Sainsbury for increasing sustainable consumption of 'green' and 'healthy' foods. Choice editing for customers may thus become an issue, and comes close to institutional catering industry's practice of "captive catering" (a notion coined by B.E. Mikkelsen), whereby only particular type of meals are available to customers. Here the caterers are the 'first order' consumers, who wield power over 'second order' consumers, the eaters.

The current Finnish food culture emphasises heavily the 'proper meal', consisting of staples such as meat or fish, carbohydrates, vegetables and fats. This kind of public meals are additionally nutritionally defined by national Finnish public nutrition recommendations, and cooked and served by public catering organizations across the country in day-care centres, primary, secondary and tertiary level educational institutes as well as hospitals and 'lunch restaurants' of the work places. The Finnish catering industry already serves more than 800 million meals annually, and 34% of the population makes daily use of these meal services. The figure sets off the importance of the catering sector in nutritional terms and prospectively, in environmental terms, yielding eventually to sustainable catering [18]. These social conditions within the industry and customers at large seem to entitle further action to define the sustainable diet as a basis for supply chain reorganisation.

The identification of the need to learn about LCA data of process phases of food production and the consequential planning of more environmentally benign meals by the caterers (and customers) took place in focus group research about sustainable food choices. The focus groups were presented with the 'dilemma' of sustainable choice by showing them diagrams of greenhouse gas emission information of dairy or vegetable milk products, both conventional and organic [16]. The focus groups, representing caterers and customers, did not just accept the 'state of the art' of greenhouse gas emissions as stable

and independent 'environmental reality'. Instead, they were impressed of the diagrams and started to learn about differences in supply chain structures, evaluate their practices in terms of their use of these ingredients and redesign their recipes for increased environmental sustainability [16]. The environmentally 'weak' ingredients such as dairy milks were replaced to some extent for the more environmentally benign ones such as vegetable milk products [16]. The conventional milk, not used in this scheme to the extent than before, could be partly converted to organic milk, positive in regard to animal wellbeing. These lines of thought were evident in "sustainability discourse", whereby dairy milk was replaced for vegetable milk products where appropriate in terms of taste and texture of the food. Particularly important for the new sustainable food culture to emerge was the concern the caterers focused on the taste of dishes and their palatability by customers [16].

In order to organise and enhance this kind of learning, participatory research may offer a progressive solution. It has been deployed for political goals whereby the aim for sustainability is given but the approach towards the end will be elaborated by the participants such as researchers and practitioners [5]. The approach may even be strengthened by 'inserting' a broker into the group of participants, as s/he can 'carry' the process of discovery and planning of implementation among the participants [11]. This promising strategy is suggested to be made use of by industrial actors such as caterers, their suppliers and the researchers. They may by co-configuration learn about 'environmental reality' and organise creative changes towards sustainability, very much needed as the chain operations and their life cycle analysis data are mostly unknown to practitioners on the one hand, and the practical options for change within catering are hardly understood by researchers, on the other.

3. PROSPECTIVE PANORAMIC TOOL

The findings about sustainable food choice behaviour by focus groups [16] led to the concept of the panoramic tool, discovered by inductive logic and planned tentatively by 'abductive' heuristics. The prospective open access tool supporting new food culture for sustainability, to be used by caterers for learning and creative redesign of meals and menus in terms of environmental sustainability, consists actually of two kinds of technologies. One of them is the bottom up modular LCA and the other a visualisation technology, 'infographics', "melding the skills of computer science, statistics, artistic design and storytelling" whereby massive amounts of (in this case, LCA) data points are displayed intelligibly to be grasped in a few seconds, in a way meaningful for the users of the information [1].

Chain specific LCA approaches have been used widely to reorganize industrial processes for environmental ends; the approach has been mostly in use within the companies. However, this limits the scope of reorganization on the chain level. Evidently, further negotiations over company boundaries are needed although they may represent possibly serious and difficult efforts for changes along the supply chain. The modular LCA data would overcome particular problems of confidentiality, but allow, in case of further interests, expert evaluation of the 'real situation'. The modular data also would align with caterers' basic understanding of industrial process phases, and thereby allow learning of industrial structures and their effects on food commodities' environmental impacts.

Additionally, given the various incommensurable impacts within the different impact classes, it has turned out to be difficult to make decisions about the 'correct' improvement targets, and furthermore, the ways of improving the current 'state of the art' may not always be affordable or known. Therefore, these decisions would be more informed and modifiable when developed by discussions with supply chain actors as practitioners, researchers and brokers. Hereby the decisions could have the option to reflect local and regional environmental problems, while still addressing the ones of a common denominator such as climate change. However, learning about 'environmental reality' connected with reorganisation efforts within the supply chains may offer a new way of constructing environmental sustainability by the chain actors. The changes could take place on two levels: first, by agreements about particular developments within a supply chain and second, by choosing ingredients according to their environmental qualities. This approach will be necessarily explorative in each idiosyncratic case, but may be supported by rigorous scientific calculations of the particular modular LCA of the food commodity.

The diagram presentations have often been used to depict the environmental impacts of food stuffs for comparison between them [16], [19]. However, in order to allow more flexible examination and learning of as well as comparison between food commodities and the variously designed meal compositions in terms of their environmental impacts, more powerful visualisations are needed. In short, the modular LCA data would need a visualisation technology, an infographic, condensing the figures of data points of empirically modelled typical process phases describing the environmental impacts of each staple from particular supply chains. The infographic allowing this kind of approach has been heuristically created here as a puzzle, to consist of equally sized but differently coloured pieces, with possible lining of a particular colour as module marker [1]. The puzzle could adopt the form of a landscape where the staple groups would form linear layers on top of each other, easily perceived and analysed by viewers. The completed puzzle

would depict the panorama of the meal in terms of environmental sustainability, whereby comparisons could be done between meals and even between menu cycles, often planned for six weeks in Finland. The menu cycle perspective would additionally enable balancing between different food cultural appropriations, such as serving northern vis-à-vis southern or western vis-à-vis eastern types of meals.

The panoramic tool as a puzzle would connote the unknown end result when starting the work, and allow the completed pattern to be built up piece by piece, amended likewise and finally, to become meaningful as condensing the data-rich modular LCA's of the staples. The panoramic tool, planned to be used by caterers for co-configuration of their sustainable meals with researchers, becomes depicted electronically as a puzzle, to be assembled according to nutritional guidelines of the most environmentally advantageous staples, shown by light colours of the modules in stead of the dark colours of the environmentally disadvantageous ones. To assemble such a puzzle may also provide 'entertainment' in a meeting for caterers, enabling them creativity for sustainability.

However, the use of the tool would also emphasise the need for learning in the workplace, which seems to be rare in terms of supply chains; the caterers may know the provenance of the food they procure, but hardly the circumstances of production [18]. The concepts of puzzle and panorama allow later on the amendment of socio-cultural empirical material into the modules, but this phase is to be postponed into future research.

4. RESULTS AND DISCUSSION

The basic aim of this panoramic tool, designed as a puzzle, is first, to support the visual construction of the meaning of the current sustainability of one's meal production, in terms of issues such as climate change, eutrophication, and depletion of fossil energy sources. Second, the tool allows examination and learning about process phases and their contribution to the total impacts of a staple. Third, the tool enables comparisons to be made between between different staples of the same nutritional content. Fourth, the tool makes possible amendments and changes into the final ingredient or dish as part of the meal pattern. Fifth, the tool enables 'playful' creation by 'error and trial' as well as planning by systematic and principled understanding of more sustainable meals. Sixth, the tool is helpful by making the planning results visible for customers as an 'environmental meal panorama' as colours change into paler or deeper hues, according to their environmental signification, within the puzzle landscape.

This kind of puzzle design has been widely used to illustrate graphically qualitative-quantitative entities consisting of various units. Educational, product and

service quality count as examples; the puzzle design in itself is not unique. However, the infographic design, with LCA databases used as modules of process phases, may be claimed to be a novel application of 'information power' for visually assembling, planning and changing meal quality at will in terms of sustainability as a contextually constructed orientation.

Although this panoramic tool presents a powerful and 'melded' technological application, to offer platform for the social orientation for sustainability, it seems to grow at best in discussions and negotiations between professionals within and across companies, along the supply chain. In these discussions, researchers, as facilitators and brokers, may support first, the 'environmental meaning making' for sustainability and second, the negotiation process inherent when choices are to be made between different optional ingredients and menus.

Finally, yet more is needed for sustainable meals; the palatability of the meals and their socially unifying role for customers is crucial in terms of adoption of a new food culture for sustainability [16], [18]. Furthermore, the information offered of their environmentally sustainable quality as orientation towards more sustainable food system presents considerable formal and informal educational possibilities. Clearly, these developments present 'grand prospects', but, however, they seem to have the conditions for implementation.

5. CONCLUSIONS

Necessary changes in consumers' eating habits towards sustainability, both within households and in out-of-home settings, reflecting to wholesale, retail and catering industries' selection and display as well as information pertaining to food, followed by structural changes in processing and primary production, present a huge systemic challenge for the current western food system. There seems to be generic interest in renewal of food culture, which is visible in Finland as well. Particularly public catering industry has been identified as a point of entry towards more sustainable food culture. When serving the customers, caterers may introduce successfully new dishes and palatable meals with a 'hard core' of environmental information, made contextually meaningful and presented by the panoramic tool in puzzle infographic design. As Spaargaren [23] puts it, "the route into an ecological more rational modernity, science and technology can indeed be said to fulfil an important and in some respects essential role... [by] taking into account notions of reflexivity that...help to shape the socio-technical changes in production and consumption cycles that are required to carry us over into a more sustainable modernity." The change into sustainability will hardly take place overnight, but in order to take place at all, it needs highly developed technological tools used by a

number of food system actors across system levels leading into more sustainable consumption patterns, perceived as satisfying and socially acceptable. Hence, a large actor such as public catering may take a decisive move and will, hopefully, be followed by other chain actors within the food system. At large, the system looks for compatible changes [10] in order to proceed 'smoothly' towards sustainability, which, however, needs orchestration of change in the widest scale imaginable.

6. REFERENCES

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