

Food Futures: Developing effective food systems interventions to improve public health nutrition

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Abstract

Meeting demands for food, energy, fuel and water as the world population increases and in the face of climate change is a major challenge for current food systems. Already, 842 million people worldwide are undernourished, while simultaneously the number of overweight and obese individuals increased to 2.1 billion in 2013. A key challenge within this nutrition crisis is that food is incorporated in many different domains, including the global economy and world trade, making this a highly complex problem. There is growing opinion that addressing the global burden of diet-related disease requires a much more comprehensive and multidisciplinary approach than stand-alone public health interventions such as nutrition education or even taxes on unhealthy food products. Instead, we need to develop whole of systems interventions to address the core problem and consider the way we grow, process, distribute and commercialize our food. However, there is little evidence or guidance on how to best achieve this.

Previously we published a protocol paper on innovative research using systems approaches to improve public health nutrition (called Food Futures). This paper aims to further our previous work by adding some preliminary findings from an early process evaluation.

The Food Futures approach is divided into three phases: A) Availability and affordability of (un)healthy food; B) Determinants of (un)healthy food availability and affordability; and C) Food system intervention development. Phase A forms the platform of this research combining a series of smaller projects examining food availability, affordability and healthiness. Phase B uses Global Value Chain Analysis (GVCA) to identify different attributes of value, including both health and monetary values, as potatoes and potato products move through the chain. Phase C aims to identify sustainable food system public health interventions using Group Model Building (GMB) and logistic modelling approaches. From the early process evaluation, we learnt what actors are crucial to talk to when aiming to retrieve information on the full value chain. For example, it is important to include actors from the fresh and processed potato value chain separately. We also found that GMB should be focused on identifying how to increase the share of healthy foods in the supply as opposed to decreasing the share of unhealthy foods in the supply. Finally, we discuss the challenges of developing a food systems approach and propose an initial focus on specific pockets of the food system that have the best potential for change, such as hospital food systems.

Key words:

Public health nutrition; food system; food policy; value chain analysis; sustainability

1. Introduction

Global nutrition is in a state of crisis; 842 million people worldwide suffer from under-nutrition (1), while simultaneously the number of overweight and obese individuals increased to 2.1 billion in 2013 (2). Furthermore, the widespread burden of diet-related non-communicable diseases (NCDs) such as diabetes is becoming one of the world's largest societal problems (3-7) and forms a barrier to achieving development goals including poverty reduction and economic stability (8). In New Zealand (NZ) about 40% of mortality is attributable to the effects of poor diets (3-5) and even modest improvements in diet could have a major impact on health if they are adopted by the majority of the population (9, 10).

Historically, industrialization, technical innovations and investments in our food supply have brought some major advancements; food became more available, varied, affordable, and famine has largely disappeared in developed countries (11). However, while being highly developed, our current food system not only delivers extremely costly food in terms of consequences to public health, but also in terms of capacity of the earth (biodiversity, ecosystem degradation and greenhouse gas emissions) and the unfair demand on developing countries (12-15). In addition, it is unacceptable that surplus food production and widespread hunger currently co-exist at the global level(16), especially when about one-third of the global food supply gets wasted (17).

Addressing the global burden of diet-related NCDs and improving population nutrition and health requires a multi-disciplinary approach. Public health interventions alone, including nutrition education, school programs or food labelling, cannot solve nutrition problems on their own (18, 19). While such health interventions can be effective, programmes are costly and their scalability and long-term effectiveness is limited. More importantly, these interventions do not address the strong societal forces (food availability, costs, and commercialization) that work against individual behaviour change and do not reach the most vulnerable populations (15, 20). Indeed, there is growing support for the position that “encouraging low-income families to consume healthier but more costly food to prevent future disease can be construed as an elitist approach to public health”(18).

Within the nutrition domain we lack a comprehensive approach combining the series of recommended policies where most interventions are implemented and tested in isolation. But, more importantly, we lack consideration how public health interventions must operate within the rest of the food system and global economy. This also applies for more powerful interventions

such as food taxes and subsidies. For example, studies to date have not taken into consideration how health policies would operate within the commercial market place where manufacturers can adopt strategies to circumvent the policy with a view to minimising impact on product sales. A retrospective example of such circumvention comes from the 1980s where United States farm policies made sugar more expensive expecting that this would result in higher soft drink prices and subsequent decreased consumption. However, the Coca-Cola Company substituted high-fructose corn syrup for sugar, saving them around \$25 million per year making Coca Cola both cheaper and more profitable (21). Currently, with net profit margins are around ¼ of the retail price, soft drink production is one of the most profitable industries in the world (22). Another example is the Danish saturated fat tax (introduced in 2011) which was abolished within one year of its introduction. While it was too early to be sure about the effects on population health, competing economic and political interests made the government decide to put it on hold (23, 24) even though recent studies have indicated some promising effects on sales of targeted products (25). Similar examples can be found in the field of tobacco prevention research where the tobacco industry has circumvented health policies by absorbing tax increases on some of their brands to reduce the financial impacts on consumers (26). There are also examples of health related food taxes that show promising results such as the recent soft drink tax in Mexico; however a much more comprehensive approach is needed to achieve long-term sustainable impacts.

It needs to be acknowledged that public health cannot operate in isolation and has to be able to achieve its goals within the existing economic, environmental and social systems. A key problem associated with the current food system is that food has become highly commercialized and prices do not incorporate externalities such as effects on public health or the environment (16, 27). The system produces an oversupply of dietary energy and certain crops (e.g., sugar, corn) (28) and provides us with more products in ultra-processed form (11, 29, 30). Furthermore, the international food system has become highly complex making it difficult to understand drivers of the system. There is a clear need to look closely at the operation of the food system to find sustainable solutions improving population health, social welfare and environmental sustainability¹ (15). We should be looking at questions such as ‘*What makes our*

¹ The importance of wider systems was already famously stated by Rose in 1985 quoting that to understand the reasons for sick populations, we must not just look at the individual but at the society

current food environment so unhealthy? And *‘Why do we overproduce and oversell unhealthy food?’* (31) New inter-sector studies combining a systems approach and public health are needed to identify feasible and effective interventions and answer questions on how to achieve a healthy sustainable food environment (32-34).

An overview of the operation of our food system is key, because understanding the structure, strengths, and weaknesses of the system is required to find realistic alternatives (35). In NZ, food production is the major contributor to the economy and there is a highly developed agricultural system (36); however, similar to other countries, there is no policy at central government that outlines a long-term food and nutrition strategy (32). The system focuses merely on short-term economic profits without considering long-term consequences for public health, the environment and food security. Countries such as the United Kingdom, Australia and Canada intend to move from agro-production oriented food policies towards a comprehensive national food strategy and a recent scientific report to the Dutch government concluded that the Netherlands needs to take a whole food systems approach to ensure a sustainable, secure and healthy food production for the population in the future (37). The newly released Sustainable Development Goals list ‘End hunger, achieve food security and improved nutrition, and promote sustainable agriculture’ as the second of its seventeen goals revealing a globally recognized need to work on our food system (38).

2. Methods

Previously, we published a protocol paper on innovative research combining systems approaches and public health nutrition (called Food Futures)(39). This paper aims to bring some preliminary findings and an early process evaluation of using such a systems approach within the public health domain.

The Food Futures protocol paper (39) outlines three separate phases, including: A) Analysis of the availability and affordability of (un)healthy food; B) Determinants of (un)healthy food availability and affordability; C) Food system intervention development (see Figure 1). The research presented below uses New Zealand (NZ) as a case study in an international context. NZ is an island nation in the south-western Pacific Ocean, with a population of approximately 4.5 Million. NZ is a developed country with a market economy that is highly focused on the exports of dairy products, meat and wine, along with tourism. New Zealand's unique geographic location and relatively small size make it a very suitable country for a food systems case study. Furthermore, NZ has clear food-related problems having the 3rd highest obesity rates in the OECD after the US and Mexico and profound inequalities with 67% of the Pacific population, 46% of the indigenous Māori population and 28% of the European population being obese (40).

2.1 Food Futures Part A

Part A forms the platform of this research and comprises of a series of smaller projects examining food availability, affordability and healthiness in NZ, within an international context. Evidence from the United States suggests that there is a large gap between dietary recommendations and the food that is available in the food supply where, for example, the total amount of fruit available per capita is not sufficient for everyone in the population to meet dietary guidelines, while the availability of sugar per capita exceeds dietary recommendations(41, 42). The 2006 NZ Nutrition Monitoring Report suggests there are sufficient fruits and vegetables available in NZ(43). The aim of Phase A is to gain insight into these issues by examining food availability in NZ supermarkets and link this to public health.

Relevant research questions include (for more details see (39)) :

- A1. What food is available in NZ supermarkets, how does this relate to level of industrial processing, healthiness and food group?

- A2. How frequently are foods discounted and how does this relate to healthiness and level of industrial processing and food group?
- A3. What is the availability of *packaged* food products for sale in NZ supermarkets by levels of industrial processing, healthiness, price and the variety of brands?
- A4. How diverse is the NZ packaged food supply? What are the most commonly used ingredients in packaged foods and how do these relate to level of processing?
- A5. To what extent does NZ food availability align with dietary guidelines and how has this changed over time (using FAO Food Balance Sheets)?

2.2 Food Futures Part B

Part B aims to develop an innovative systems approach methodology by combining **global value chain analysis** and public health research. **Value chain analysis (VCA)** is defined as ‘analysis of where, how, and why value is added and created along the (food) chain. Its objective is to understand why the value chain is structured as it is and how it could be leveraged for change (31)’. VCA was originally developed in the 1980s as an instrument to help businesses to be more efficient and generate more profits and has been rarely used for public health nutrition outcomes (Hawkes and Ruel, 2011). However, the food supply chain has been identified as a major opportunity to improve population nutrition (44) and value chains have specific features that are important for food availability, affordability and quality (31). For example, while food processing is a way to increase the monetary value and shelf life of products (45), it is generally associated with lower nutritional value and, from a health perspective, consumption of this category should be discouraged (46). Nevertheless, sales of ultra-processed foods are increasing rapidly where currently about three quarters of total global food sales are ultra-processed foods (47) and these foods form the majority component of unhealthy diets (48, 49).

Global value-chain analysis (GVCA) is a specific form of VCA that draws on world systems theory (Hopkins and Wallerstein 1986) and concerns the food industry sector on a global scale (50). This global perspective is important because the food system operates internationally. For example, NZ Food and Beverage exports contribute over 10% to expenditure on Gross Domestic Product (GDP) and represent half of all NZ merchandise exports by value(51). Each stage of the food production system connects NZ to other countries and these connections are driven by the practices of lead firms (e.g., Coca-Cola, Fonterra). The prevalence of NCDs can be linked to the behaviour of these lead firms in global food production systems (50). To date, GVCA has been

used to analyse agro-food chains where it focuses on quantifying facets of costs, prices, profits, and returns in the chain (31). However, similar to VCA, GVCA has the ability to be used to identify influences on the availability, affordability and quality of food. Further, GVCA has the specific advantage of being able to analyse the differing amounts of power exerted by each actor in the chain and how the system operates on a global scale (31). These methods will be used in this research where we will build on a report by Hawkes and Ruel that outlines how VCA methods can be used in nutrition and health (31).

2.3 Food Futures Part C

Part C will build on the outcomes of part B and will focus on sustainable food system intervention development. The GVCA procedures outlined above will provide insight into the actors in the chain, their activities, location and where (monetary or nutritional) value is added along the chain. However, this process does not provide full insight into power relations and how decisions are made, particularly because the food system is highly complex and power dimensions are tricky to measure. For example, a common problem when thinking about public health interventions is that the actors in the system have different priorities and are reacting to different feedback i.e. economic profits as opposed to effects on population health. This requires in-depth analysis to know how the system really works and how public health can play an effective role within this system. Also, while the GVCA will provide a detailed overview of the operation of the food chain, it does not yet provide sustainable public health interventions that can work within this system. A common approach to uncovering complex systems is *community-based systems dynamics*. This method is participatory and involves communities in the process of understanding systems from the endogenous or feedback perspective of system dynamics (52). A specific method within system dynamics is *Group Model Building* which involves stakeholders in the process of developing a logic model with the expectation that this will lead to a better understanding of the system, shared insights, consensus and motivation for implementing the results (53). For example, GMB has been used in a recent paper aiming to understand factors influencing childhood obesity and create a process for dialogue and commitment by stakeholders to build capacity for change in an urban environment(54). We will explore different methods including Group Model Building (GMB), stakeholder interviews and Logistics Modelling to enable examination of power dimensions and identify sustainable food system public health interventions.

3. Results

The Food futures project began in early 2014 with some initial results presented below. Most importantly, we have gained a better understanding of the barriers and facilitators to applying a food systems approach to improve public health nutrition. We discuss our findings in developing and improving these methods.

The original aim of Food Futures was to provide an overview of the entire food system in relation to public health. However, we found that the food system is too complex, with too many different actors and dimensions, making it impossible to map the entire system. In addition, the system is highly dynamic, making it impossible to describe it in full. Therefore, Food Futures will focus on a set of specific case studies within pockets of the food system, which aim to help understand how the system works. When thinking about points of food purchase, Food Futures will focus on supermarkets (as opposed to for example fast food restaurants, markets or cafeteria). Supermarkets play a central role within the food system and their share of retail sales is growing globally, including in both developed and developing countries(47). Supermarkets also play a significant role in the availability of food (e.g., the products they stock, prices and marketing), thereby influencing the food environment(55). Finally, the importance of supermarkets is highlighted by their dominant position compared to the other actors in the chain. This dominance is seen globally, but particularly in NZ where two retail organisations, Foodstuffs and Progressive Enterprises Ltd., form a duopoly in the retail sector and control over 90% of the grocery market(56). This lack of competition is expected to negatively impact (healthy) food availability and is important to examine in this research context (57-59).

3.1 Results for part A: Analysis of the availability and affordability of (healthy) food

We published a paper on the availability of ultra-processed foods in NZ supermarkets. Using Monteiro's classification system (46), we found that the majority (84% in 2011 and 83% in 2013) of packaged foods available in NZ supermarkets were ultra-processed. Furthermore, we observed many variations of virtually the same product and a high dominance of a small number of large food manufacturers where the ten largest food manufacturers produced 35% of all packaged foods available (60). Currently, we are starting data collection for a project measuring the availability of fresh and processed foods in different retail settings.

3.2 Results for part B: Combining GVCA and public health nutrition

GVCA is a new method for application in public health nutrition research. Therefore, we start with a case study using GVCA for a specific product category (potatoes) to develop the method which can form the basis for future research in this area. We aim to expand the analysis to other food products once the method has been fully developed.

Potatoes were chosen because they are considered a staple food and important source of dietary energy and carbohydrate for many populations globally. Data from Statistics NZ show that potatoes are amongst the three most highly weighted fresh vegetables in the Food Price Index basket, accounting for over one-third of the expenditure weight of vegetables (Statistics New Zealand, 2014b). However, potatoes are often processed into unhealthier foods such as salty crisps and French fries. We have started a GVCA on whole potatoes and processed potato products following the four GVCA steps as outlined below:

1. Value chain analysis on specific food products: What are lead firms and suppliers for the selected food products? (21)
 - a. Identification of actors and the relationship between them.
 - b. Documentation of activities and their location.
 - c. Examining attribution of value corresponding to activities and actors in the chain.

First, we are building the value chain, including health and monetary value, of products as they move along the chain. Here we aim to examine what the incentives are to produce unhealthier potato products instead of healthier potato products and how this related to profit margins.

At this stage, the lead author has met with two of the largest potato farmers in NZ. We learnt that we will need to build two completely separate value chains for the fresh and the processed potato industry as these are complete separate entities. Also, the chain for potato products such as potato starch needs to be examined independently. While potato starch is present in many ultra-processed foods in NZ supermarket (such as pizza bases and ready to eat meals) this product is not produced domestically because of the large scale that is needed to make this cost-effective. We also learned that all fresh potatoes are grown and sold domestically, largely because of strict phytosanitary regulations preventing large-scale potato imports and exports. There are only a handful of large family-operated potato farms in New Zealand supplying the two main supermarket chains and it will be crucial to talk to all of them to gain full insight into the fresh potato market. The fresh potato value chain appears to be very short, with the biggest potato farmers having contracts directly with the supermarkets. Furthermore, we found that

farmers face many challenges with regard to tensions between achieving the highest yields, margins, appearance, taste and nutritional value of the potato; mainly with regard to demands from supermarkets. Both farmers indicated they had a strong preference for the Agria potato because of its high-quality taste and nutritional value. However, supermarkets (and/or consumers) pre-dominantly demand the good-looking and high-yielding Nadine potato and are mainly interested in the potato that can be produced at the lowest cost. These tensions will be examined in more depth when continuing this value chain research. Other crucial elements to consider include: influence of the processing market on the fresh market, fixed costs for potato production, margins for the farmer and the supermarket, contracts between the growers and the supermarket. We also learnt that farmers have a strong interest in growing their 'brand', independent from the supermarket (they now predominantly sell under the supermarket own-brand), and increase consumer demand for fresh, nutritious, local produce. This finding will form the basis for the Group Model Building research in Phase C.

2. Determining the geography of the chain:

- a. How do the NZ lead firms operate within the world market, what sources do they have access to? Which foods are imported to NZ?

Imports and exports are very relevant to food availability and pricing. For example, data from Statistics NZ show that the average domestic price of products that are exclusively imported to NZ (such as bananas and grapes) closely aligns with the import price. However, other fresh fruit and vegetables have average domestic prices that align with the export price (61). Furthermore, this analysis is crucial with regard to ultra-processed foods; ~75% of global food sales are from ultra-processed foods although only 6% of ultra-processed food sales are traded (imported/exported) (47). Food suppliers generally build a local plant so that they can be more responsive to local market and consumer needs. Also, trade tariffs are much higher on fully processed goods as opposed to primary products. Countries are trying to capture value-added locally and implement trade regulations that encourage imports of less-processed commodities (47). It is important to record and understand these processes accurately if we aim to successfully limit production of ultra-processed foods from a health perspective. As explained above, this phase will need to collect information on potato starch production, imports and processing into foods in the NZ food chain.

3. Analysis of governance structures and ties between firms: How does the NZ food supply chain operate and who controls the diffusion of technology, standards and brands? &

4. Analysis of the institutions that influence the activities of the chain: What is the role of governmental institutions and regulations within the chain (e.g., agricultural subsidies)?

Each public health programme must comply with relevant legislation and standards (Ministry of Health, 2006). Therefore, in step 3 and 4 we will analyse the role of institutions and governance structures and how these influence food availability and affordability and how this relates to public health. For example, as explained above, many countries have restrictions on the import of fresh potatoes due to phytosanitary reasons. Also, agricultural policies can have important effects. At a national level, NZ government direct support (subsidies) to agricultural producers is the lowest among OECD economies (62). Nevertheless, it is likely that the NZ food system is affected by international subsidizing schemes, such as the European Common Agricultural Policy (CAP)(63). Furthermore, the central NZ government is involved in the food system by putting large efforts into growing a stronger export economy in the agri-food sector. For example, ‘High Value Nutrition’ is one of eleven government science investment challenges and aims to ‘Growing New Zealand food and beverage export revenue through international leadership in the science of food and health relationships (64).’ NZ also has free trade agreements with numerous countries, including Australia and China, and has recently agreed on the Trans Pacific Partnership Agreement (TPPA) with the United States. These free trade agreements are thought to have important impacts on public health as well, but are likely to go beyond the purpose of this research (65).

3.3 Results Part C: Food system intervention development

Our original idea was to use Group Model GMB to complement the GVCA and to examine who holds power in the system. For example, a commonly perceived problem is the high availability, low cost and profitability of ultra-processed food. Often, public health experts try to develop interventions to make people eat less of these foods. Instead, in this project, we aimed asking industry/ retail ‘what are the incentives for you to produce ultra-processed foods?’(39) However, an initial meeting with an informant who formerly held a high-level position in food industry revealed that this process would be infeasible. He perceived that conflicts of interest and power dimensions between different parties involved would result in players being reluctant to reveal what is really going on behind the scenes. If we want to reveal power dimensions, a better approach would be to conduct interviews with people who understand the food sector, but no longer have any conflicts of interest and are able to speak freely. Therefore, stakeholder interviews will form a new component of Food Futures.

3.3.1 Group Model Building

While GMB might not be feasible to examine power dimensions in the food system, it could be a very useful method to examine how to improve the availability, accessibility and affordability of healthy food. The meetings with the two farmers in the GVCA phase revealed that they are very interested to find ways to increase access to fresh, healthy NZ produce. There is a clear interest in solving some of the issues farmers are facing that limit them in providing the healthiest produce and GMB is a very suitable method to achieve this goal.

The design of GMB can vary across four dimensions: 1) the method for defining the initial problem; 2) structuring of the group process; 3) the type of model; and 4) the starting point. We found that, for this project, the best approach is to define the initial problem based on the outcomes of Part A (the food that is available) and B (the global value chain analysis) and will focus it on ‘how to improve the availability, accessibility and affordability of fresh NZ produce’. Furthermore, we propose it is most suitable to initially build an informal causal map instead of a full computer simulation model which will be a separate project (see below). Participants will be provided with some initial model structure illustrating the players in the NZ food system (53). The GMB workshop will be designed with input from NZ expert(s) and will be developed using the ScriptsMap framework which helps linking together tasks and deliverables (66). Moreover, the format will be built on previous similar activities and publications such as a recent Institute of Medicine (IOM) report on using Agent-Based-Modelling, System Dynamics and Life Cycle Assessment to identify the inducements and barriers to fruit and vegetable consumption throughout the food system (67).

3.3.2 Logistics Modelling

GMB has the potential to inform the development of full simulation models that can be used to predict the effects of certain changes on complex systems (for example the effect of changing agricultural subsidies on food production). One example of a full computer simulation (logistics) model is HERMES (a Highly Extensible Resource for Modelling Agricultural and Food Supply Chains) (68). This model, developed by Johns Hopkins and the Pittsburg Supercomputing Center, was originally designed to evaluate vaccine supply chains and the researchers aim to develop this into a model for agricultural and food supply chains. The final stage of Food Futures will consist of collaborating with the HERMES team to build a quantitative logistics model based on our data on the potato supply chain from the GVCA and GMB. This will be an iterative process where we share the initial data showing the potato

value chain, process this into the logistics model, and collect more information for further input into the model where required. The model will include virtual representations of every farm, food production location, processing location, storage, equipment, transport, workers, food product and accessory in the supply chain (68). Eventually, this model can be used to evaluate interventions, food supply operations and performance. Furthermore, the model can be modified to use for different foods than potato products. Potential interventions that can be evaluated include revision of agricultural subsidies, policy changes, impact of new technologies or creating shorter supply chains.

4. Discussion

There is growing recognition that we need to move towards a more sustainable food system, especially in relation to projected population growth, the increasing burden of diet-related NCDs and growing concerns about climate change (69). According to the definition by the FAO, sustainable diets are “those diets with low environmental impacts which contribute to food and nutrition security and to healthy life for present and future generations (70).” There is a clear need for high-level trans-disciplinary science that brings together agriculture, food systems, nutrition, public health, environment, economics, culture and trade to inform guidance on vital elements of healthy, sustainable diets (69, 71). The programme of research outlined in this paper will contribute to this emerging science base by examining public health from a food system perspective and vice versa (examining the food system from a public health perspective). This will be accomplished by providing a detailed overview of the availability and affordability of food in NZ (Part A), unique insights into how the global food system influences this availability (Part B) and identifying levers for change (Part C).

The second aim of this research is to develop a new food systems method for public health nutrition research that can guide future intervention development and form the basis for new interdisciplinary research. As shown in this paper, examining the food system is challenging, particularly with regard to exposing conflicts of interest and power dimensions. A common problem when thinking about public health interventions is that the actors in the system have different priorities and are reacting to different feedback i.e. economic profits as opposed to effects on population health. Solving this problem requires in-depth analysis to know how the system really works and how public health can play an effective role. We aim to achieve this goal by combining sound methodologies from systems science and public health. Furthermore, we choose to focus on specific case studies to make the research comprehensible and feasible. Initial results show that is likely to be more feasible to work with actors that aim for the same goal (e.g., providing more healthy fresh produce) instead of working against actors providing unhealthy ultra-processed foods. We aim to monitor this kind of feedback closely as we progress this program of research. The Methods are not set in stone, instead we use an iterative process where methods are adapted based on the information we are collecting within this research.

During the initial development of Food Futures we have learnt that is extremely challenging to evaluate the whole food system. A better approach might be to look into specific pockets of the

food system that have the greatest potential for change. Food Futures currently focuses on supermarkets and the potato value chain and uses the NZ food system as a case study. NZ is particularly well suited for such a case-study because it is an island nation with an isolated geographic location making its food system relatively coherent compared to that of other countries. Nevertheless, NZ is still highly developed with a similar economic and social structure to other countries in the Organisation for Economic Cooperation and Development (OECD)(72). Finally, NZ is part of the global food system meaning the methods of this case study will be able to be further expanded for use on a global scale. Nevertheless, it is likely that different countries have specific aspects in their food system that differ from other countries (for example, EU countries will differ from non-EU countries); making that it is crucial to expand this research to other contexts including lower and middle income countries.

Another food pocket that would fit a public health food systems approach is hospital food systems. Individual US hospitals will serve up to 1.7 million meals per year (73). Hospital food systems work on many different levels and have been identified by the Centers for Disease Control and Prevention (CDC) as having “the potential to be large food procurers and powerful community citizens, employers and role models by providing the healthiest food venues possible for their employees and community”(73). We are currently looking for funding to conduct hospital food system research.

5. Conclusion

We envision that the methods developed as part of this work will form the basis for future research in this area where it can be applied to other public health nutrition research (for example other food products, in relation to specific diseases, different countries) as well as other domains of a sustainable food system not specifically focussed on here e.g. economic, social and specific environmental outcomes. To assess whether we have been successful in developing this method we will include an evaluation component. This evaluation will contain specific elements including, but not limited to: ability to obtain/access required information; experienced barriers in conducting the research; and time and cost of conducting the research. Altogether, we view this programme of research both as a way to find new answers and to develop new research methods for public health nutrition.

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Figure 1 Systematic logic model for the Food Futures research programme

