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1 **TITLE**

2 Analyzing food value chains for nutrition goals

3 **ABSTRACT**

4 First proposed in 2010, the use of “value chain analysis” to identify opportunities for targeted nutrition
5 interventions in food systems is still an emerging method. This review explores and summarizes the
6 application of value chain analysis to nutrition and from this provides five insights into how to more
7 effectively conduct value chain analysis for nutrition: 1) use a consumer perspective to inform selection
8 of foods and chains; 2) consider the research question, available resources, and the type of chain; 3)
9 situate consumer research at the center of the analysis; 4) assess economic trade-offs; and 5) pay attention
10 to governance and stakeholders’ capacity for and incentives to change.

11 **KEY WORDS**

12 Value chain analysis; study design; food system; agriculture; nutrition

13

14 INTRODUCTION

15 As the source of the world's food supply, food systems have important consequences for nutrition and
16 health. Slow progress towards reducing undernutrition and micronutrient deficiencies, together with
17 increases in obesity and nutrition-related chronic diseases, has focused international attention on how
18 food systems can improve access to and acceptability of healthy diets.¹ Thus there is increased interest in
19 understanding how food systems can be levered to achieve this goal.

20 A food value chain is a core component of a food system and consists of all of the activities involved in
21 bringing a particular food to consumers, including the various phases of on-farm production, processing
22 or product transformation, delivery, and consumption or disposal as waste.² Central to the value chain
23 concept is the notion that the chain operates as a system and activities are interconnected and
24 interdependent. For the past decade, the international development community has focused on improving
25 the competitiveness of food value chains in low- and middle-income countries as a strategy to generate
26 growth and reduce rural poverty. These initiatives tend to focus on integrating small businesses –
27 particularly small-scale farmers – into food value chains so that they may escape poverty through market
28 participation.

29 More recently, several authors have proposed frameworks linking food systems and nutrition.³⁻⁸ Food
30 value chains have emerged in the context of nutrition-sensitive development as an organizing feature for
31 addressing malnutrition in all its forms, including undernutrition, micronutrient deficiencies, overweight,
32 obesity, and diet-related diseases.⁹ Given the implications of food value chains for food availability,
33 affordability, acceptability, and nutritional quality, the idea is that targeted intervention in chains could
34 help tackle some of the underlying determinants of poor diets.^{3,10-12}

35 Value chain analysis (VCA) for nutrition involves the assessment of a food value chain in order to
36 identify opportunities to increase the supply of and demand for nutritious, healthy diets by nutritionally-

37 vulnerable populations, whilst also considering other development challenges.¹⁰ Although there is
38 obvious potential for food value chain interventions to improve nutrition, the use of VCA to identify
39 nutrition interventions is still an emerging method.

40 There is much to be learned from previous research on food value chains and it is important for future
41 nutrition-oriented studies to build on this body of evidence to maximize research investments. The
42 objective of this paper is to identify lessons that can be used to inform the design of VCA for nutrition. It
43 aims to enable researchers to use VCA in ways that will take full advantage of its potential contribution to
44 sound nutrition interventions and policies. To do this, we review the origins of VCA and the emerging
45 literature on VCA for nutrition. Using the findings, we propose and discuss five key insights to consider
46 when designing VCA for nutrition.

47 **OVERVIEW OF THE MAJOR TRADITIONS OF VALUE CHAIN ANALYSIS**

48 The application of VCA to study food systems arose primarily from three broad and somewhat
49 overlapping traditions of value chain research (Table 1): (1) *filière* analysis; (2) VCA as a strategic
50 management tool; and (3) VCA as a tool to study the political economy of global industrial integration.
51 Development planners and practitioners have found elements from each useful for examining agri-food
52 value chains and designing value chain approaches to development.

53 <Insert Table 1 here>

54 The *filière* tradition emerged in the 1960s and 1970s as French agricultural economists sought to identify
55 the major institutions involved in commodity chains and understand the activities and exchanges
56 therein.¹³ The approach does not have a unifying theoretical framework; rather, *filière* analysts have used
57 different theories and methods to explore a range of research questions about commodity chains. Much
58 of this research has focused on how public policies and institutions affect agricultural systems and the
59 smooth flow of food and fiber products.¹³

60 In the mid-1980s, Porter introduced the term ‘value chain’ to the management field to describe a series of
61 value-adding activities that work together to create a product or service.¹⁴ Value chain management
62 developed as an approach to help businesses achieve a competitive advantage by understanding the
63 market and creating value for consumers. It involves collaborating with trading partners to solve
64 problems, generate ideas, and allocate resources.¹⁵ VCA is used as a diagnostic tool to support value
65 chain management by identifying wasteful activities, bottlenecks and other problems, and un-tapped
66 opportunities to generate value.¹⁶ Analyses consider three core issues across the chain: (1) the movement
67 of materials and the contribution of each activity to value creation (material flows), (2) the generation and
68 sharing of information (information flows), and (3) the degree of collaboration and commitment between
69 trading partners (relationships).¹⁶ Value chain management techniques, including VCA, are sometimes
70 used by agri-food companies and industries.

71 The third tradition – known collectively as ‘global chains’ research – focuses on understanding the
72 differential implications of the capitalist world economy, particularly how power is distributed and
73 exerted.¹⁷ Though several ‘global chains’ frameworks exist, the global value chain (GVC) is the most
74 prominent and often used to answer development questions. The framework considers four dimensions of
75 a chain: the input-output structure, geographical scope, governance structure (i.e. how the chain is
76 controlled), and institutional context.¹⁸ Upgrading, or the ways in which businesses, countries, or regions
77 maintain or improve their positions in the economic system, is another key concept.¹⁹ GVC analyses have
78 explored different types of food value chains, including for products originating in poor countries and
79 ending in wealthier countries.

80 **EVIDENCE ON THE APPLICATION OF VALUE CHAIN ANALYSIS FOR NUTRITION**

81 To review the application of VCA frameworks to nutrition, we follow the approach of Hawkes et al. and
82 consider ‘short’ and ‘long’ food value chains separately.²⁰ Short chains exist where markets are served by
83 local or regional farmers and changes to production have a direct impact on what is available for

84 consumption. They include chains in which consumers obtain fresh products directly from the farm or
85 through a trader who has a proximal relationship to the farmer. Short chains may also involve other
86 actors such as regional aggregation and small-scale processing units. Long chains are those in which
87 farmers and consumers have a more distant connection and the design of activities to be efficient at scale
88 increases the potential impact of upstream interventions. Although this includes any chain in which the
89 food is traded and transformed multiple times midstream, the most obvious examples are for foods with
90 multiple ingredients produced through large-scale manufacturing and for widely traded commodities.

91 **Value chain research of short chains**

92 To date, nutrition-related research on short value chains has focused mostly on traditional markets for
93 micronutrient-rich foods in low- and middle-income countries. The main objective of this work has been
94 to inform interventions to improve nutrition (particularly undernutrition and micronutrient malnutrition)
95 whilst also supporting the livelihoods of chain participants.

96 The Global Alliance for Improved Nutrition (GAIN) and the Institute for Development Studies (IDS)
97 have designed the “Nutritious Agriculture by Design” tool to assess how agriculture and food value chain
98 projects can be made more nutrition-friendly.²¹ The tool considers how projects promote consumption of
99 nutrient-dense foods in producer and non-producer households. Users progress through a series of
100 questions designed to make explicit the organization and operation of the chain and how it does or could
101 contribute to measureable nutrition impacts. Assessments can be conducted by examining written
102 documents, but primary data collection is recommended. IDS research teams have drawn from this tool
103 to examine short chains for minimally-processed, nutrient-rich foods in Ghana, Nigeria, and Tanzania.^{22–}
104 ²⁴ These case studies examined opportunities and challenges to mobilizing private sector involvement in
105 addressing undernutrition and micronutrient deficiencies and involved literature reviews, expert
106 workshops, stakeholder interviews, and site visits. In each, the findings highlighted areas for
107 intervention, with a focus on action needed to support viable business models.^{22–24}

108 A conceptual framework for assessing value chain interventions for nutrition was developed within the
109 Leveraging Agriculture for Nutrition in South Asia (LANSA) program.⁶ The framework outlines three
110 key outcomes that food value chains must achieve in order to improve micronutrient intake among target
111 populations: food must be (1) safe to eat on a sustained basis; (2) nutrient-dense at the point of
112 consumption; and (3) consumed in adequate amounts on a sustained basis. It also specifies requirements
113 that underpin these outcomes: participants along the chain must produce, process, and distribute the food
114 and target households must choose to eat it. Application of the framework involves evaluation of
115 whether, how, and why an intervention worked and a comparison of the effectiveness between the
116 intervention and others aimed at improving nutrition. As part of LANSA, a series of case studies using
117 this approach is being carried out across South Asia.⁶

118 The International Food Policy Research Institute (IFPRI) developed a complementary framework to
119 support the identification, design, and evaluation of value chain for nutrition interventions.³ This
120 framework specifies three ways that value chain interventions could improve nutrition: (1) increase
121 demand for nutritious foods; (2) enhance supply of nutritious foods by reducing costs and increasing
122 output and economic returns along the chain; and (3) improve chain efficiency. Building on this, they
123 outlined a five-step diagnostic approach: (1) identify the nutrition problem to be addressed; (2) analyze
124 the macro-level food systems context; (3) characterize diets, identify constraints and relative contributions
125 of key foods; (4) examine nutrition and food safety value addition; and (5) prioritize intervention options.³
126 A wide range of potential indicators and methods are suggested.

127 Stand-alone studies using VCA of short chains have used other approaches. One project led by
128 Bioversity International employed a value chain approach to the promotion of neglected and underutilized
129 grains in the Andes.²⁵ Rather than a single VCA, the initiative included a range of complementary studies
130 seeking to characterize different aspects of the value chains, including research to evaluate cultivars for
131 the target species, identify pests and diseases affecting their production, understand obstacles to
132 processing and use, document indigenous knowledge, characterize consumer demand and acceptance, and

133 assess nutritional content.²⁵ Masters et al. used a desk review and key informant interviews to investigate
134 the peanut value chain in Ghana with attention to identify opportunities to strengthen the chain for
135 improved nutrition and livelihoods.²⁶ Nutrition-oriented case studies in Fiji and Papua New Guinea
136 adapted the strategic management model of VCA to identify opportunities to improve the marketing of
137 fruits and vegetables.^{27,28} Both studies incorporated research to understand what consumers value and to
138 map and investigate the material flows, information flows, and relationships in local value chains.
139 Recently, VCA has been used to inform food system interventions for vulnerable women and young
140 children in Sierra Leone and Kenya. Similar to the approaches taken in the Pacific Islands, the study in
141 Sierra Leone used consumer research, value chain mapping, and semi-structured interviews to identify
142 entry points for nutrition in pumpkin and fish value chains.²⁹ In Nairobi, Kenya, a detailed quantitative
143 assessment of nutrition and food choice in low-income households was paired with interviews, focus
144 groups and observations along animal-source food value chains in order to assess associations between
145 access to and use of livestock value chains and maternal and child nutrition.³⁰⁻³²

146 **Value chain research on long chains**

147 VCAs of long chains in the nutrition space have focused on understanding how globalization and free
148 market forces are changing food marketing systems and thereby influencing consumption patterns
149 primarily in high-income countries. Unlike case studies on short chains, the intention of most of these
150 studies has not been to inform immediate nutrition action, but rather to raise awareness of the upstream
151 forces in food systems and the downstream public health implications. To date, the emphasis of this work
152 largely has been on overweight, obesity, and diet-related non-communicable diseases.

153 Gereffi and Christian made the first substantive contribution to nutrition-oriented research on long chains
154 when they presented a GVC approach to the study of childhood obesity at the WHO Early-Stage Expert
155 Meeting on Trade and Healthy Diets.³³ They have since applied the approach to commercial case
156 studies.³⁴⁻³⁶ Their findings are based on reviews of industry and government reports and analyses of

157 secondary data, and suggest a benefit to GVC analysis in identifying lead firms (companies with
158 disproportionate market power in the chain), the factors that underpin the structure and function of global
159 food industries, and leverage points for nutrition.

160 To analyze the Australian canned fruit industry from a nutrition perspective, Hattersley drew on insights
161 from Neilson and Pritchard, who argue that GVC research should afford greater space to analyzing the
162 institutional environment within which chains operate.^{37,38} She interviewed key informants in the canned
163 fruits industry and reviewed documents and reports on the sector. The study highlighted how
164 consolidation and shifting consumer demands have led to a more consistent supply and the development
165 of new, healthier canned fruit products, but the nutrition impacts of these changes remained unclear.

166 Hawkes developed a complementary framework for understanding food value chains and their
167 implications for nutrition and diet-related disease, termed ‘consumption-oriented food supply chain
168 analysis’.³⁹ The approach focuses on understanding the incentives and disincentives influencing chain
169 participants’ behavior and how the incentive structure could be leveraged to better align the chain with
170 healthy diets. The analysis draws from established approaches for examining food value chains, and
171 involves five steps: (1) describe the stages of the food supply chain; (2) describe the organizational,
172 financial, technological, and policy characteristics of the activities and participants at each stage and the
173 characteristics of consumers; (3) identify the organizational, financial, technological, and policy
174 incentives and disincentives in the chain and how they interrelate with consumer incentives; (4) analyze
175 how the features identified in steps two and three affect the food environment; and (5) use information
176 gathered to determine what incentives could be adjusted to improve the food environment. Hawkes
177 applied the approach to study the supply of Coca-Cola beverages to vending machines in US schools
178 using analysis of publically available information.³⁹

179 Consumption-oriented food supply chain analysis also has been used to investigate the World Trade
180 Organization’s Aid for Trade initiative and the supply of oils and fats in India.⁴⁰⁻⁴² The Aid for Trade

181 study summarized the policy and structural barriers to fruit and vegetable production and availability in
182 low-income countries, and highlighted opportunities for Aid for Trade to address these barriers.⁴⁰ The
183 Indian study used document reviews and key informant interviews to map the oils supply chain and
184 identify policy options to reduce purchases of oils and foods high in trans and saturated fat.^{41,42}

185 **INSIGHTS FOR DESIGNING VALUE CHAIN ANALYSIS FOR NUTRITION**

186 In this section, we propose five insights for the design of VCA for nutrition. These insights are based on
187 reviews of the primary and gray literature on food value chain research, the emerging case study evidence
188 on nutrition-oriented value chain studies presented in Section 2, research projects in which we have been
189 involved over the past seven years, and discussions with other researchers working in this area.^{3,10,28}

190 **Insight 1: Use a consumer perspective to guide selection of foods and chains for value chain analysis**

191 A keystone feature of value chains for nutrition is the emphasis on consumers. The underlying premise of
192 VCA for nutrition is that there is a discrepancy between actual and ideal dietary patterns and that
193 systematic assessment of food value chains can uncover opportunities for targeted nutrition intervention.
194 This is supported by basic economic modelling, which indicates that consumers are unlikely to demand a
195 nutritionally optimal combination of foods without intervention.¹² Therefore, the starting point for
196 analysis is understanding nutrition problems faced by target groups and what people in those groups are,
197 or are not, eating.³

198 In many cases, this can be informed by examining existing dietary data sources, but new data collection
199 may be required. For example, in the case study in Nairobi, the research team collected dietary,
200 anthropometric, biochemical, expenditure, and other questionnaire data from 205 low-income households
201 to understand intake and decisions regarding consumption of animal-source foods.^{31,32} In high-income
202 settings, evidence of actual purchasing behavior may be available, for instance through retailers' loyalty
203 cards. Where data permit, linear modelling using tools such as Optifood can elucidate nutritional

204 constraints, estimate the deviation of existing diets from recommendations, and identify what types of
205 food could help achieve nutrient adequacy.⁴³

206 VCAs traditionally examine value chains in relation to a single product or a small number of related
207 products (product family). Although this type of analysis clearly has merit, it has several conceptual and
208 methodological limitations for nutrition. First, people do not eat isolated foods produced through isolated
209 value chains.¹⁰ Instead, they have complex diets consisting of a variety of foods and the overall quality of
210 a diet depends on the combination and quantity of different foods consumed. Second, in most settings,
211 people do not eat enough of any single product for the operation of that product's value chain to make a
212 meaningful contribution to nutrition. The effect of a single food on nutrition may be negligible, but the
213 combined effects of multiple related foods included in a dietary pattern may be large enough to be
214 detectable.ⁱ Third, there may be substitution and complementarity effects, such that changes to the
215 performance of one value chain may have consequences for consumption of other foods.⁴⁴ For these
216 reasons, it is imperative from a nutrition perspective to develop an understanding of the wider agri-food
217 sector, a task beyond the scope of VCA. Yet, if there is evidence that a specific food or bundle of foods
218 can solve part of an identified nutrition problem, there is a benefit to concentrating on the chains or sub-
219 sector that deliver those products.

220 One way to broaden VCA beyond individual foods is to consider product families. This can be useful
221 when the foods and beverages in a family make major contributions to nutrition for a target population.
222 The VCAs led by IDS in Ghana, Nigeria, and Tanzania provide an example of this technique.²²⁻²⁴ The
223 identification of inadequate complementary feeding as a nutrition problem among the poor led the
224 researchers to analyze locally-produced complementary food mixes made of cereals and legumes. In all
225 three countries, complementary food mixes have a potentially important impact on nutrition for young
226 children and the local markets involve large numbers of small businesses and small numbers of large
227 national and multinational manufacturers. Although a variety of complementary food products are
228 available, nutrient content varies. Because no single complementary food mix and chain has a monopoly

229 on the sector, adopting the product family technique that looked at various chains for similar products
230 produced by different manufacturers enabled the analysts to gain a broader view of constraints to the
231 supply and identify options for strengthening the chains for nutrition.

232 The product family approach can also be applied when a single chain produces a family of similar
233 products and the resources, activities, and relationships along the chain are common to every product in
234 the family. Hawkes applied this technique when investigating the supply of Coca-Cola beverages to
235 school vending machines.³⁹ Given the nutrition and health concerns associated with sweetened beverages
236 and the centralized processing of Coca-Cola soft drink concentrates, her analysis focused on all Coca-
237 Cola beverages rather than a specific product (e.g. Coca-Cola classic, Diet Coke, Fanta). Using this
238 technique, she identified existing incentives for the sale of soft drinks in schools and opportunities for
239 leveraging these incentives for change.

240 A second way to broaden VCA beyond specific foods is to consider a small number of exemplar products
241 which collectively contribute to a nutrition problem or solution. The nutrition-oriented VCA in Fiji
242 provides an example of this technique.²⁸ After identifying low fruit and vegetable consumption as the
243 target nutrition problem, the researchers consulted with local partners to select a cluster of three locally-
244 grown products with distinct agricultural, nutritional, and economic characteristics. They found the
245 exemplar approach valuable because the Fijian fruit and vegetable sector is smallholder-led and most
246 value chain participants are incorporated simultaneously in multiple chains in multiple capacities. Any
247 effort to define roles in terms of a single chain may have precluded learning about important linkages and
248 decisions relevant to the fruit and vegetable sector as a whole.

249 **Insight 2: Consider the research question, available resources, and the type of value chain when**
250 **making study design decisions**

251 The second insight is that there is not one gold standard approach for VCA with nutrition objectives.
252 Several researchers have concluded that it is very difficult to make generalizations regarding the design of

253 VCA for nutrition.^{3,10} Value chains and nutrition challenges are context-specific, hence the most relevant
254 concepts and methods will vary between studies.

255 We have identified three perspectives on or approaches to nutrition-oriented VCA that have been adapted
256 to meet the needs of different research projects. All draw from the major traditions of VCA, examine the
257 chain as an interlinked system, and seek to identify points in the chain that could be levered for improved
258 nutrition. However, they differ with respect to how value chain concepts are prioritized and the degree to
259 which the research is action-oriented. They are termed here the problem-solving approach, the GVC
260 approach, and the consumption-oriented approach.

261 Problem-solving approach

262 The first, which we call the problem-solving approach, aligns with the strategic management tradition
263 introduced in Section 2. It re-frames food and nutrition insecurity as entrepreneurial opportunities.²⁷ The
264 business challenges are to effectively increase demand for nutrition and find profitable and sustainable
265 ways to reach at-risk populations with nutritious, affordable, and acceptable products.

266 VCA from the strategic management perspective typically involves gathering detailed information on
267 specific interlinked businesses in order to identify opportunities to reduce waste and create value. Chain
268 participants are involved in the investigation since the success of potential interventions hinges on their
269 readiness and ability to collaborate with each other. Market research is used to explore demand and is
270 followed by an investigation of material flows, information flows, and relationships. Qualitative data
271 produced from observations and interviews are reviewed and evidence is triangulated with other
272 documents (e.g. company records and reports). Key value chain metrics, such as volume, prices, and
273 profit margins are measured at each link in the chain. In nutrition-related studies, these can be augmented
274 with assessments of changes in nutrition value. Finally, findings are presented to key stakeholders to
275 draw attention to opportunities for improvement. Ideally, VCA is used to support a cycle of continuous
276 improvement.^{15,16}

277 This approach aligns with the tools and frameworks developed by IDS, GAIN, IFPRI, and other short
278 chain studies in Section 3.1. Incorporation of quantitative assessments of material and information flows
279 has been limited in nutrition-oriented studies to date, likely in part due to minimal record-keeping in
280 emerging markets and the unpredictable nature of agricultural production and trade, indicating an area for
281 additional methodological development. The problem-solving approach also could be applied to
282 nutrition-related research on long value chains. Opportunities include investigating post-harvest nutrient
283 losses, the addition of nutrient-rich ingredients, or the removal of unhealthy ingredients (e.g. salt, added
284 sugar).

285 Global Value Chain approach

286 The second major approach is the application of the GVC framework to nutrition. The GVC perspective
287 contrasts with the problem-solving approach's active involvement of those being studied in the research
288 process. In GVC analyses, the researchers control the research agenda and take an outsider's view of the
289 firms and chains under study. Information on the four key dimensions of GVC analysis is compiled
290 mainly using publically-available reports on lead firms and the industries and markets in which they
291 operate. Additional information may be obtained from interviews with industry stakeholders and experts.
292 For example, Hattersley's research on the Australian canned fruit industry drew from both primary and
293 secondary sources.³⁷

294 As illustrated in Section 3.2, long food value chains have proven to be particularly amenable to this form
295 of analysis because of public record-keeping. Publically held companies must prepare regular reports for
296 shareholders and markets, and cross-border trade often is documented by governments. The GVC
297 framework may be less well suited for short food value chains, where relationships tend to be
298 transactional and lack explicit coordination and where public documentation is more limited.

299 Consumption-oriented approach

300 The third major approach is application of the consumption-oriented food supply chain framework. The
301 data sources and methods used for consumption-oriented food supply chain analyses parallel those used
302 for GVC studies. The research approach relies heavily on reviews of published reports and publically-
303 available data, although collection of additional primary data may enrich the analysis, especially when
304 existing evidence is limited. For instance, in examining fats supply chains in India, Downs et al.
305 augmented document analysis with key informant interviews.^{41,42} In all applications, evidence gathered is
306 used to describe the structure and function of the chain and the incentives and disincentives at play.

307 To date, the few case studies that have used this approach have been of long chains. However, the
308 framework is not specifically oriented towards a certain level of analysis and also is potentially applicable
309 to the study of short chains. For instance, Hawkes suggests that the analysis could be used to identify
310 opportunities to develop local fruit and vegetable chains to encourage consumption and deliver value to
311 producers.³⁹ Further application of consumption-oriented food supply chain framework to different types
312 of value chains is needed to understand its full potential.

313 Regardless of the approach, VCA for nutrition requires methodological flexibility. Analytical tools
314 already exist for examining the various dimensions of food value chains and work is underway to develop
315 metrics and methods that provide a more holistic assessment by integrating different disciplines and
316 models.⁴⁵⁻⁴⁷ This remains an important area for future research.

317 **Insight 3: Situate consumer research at the center of the analysis**

318 A market orientation – defined as the extent to which information about the market is used as the basis of
319 decision-making – is central to the sustainability and competitiveness of value chains and the integrity of
320 VCA.⁴⁸ In addition to shedding light on diets and consumption patterns, consumer research can provide
321 information on how people think about nutrition, make purchasing decisions, and will perceive and react
322 to healthier food choices. Fundamental questions relate to whether consumers perceive a gap in the diet

323 and their willingness to pay for foods to fill the identified gap.³ Yet consumer research has been a
324 marginal component of most VCAs for nutrition to date. A notable exception is the work by Dominguez-
325 Salas et al. and Cornelsen et al. to characterize diets and drivers of animal-source food demand among
326 low-income households in Nairobi.^{31,32}

327 Efforts to improve VCA to include evaluation of consumer value could draw ideas from the strategic
328 management approach which incorporates specific consumer research to understand the factors that
329 influence consumers' food purchasing decisions and the importance of different product attributes.
330 Within the strategic management framework, consumer research is product-specific and focused on the
331 target consumer segments to account for the unique activities and distinct market potential of each
332 chain.^{49,50} Value chain management researchers use a combination of qualitative and quantitative
333 research methods to achieve this.⁵⁰ In the study in Fiji, Morgan et al. used focus groups to understand
334 general factors influencing fruit and vegetable intake among urban residents and the specific dimensions
335 of consumer-defined value for the three exemplar products.⁵¹ In the analysis of fish and pumpkin value
336 chains in Sierra Leone, SPRING used barrier analysis surveys in 15 communities for a similar purpose.²⁹
337 Further insights may be generated through research involving consumer segmentation using techniques
338 such as factor and cluster analyses. Studies of fresh vegetable value chains in Kenya and Nepal show that
339 consumer segmentation can be useful in informing efforts to better target shoppers, even poor consumers
340 in low- and middle-income settings.^{52,53}

341 **Insight 4: Incorporate assessment of economic trade-offs**

342 A fourth insight is that VCA for nutrition must find opportunities to align nutrition goals for consumers
343 with profit margins for those working along the value chain. Most food value chains are comprised of
344 for-profit businesses that make profit-driven decisions about what they will produce and sell, and the
345 volume and prices of those products.⁶ Regardless of the analytical approach adopted, an essential
346 question in every VCA for nutrition relates to the economic incentives for each chain participant.

347 Existing value chain frameworks acknowledge that an integral dimension of value in value chains is the
348 financial benefit that accrues to participants, and that to be sustainable, participation in the chain must be
349 profitable. However, engagement of the commercial agri-food sector in efforts to improve nutrition at
350 larger scales has been limited and challenging, due to distrust between the private and public sectors and
351 limited evidence on the business case for creating nutrition value.^{6,54}

352 A weakness of existing approaches to analyzing food value chains is the lack of a functional economic
353 model to measure the costs of current operations and the potential benefits of improvements.¹⁶ In fact,
354 none of the VCA case studies highlighted in Section 3 reported this type of robust economic assessment.
355 However, tools for integrating economic considerations into food value chain research are emerging. For
356 example, the US Department of Agriculture recently released a toolkit to guide economic assessments of
357 planned interventions in local food systems.⁵⁵

358 Understanding costs and benefits also is useful to inform decision-making and prioritize options.

359 Research from the Pacific Islands shows that even with limited food supply data, simple macro-
360 simulation modelling of costs and benefits of different actions is possible.⁵⁶ Assessing and explicitly
361 discussing economic trade-offs may result in less contentious and more sustainable interventions.

362 Further, if VCA is part of a cycle of continuous learning and development, as is advocated within value
363 chain management, it can be used to monitor the economic impacts of interventions (and identify suitable
364 adjustments).³

365 **Insight 5: Consider governance and stakeholders' capacity for and incentives to change**

366 The final insight is VCA should consider value chain governance and the capacity of all participants,
367 particularly private sector participants, to adopt new business models that integrate nutrition goals.

368 Gereffi defined governance as “authority and power relationships that determine how financial, material,
369 and human resources are allocated and flow within a chain”.^{18(p97)} In many chains, lead actors control key

370 resources and can exert pressure for change on trading partners with both positive and negative
371 consequences for nutrition, whilst those with less authority may have limited scope to change processes
372 without jeopardising their participation in the chain.³⁶ Further, food value chains are embedded within
373 wider macro-level economic environments, and government policies and regulations, trade agreements,
374 infrastructure and investment, social context, and other external forces can play a crucial role in how
375 value chain businesses organize their operations. Analysis of governance sheds light on how a chain is
376 coordinated, controlled, and regulated, and the relative power of different chain participants. This can
377 provide insights into potential entry points for nutrition action.

378 Although the level of detail varies, most nutrition-oriented VCA case studies have considered at least one
379 dimension of governance. Long chain studies organized around the GVC framework have sought to
380 identify the most powerful participants, explore change over time and drivers of change, and assess
381 implications for consumers.³³⁻³⁷ For long chains that involve cross-border economic activity, other
382 important aspects of governance are trade rules and regulations.⁵⁷ For instance, tariffs and non-tariff
383 barriers, such as sanitary and phytosanitary measures, can have a profound influence on food value chains
384 with implications for nutrition.⁵⁸ Therefore, understanding these aspects of the business environment, in
385 addition to the role of and incentives for lead actors, is important.

386 Studies of short value chains have tended to focus more on trust and commitment between trading
387 partners and less on the distribution of power. However, even in chains not governed by formal
388 contractual agreements, imbalances of power can impact chain participants and consumers.⁵⁹ For
389 example, recent experimental research on maize value chains in Kenya identified a high degree of market
390 power and strong suggestive evidence of collusion among traders with important implications for final
391 consumer prices.⁶⁰ Understanding intra-chain dynamics in short chains and how they intersect with
392 nutrition goals is an important area for future research, as it can suggest the types of policies and
393 interventions that may be most effective.

394 A broader perspective of a value chain considers how the business environment could be improved to
395 support value chain participants. This area has been largely overlooked in nutrition research.⁵⁴ However,
396 it is integrated into the IFPRI, GVC, and consumption-oriented food supply chain frameworks and
397 presents a gap that VCA for nutrition could address.

398 **CONCLUSION**

399 VCA is an emerging tool in nutrition intervention research and has promise to improve and promote
400 evidence-informed nutrition action. In this paper, we reviewed the current literature to explore the
401 different ways that VCA has been used to study food value chains, with a focus on its recent application
402 to nutrition. Using this information, we concluded five insights for improving the design of future VCA
403 to improve nutrition.

404 Understanding the basic principles of VCA, how it has been developed in different fields, and how it can
405 be applied to nutrition-related questions is critical to maximizing its utility for nutrition policy. It is
406 important to appreciate that VCA is flexible and can accommodate a range of nutrition questions and
407 wide variations in data to answer them. Well-designed studies can provide a 360-degree perspective on a
408 value chain's nutrition-related strengths and weaknesses and draw attention to potential entry points for
409 intervention. It is equally important to understand that poorly designed VCA studies represent a lost
410 opportunity to generate strong evidence to support decision makers aiming to make the greatest return on
411 investment.

412 There is a need to adjust the traditional VCA approaches to make them work for nutrition research and
413 policy, and finding ways to achieve this will only happen through evaluation of natural experiments of
414 food value chains. Our review of research to date suggests a useful approach might involve a fusion of
415 fidelity and flexibility: fidelity with the broad VCA frameworks and concepts that currently exist and
416 flexibility to tailor the research approach to the nutrition context. Ultimately, VCA is a means to an end,
417 so the focus should be on producing robust and useful information for nutrition interventions. More work

418 is needed to evaluate the utility of different analytical approaches and frameworks to examine different
419 types of chains, and whether VCAs for nutrition deliver on their potential to generate positive change.

420

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¹Exceptions exist; where dietary diversity is limited, changes to individual value chains may lead to positive nutritional outcomes. A notable example is the introduction of biofortified β carotene-rich orange sweet potato in rural Uganda and Mozambique. Effectiveness trials showed increased vitamin A intakes among women and children in both countries and improved vitamin A status among children in Uganda.^{61,62} A more recent example comes from Senegal where a value chain intervention that distributed micronutrient-fortified yogurt among pastoralists led to an increase in hemoglobin concentrations in children under five.⁶³