



Ranking of scenarios, actors and goals of food security: motivation for information seeking by food security decision makers

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Abstract

The establishment of the millennium development goals (MDGs) in 2000 and the sustainable development goals (SDGs) in 2015 (several of which are relevant to food security) meant that countries may use these markers to evaluate their progress and development. In order to achieve the targets identified in the SDGs which focus on food security, two scenarios have been identified. The aim of this paper is to rank the scenarios which would better assist in achieving food security, the actors and the goals of food security, expecting that the results would serve to inform the motivation and information seeking habits of decision makers in three Caribbean countries. The analytic hierarchy process and point score analysis were used to analyse the ranks assigned by the respondents. It was found that overall for policymakers/stakeholders/experts, trade-based food security was ranked higher than self-sufficiency food security and that Trinidad and Tobago and Barbados ranked it more important than in Belize. Regarding actors in obtaining food security, government was ranked most important in Trinidad and Tobago and Barbados but Belize felt that farmers were more significant. The economic goals of food security were ranked higher than physical and political goals, with socio-cultural goals ranked least important. Of the sub-goals, post disaster food security (physical); ensuring a stable food supply (political); having optimum levels of productivity (economic); and decreasing chronic non-communicable diseases and obesity (socio-cultural goals) were rated most important. These results reflect the motivation and information seeking behaviour of decision makers. They illustrate the ‘bias’ in searching and selecting information and where balance would be needed to treat with all aspects of food security.

Keywords Analytic hierarchy process · Caribbean · MDGS · Point score analysis · SDGS · West Indies

Abbreviations

AHP	Analytical hierarchy process
CNCDs	Chronic non-communicable diseases
MDGs	Millennium development goals
PSA	Point score analysis
SDGs	Sustainable development goals
UWI	The University of the West Indies

1 Introduction

The popular definition of food security, “food security exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy

life” (FAO 1996), was derived from the 1996 World Food Summit when global targets sought to “halve the 800 million of undernourished people by 2015” (FAO 1996). More recently, in 2015, the United Nations (UN) introduced 17 Sustainable Development Goals (SDGs) in the “2030 Agenda for Sustainable Development”. SDG 2: Zero Hunger “aims to end hunger, achieve food security and improved nutrition” is the new target following on from the Millennium Development Goals (MDGs) which aimed to reduce the proportion of people who suffer from hunger by half from 1990 to 2015 (Goal 1) and reduce the mortality rate among children under five by two-thirds between 1990 and 2015 (Goal 4) (IIED 2015).

Perrett (2012) described food security as a “wicked problem”, which Kolko (2012) defines as a “social or cultural problem that is difficult or impossible to solve for as many as four reasons: incomplete or contradictory knowledge, the number of people and opinions involved, the large economic burden, and the interconnected nature of these problems with other problems”. Other well-known wicked problems

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including climate change, poverty alleviation and similar concerns where resolution is not easily forthcoming can persist over time and require integration across levels and scales to deal with them.

Planning, according to Hayek (1945, p. 520)—especially for wicked problems, such as food security—is the “complex of interrelated decisions about allocation of available resources” where the knowledge needed to plan is not always known by the policymakers, but by others. In order to make decisions under such circumstances, use of appropriate and timely information is crucial, even obligatory. The role of data to guide decision making has been recognised as critical from as early as 1945 with the First Work Survey conducted by the FAO on malnutrition and starvation numbers in the world. It was highlighted that “vague knowledge that this situation exists is not enough: facts and figures are needed if the nations are to attempt to do away with famine and malnutrition” (FAO 1985, p. 73).

The paradigm of information availability and access have undergone a major shift with Information and Communication Technologies (ICTs), evolving rapidly and continuously transforming how we acquire information and, thus, use it. Bharat Jagdeo, former President of Guyana (with assistance from the Food and Agricultural Organization (FAO), the Inter-American Institute for Cooperation on Agriculture (IICA) and the Caribbean Community (CARICOM) Secretariat) published the *Jagdeo Initiative*—a strategy to reposition agriculture in the CARICOM region. In it he proffers ten key binding constraints affecting the agricultural sector, one of which was “weak and non-integrated information and intelligence systems” (Private Sector Commission of Guyana 2007; Monize 2011, p. 12).

The high-level regional recognition of data gaps suggests that decisions made at the national/regional level are crucial in improving the level of national/regional food security. Making such decisions depends on an improved understanding of the knowledgebase and rational used in prioritisation of food security issues as applied by decision makers.

Indeed, Ballayram et al. (2015) charge that, at the national level, relevant policy formulation and implementation in the area of food security have not been deemed to be urgent. More globally, even at the level of the European Union (EU), Candel et al. (2014) reveal that the interpretations of food security vary and the basis for decision making is unclear. Hence, aspects of food security believed to be more significant would affect the information seeking perspectives of decision makers and, thus, which goals guide decision making and planning.

1.1 International development goals and political goals

In the context of looking at development goals, prior to the year 2000, many developing countries followed an agenda

for growth and development devised for that country, often on advice from developed countries. Such technical and policy support depended on the extent of aid or other assistance obtained from beyond their (developing countries’) borders.

However, with the launch of the Millennium Development Goals (MDGs) and Sustainable Development Goals (SDGs) of the United Nations, respectively (UN. General Assembly 2000; UN. General Assembly 2015), countries now had a different way to arrive at their development agenda and priorities, moving away from generalised objectives to people-centred, time-bound, measurable objectives (Kumar et al. 2016).

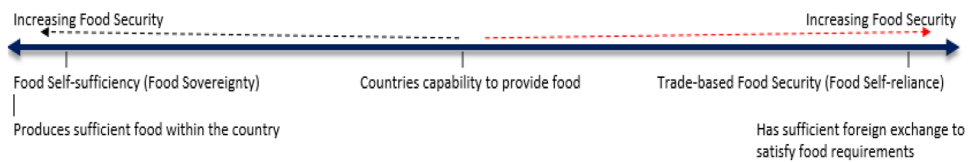
In 2000, the eight MDGs were drafted, ratified and adopted by world leaders, thus committing nations to achieve these goals by 2015. Subsequently, the SDGs were launched in 2015 to be achieved to some degree by 2030. Though there is a relationship between all the MDGs/SDGs and agriculture/food insecurity in some form (Pérez-Escamilla 2017), there are seven SDGs which are closely aligned to food security, namely

- (1) End poverty in all its forms everywhere.
- (2) End hunger, achieve food security and improved nutrition, and promote sustainable agriculture.
- (3) Ensure healthy lives and promote wellbeing for all at all ages.
- (8) Promote sustained, inclusive and sustainable economic growth, full and productive employment, and decent work for all.
- (12) Ensure sustainable consumption and production patterns.
- (13) Take urgent action to combat climate change and its impacts.
- (14) Conserve and sustainably use the oceans, seas and marine resources for sustainable development.
- (15) Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification and halt and reverse land degradation, and halt biodiversity loss.

Political goals to reduce hunger and malnutrition will have to address issues detailed by Drèze and Sen (1989, pp. 3–4) who argue that hunger is not a “new affliction” but is intolerable in the modern world for a number of reasons and, especially now perhaps, because there is adequate globally available food for all for the first time. Despite the growing production and availability of food, people can vary in their ability to access food for different reasons arising from the economy and the society.

Firstly, a large number of people have health problems from over consumption resulting from inequalities of distribution. Secondly, hunger persists, not because of a lack of affluence, but to “substantial—often extreme—inequalities

Fig. 1 Spectrum of scenarios for ensuring food security



in society”. Thirdly, markets can result in a drop in the more vulnerable in society’s ability to “command food on its relative position and comparative power versus other groups”. So if the price of fish or the price of animal products is less than staples, the fisherman and the livestock farmer may go hungry. Fourthly, wage labour, where persons have no other means of production, will try to get a wage which allows them to get food. But if food prices are high or there is an increase in unemployment, this group becomes increasingly vulnerable. The state can play a positive role but “dogmatic pursuit of policies” (Drèze and Sen 1989, p. 7) can force the susceptible to be in an even more precarious position.

Naylor (2018) suggests that food security is an elusive goal...a moving target as malnutrition continues for various reasons and is manifested in different ways, conflict and climate change issues exacerbates hunger and wavering commitment by humanitarian relief organisations, foreign aid agencies and governments.

Ford (2007) states that “despite these successive efforts, implementation of national policies, priorities and action plans for enhanced food and nutrition security in CARICOM remains challenging and incomplete” (as quoted in Lowitt et al. 2016).

This paper investigates who and what is important to decision makers in terms of the scenarios, actors and goals of achieving an enhanced level of food security in three CARICOM countries¹: Trinidad and Tobago, Belize and Barbados in order to determine the motivation for information seeking priorities.

1.2 Scenarios to enhance food security

Food production includes the contribution of fisheries and, though most times, food production is equated with food security, it is not. Nowadays, not only does the concept of food security include that all people, at all times should have physical, social and economic access to adequate food, which is safe and nutritious, but must also meet their dietary requirements and cultural customs (FAO 2003;

Pinstrup-Andersen 2009). In surveying the literature, it was determined that food security at the national level can be achieved essentially by one of two scenarios which provide for food to be available and accessible: trade-based food security and food self-sufficiency. Figure 1 illustrates the policy positions to support increasing levels of food security.

1.2.1 Trade-based food security/food self-reliance

“Trade-based food security” involves a mixture of growing food and importing food to satisfy the needs of the population. This circumstance is also called “food self-reliance”, defined as a situation where sufficient foreign exchange must be earned and managed so that all food needs are adequately served by purchase from external markets (Cashman 2014; Deep Ford and Rawlins 2007). For countries with adequate foreign exchange, allowing food to be available and accessible may be to the possible detriment of local agriculture/food production. Thus, in times of high food prices or the inability to ship food into a country, for example, food availability and accessibility may be a problem that could result in the population becoming food insecure.

1.2.2 Food self-sufficiency/food sovereignty

Food self-sufficiency is defined as a situation when a country is “able to meet consumption needs (particularly for staple food crops) from own production rather than by buying or importing” (Peljor and Minot 2010, p. 26). This is sometimes aligned to food sovereignty, which has been defined as:

The right of peoples to healthy and culturally appropriate food produced through ecologically sound and sustainable methods, and their right to define their own food and agriculture systems... Food sovereignty prioritises local and national economies and markets and empowers peasant and family farmer-driven agriculture, artisanal-fishing, pastoralist-led grazing, and food production, distribution and consumption based on environmental, social and economic sustainability. Food sovereignty promotes transparent trade that guarantees just incomes to all peoples as well as the rights of consumers to control their food and nutrition. It ensures that the rights to use and manage lands, territories, waters, seeds, livestock and biodiversity are in

¹ CARICOM member countries include 15 territories: Antigua & Barbuda, Barbados, Belize, Commonwealth of the Bahamas, Commonwealth of Dominica, Co-operative Republic of Guyana, Federation of St. Kitts & Nevis, Grenada, Jamaica, Montserrat, Republic of Haiti, Republic of Suriname, Republic of Trinidad & Tobago, St. Lucia, St. Vincent & the Grenadines.



Fig. 2 Scenarios for achieving food security



Fig. 3 Actors for achieving food security

the hands of those of us who produce food... (IPCFS 2009).

Food sovereignty has also been described as the right of a country to be able to define its food and agricultural policies without “dumping” [i.e. the sale of agricultural commodities by other countries at less than the cost of production prices (IATP 2004)] (Schanbacher 2010).

Although this scenario allows for persons in agriculture/food production to have higher levels of food security as government policy and funding provide adequate support, few countries are able to be fully food secure as described in this scenario. In theory, it ensures basic food (staples) is available. In practice, many countries are unable to produce all the food that they need and, without adequate foreign exchange, cannot ensure that all the food required for healthy, productive life is available and accessible to all citizens.

Figure 2 shows the two scenarios for achieving food security in the Caribbean.

1.3 Actors involved in achieving food security in the Caribbean

The major actors or players involved in ensuring food security are, for example, farmers, government, local business/trade, researchers, financial sector and external entities. External entities/foreign sector here refers to all entities/factors outside of the country which may have an influence on food security, e.g. on food prices, food supplies, and agricultural inputs. Figure 3 reflects the partners involved in achieving food security.

1.4 Information flows to support food security

There are several characteristics of food security/agricultural information which make it different to information in other disciplines. Food security/agricultural information is multidisciplinary and interdisciplinary at a number of levels—scientific, social and economic, “drawing, as it does, from biology, medicine, chemistry, soil science, various branches of engineering, climatology, food technology, the environmental sciences, economics, management, and a whole host

of other fields” (Lancaster and Beecher in their 1981 article “Agricultural Librarianship and Documentation as a Profession” (quoted in Paskoff 1990). Food security/agricultural information is location-specific, i.e. sensitive to geographic differences as well as issues of climate, soil, economics and national policy.

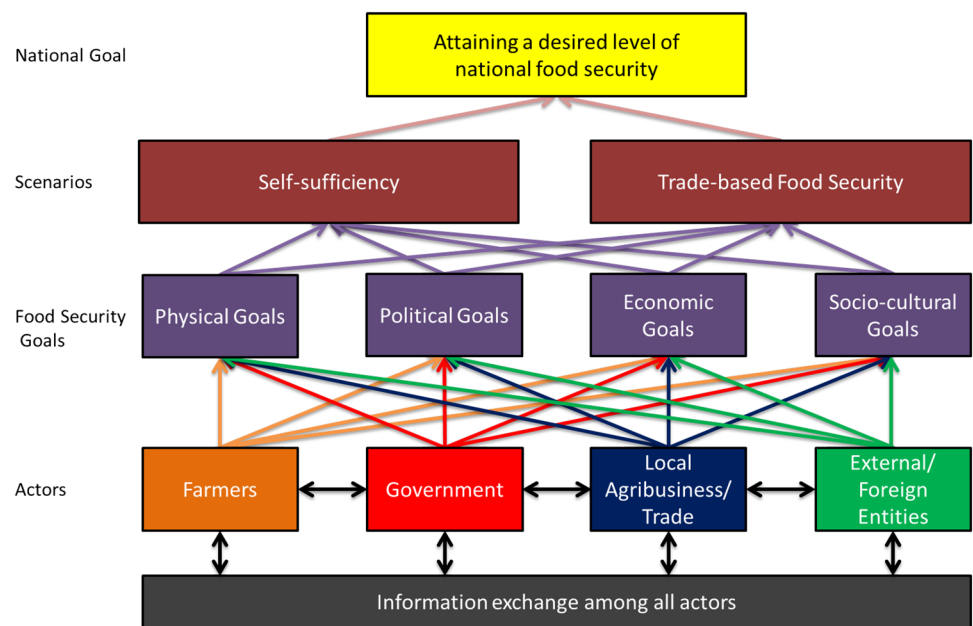
Cafiero and Stamoulis (2015, p. 2) state that “Many countries have data on food and nutrition security related to the various sectors (agriculture, health, education, forestry, fisheries, trade, economy, gender, etc.) generated by various stakeholders (government ministries, civil society organizations, private-sector organizations, academia, development agencies, etc.) However, the lack of a consolidated view of how the different pieces of information might tie together in providing a coherent picture of the complex web of food security and nutrition determinants and outcomes may reduce the effectiveness of available information”.

Cafiero and Stamoulis (2015, p. 3) propose that (1) the role of collecting and analysing data is to design better policies and have more effective implementation; (2) there should be increased political commitment, for example, in alleviating malnutrition; (3) there should be more coordination of the actors in food security as they hold all the information about the food and nutrition security situation; (4) there should be evidence-based decision making.

Agriculture, according Engelhard (2001, p. 65), is an “information-intensive industry” utilising indigenous knowledge as well as research materials and market data from local, regional and international sources.

The agricultural value chain is a complex system connecting research, input providers, service providers, growers, buyers, processors, and wholesale/retail. Most links in the system are compounded by the logistics of moving massive tonnage of material over land and water... Complex systems are all about information. In times of great variability, the whole of the agricultural value chain requires in-time, localized information to solve, limit and prevent the myriad of compounding events that lead to negative human impacts... Big Data methods, analysis and approaches can deliver information to help the agricultural value chain become more antifragile (and yes, robust and resilient) (Corbett 2015).

Fig. 4 Model of information flow and support for attaining an enhanced level of food security



Today, food security/agricultural information is stored and shared using a multitude of repositories and channels which require varying software and skillsets to utilise. Users have to navigate through a range of formats, e.g. photos, satellite and radar images, agricultural statistical data, journal articles, published and unpublished reports, books, graphs, maps and other geographic information, genomic information—many with varying standards.

The following model was developed based on the actors who utilise information to support food security. See Fig. 4.

This model illustrates that among actors, information must be shared and used by all to influence all goals of food security simultaneously and through the most efficient scenario at a given time to attain an enhanced desired level of national food security.

The black arrows depict the information flow among the actors going both ways and with all. This is where an efficient Extension Service facilitates information to and from farmers and to the other entities that influence food security levels.

The multi-coloured arrows portray the support every actor exerts to fulfil all the goals of food security. Depending on a country's economic and domestic food production at a given time, either scenario (since they exist on a continuum, see Fig. 1) could be supported to achieve an enhanced level of food security.

1.5 Objective and research questions

1.5.1 Objective

To determine how decision makers rank the food security scenarios; actors in attaining food security; and food security

goals; and compare these perspectives among three Caribbean territories.

1.5.2 Research questions

- How do decision makers rank the scenarios, actors and food security goals?
- Are there differences between how countries and categories of persons rank the scenarios, actors and food security goals?

2 Research design and methods

2.1 Methodological approach

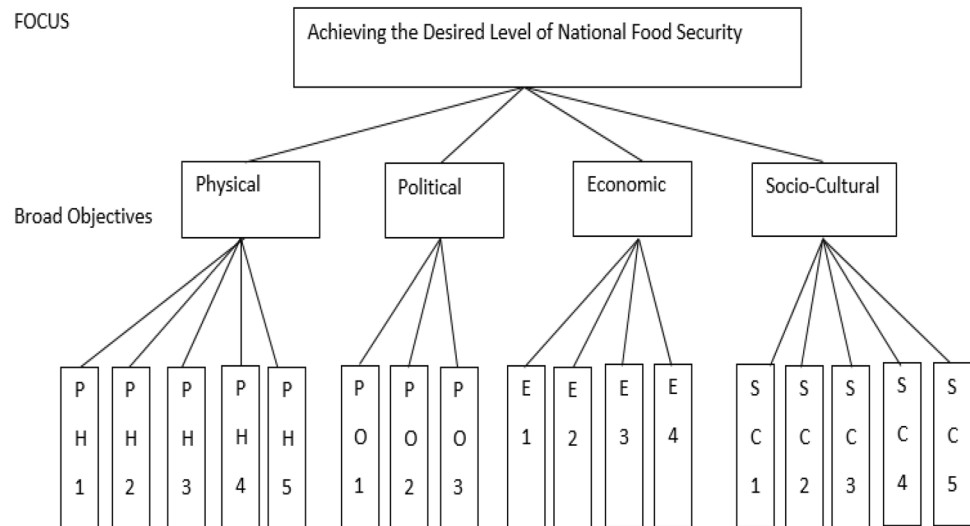
This study forms part of a larger mixed methods study investigating the information experience of food security decision makers in three countries in the Caribbean, which capitalised on the strengths of both qualitative and quantitative methods. Using a quantitative approach, this aspect of the study used a case study research design. Each country selected for study being sufficiently different from each other yet reflective of other Caribbean states allow generalisations to be meaningful.

2.2 Methods

In order to develop a list of the goals and sub-goals of food security, a review of the literature was conducted and a number of goals and sub-goals were identified. In order to verify that they were relevant to the Caribbean and feasible

Fig. 5 Goals of achieving food security

FOCUS



to accomplish the ranking exercise required for this study, consultations were held with experts whose area of research interest include food security: three lecturers in the Department of Agricultural Economics and Extension and one in the Department of Geography at the University of the West Indies (UWI), St. Augustine, Trinidad and Tobago. In this case, having deduced the list from the literature, the insight into the Caribbean perspective was essential and, possibly outweighed the biases which the expert-endorsed lists might have introduced. The corroborated list of goals and sub-goals were categorised into four main goals or broad objectives: physical, political, economic and socio-cultural as follows:

Physical

1. Ensure food is safe (e.g. national standards for the informal/roadside food sector/food monitoring/bioterrorism)
2. Ensure post disaster food security (includes storage capacity, ensure access to local genetic resources/decrease loss of biodiversity, etc.)
3. Ensure people get the minimum nutritional requirements
4. Produce more local foods in a sustainable way
5. Ensure adequate food distribution

Political

1. Eradicate hunger and malnutrition
2. Ensure stable food supply—political/national security
3. Reduce foreign dependency/achieve a preset level of food self-sufficiency

Economic

1. Reduce food import bill—optimise government income; more money for other things; balance of payments

2. Ensure optimum levels of productivity—agricultural yields (optimise inputs, land usage, water usage), overall labour
3. Reduce the volatility and level of food prices
4. Offer a fair price to farmers

Socio-cultural

1. Reduce poverty/reduce vulnerability of groups
2. Decrease chronic non-communicable diseases and obesity
3. Satisfy food habits and preferences of all citizens
4. Increase consumption of local foods
5. Maximise employment opportunities

Figure 5 depicts the broad objectives and goals of food security to be ranked.

2.3 Study area

Out of the 15 territories in CARICOM, Trinidad and Tobago, Belize and Barbados were selected based on their diverse characteristics regarding food security which reflects the variation of the natural resource base, climate, agricultural production, trade patterns, economic circumstances, population characteristics as well as culture, language, literacy levels, history, etc., found in the region. Rather than a single-country study or one that generalises on similar countries, this study used a sample from different types of territories to illustrate the varied nature of the Caribbean states.

Limited time and resources for travel and field work restricted the study to three countries. So one mainland territory (Belize), a small island state (Barbados) and a country with energy based economy (thus a high GDP compared to

Table 1 Characteristics of selected countries

Characteristics	Country ^a		
	Trinidad and Tobago	Belize	Barbados
Land size (km ²)	5128	22,966	430
Arable land (km ²)	251.3	757.9	120.0
Arable land as % total land	4.9	3.3	27.9
Population	1,225,225	334,297	288,275
Pop density (pop per km ²)	239.0	14.6	670.4
Labour force in (agri)	46,559	34,098	28,826
Agri labour force as % pop	3.8	10.2	10.0
Main econ activity	Oil/gas	Agri/tourism	Tourism
GDP (US\$ billion)	26.4	3.0	6.9
Agri contribution to GDP (%) ^b	0.3	10.2	3.1
Food import bill (US\$ million)	364	44	128
Description	Large island state	Mainland state	Small island state

Source: Data from CIA (2013)

^aTrinidad and Tobago (11° 00' N and 61° 00' W); Belize (17° 15' N, 88° 45' W); and Barbados (13° 10' N, 59° 32' W)

^bGross Domestic Product (GDP) (PPP-Purchasing Power Parity) figures are a 2012 estimate in 2012 dollars

the others) (Trinidad and Tobago) were selected so that they were reflective of the issues shared by the other states.

Table 1 lists the characteristics of the three countries which illustrate their diversity.

2.4 Sample

The study population considered was the category of persons who make or influence decisions for national food security to bring a unique information-based perspective to planning for food security in CARICOM. As such, the food security decision makers comprised:

- **Policymakers:** Ministers, Permanent Secretaries, Director of Planning/Senior Research Officer/Senior Economist in the Ministries of Agriculture/Food Production and, possibly, Environment, Health, Trade, Planning, Social Development
- **Planners and Technocrats/Specialist and Statistical Advisors** in the Ministry of Agriculture/Food Production (i.e. persons who provide policymakers with briefs, policy options and advice, etc. and support for decision making)
- **Influencers** (i.e. persons who influence policymakers/planners, social policymakers): e.g. Directors of International and Regional Agencies and Specialist Research Institutes; Respected Food and Agriculture Academics and Professionals; Heads of Relevant Associations, Boards, Local, Regional and International Non-Governmental Organisations (NGOs) and Faith-Based Organisations (FBOs); Mass media and newspaper columnists; Political Advisors (FAO 2011, p. 111)

After considering the various sampling methods available, both probability and non-probability types as well as the nature of the study population in terms of size and time available to take part in the study, the sampling method utilised was purposive sampling. Selecting participants purposefully is a method used in qualitative studies as these persons may provide the better responses than larger random samples often used in quantitative studies (Creswell 2014). Purposive sampling allows for selection of a small number of respondents who may provide the most appropriate information about the study at hand (Bickman and Rog 2009) and have attributes relevant to the study (Gorman and Clayton 1997). Patton (1990, p. 169) suggests that the strength of purposeful sampling is the selection of “information rich cases” who are capable of addressing the core issues of the research at hand in a fundamental and focussed way.

The sampling method was also stratified. Creswell (2007) notes that stratified purposive sampling allows for comparisons in small subdivided populations. The sampling method may be considered expert sampling, which according to Trochim and Donnelly (2008) assembles experienced persons who have shown expertise in the subject under study.

As a result of this process identified to select the sample, the author based on her own expertise and experience was able to select persons who are information-rich with respect to achieving objectives of the study. Based on snowballing techniques, the researcher validated the selection of participants. In this case, the author can be said to have high theoretical sensitivity based on professional and personal experience (Strauss and Corbin 1998) in her agricultural background (academic and practitioner), library science and regional librarianship experience. Mills et al. (2006, p. 4)

Table 2 Overall sample by country and category of persons

Category	Country			Total
	Trinidad and Tobago	Belize	Barbados	
Policymakers	5	4	5	14
Planners/Technocrats	7	4	5	16
Influencers	18	18	16	52
Total	30	26	26	82

elaborate that “theoretical sensitivity is a multidimensional concept that includes the researchers’ level of insight into the research area, how attuned they are to the nuances and complexity” of data gathered in the study.

In selecting the subset of influencers, snowballing (recommendations from sample persons already chosen (Patton 1990)) was used to identify some of the participants, especially in territories where the researcher was a non-resident, Barbados and Belize. See Table 2 for a breakdown of overall sample.

Key policymakers included in the study, among others, were three ministers of government, three permanent secretaries, two deputy permanent secretaries, two chief executive officers and two chief agricultural officers.

2.5 Data collection

In order to accommodate the limited time decision makers have as a result of the nature of their work and demands on their availability, two methods were used to answer the research questions: the Analytical Hierarchy Method (AHP) and Point Score Analysis (PSA). As the former instrument was time intensive and required detailed responses, the latter was used to capture data from those with less available time to answer in detail.

2.5.1 Analytical hierarchy process (AHP)

Saaty devised the AHP in the 1980s and it was utilised as one of the tools to be used for analysing complex decision-making processes in many fields, e.g. business, engineering (Saaty and Vargas 2001). The AHP has been used in agricultural decision making (see e.g. Alphonse (1997), Leung et al. (1998) and Chowdhury et al. (2010)). AHP uses pairwise comparisons to derive priorities when applied to complex problems (Saaty 2008) and can, among other assessments, rank a number of alternatives (Power 2003).

Data gathering was done by interview utilising an AHP questionnaire (see Appendix 1), which posed the pairwise comparisons and required interviewees to indicate on a scale how much more important one item was relative to the other.

Table 3 Breakdown of sample by country and category of persons

Category	Country			Total
	Trinidad and Tobago	Belize	Barbados	
Policymakers	1	2	2	5
Planners/Technocrats	3	3	2	8
Influencers	3	2	3	8
Total	7	7	7	21

SCALE

9	7	5	3	1
Absolutely Important	V. Strongly Important	Strongly Important	Slightly Important	Equally Important

Participants were asked to do the ranking from an ideal point of view (not from what they think currently obtains in practice) as the former allows insight in to the participants’ thinking (which influences information seeking) rather some general perspective which may not be reflective of their thinking when searching for information. The hierarchies used to illustrate the items that were ranked may be seen in Figs. 2, 3 and 4.

Ideally, using the AHP questionnaire across the sample population would have been optimal. However, due to the limitations of time, 21 persons were identified from the sample (see Table 3) to be interviewed using the AHP questionnaire (see "Appendix 1"). The researcher selected persons based on knowledge of experts as well as asking these experts for advice (snowballing) and then verifying that the participants were willing to be involved in the study and would be able to allocate sufficient time to complete the questionnaire. These persons were able to rank both major goals and sub-goals.

2.5.2 Point score analysis (PSA)

PSA is a qualitative method of analysing decision making in agriculture (Ilbery 1977). The factors for analysis are identified. Each attribute is granted a point score according to a graduated scale of significance. The points on the scale range, as appropriate, from 1 for ‘not really important,’ 2 for ‘important,’ 3 for ‘very important,’ to 4 for ‘essential’. ‘Irrelevant’ factors are 0. The sum of scores allocated to each factor is taken to be a measure of its relative importance. As a result, the factors can be ranked according to significance. Converting the score to a percentage of the maximum possible score illustrates the rank as a function of sample size (Ryder 1993).

Table 4 Breakdown of sample using PSA by country and category of persons

Category	Country			Total
	Trinidad and Tobago	Belize	Barbados	
Policymakers	4	2	3	9
Planners/Technocrats	4	1	3	8
Influencers	15	16	13	44
Total	23	19	19	61

The rest of the sample ($n = 61$) were asked to rank only the major goals when interviewed using the following questions:

1. Which is more important in the context of this country (1 – most important, 2 – less important):

__ Economic-trade based food security or

__ self-sufficiency/taking care of the environment/sustainable practices

2. Rank the following in order of importance (1 - most important, 4 – least important):

Participants in Food Security:

__ Farmers

__ Government

__ Local business/Trade

__ External Entity

3. Broad objectives of Food Security Goals (1 - most important, 4 – least important):

__ Socio-cultural

__ Political

__ Physical

__ Economic

The breakdown by category and country of this portion of the sample, which used PSA analysis, is shown in Table 4.

2.6 Data analysis

Two methods, AHP and PSA, were used to collect and analyse the data. The final ranking scores from both methods were combined for an overall rank. Kendall's coefficient of concordance W was used to check the degree of inter-rater agreement.

2.6.1 Kendall's coefficient of concordance W

Siegel (1956) explains that Kendall's coefficient of concordance w is a non-parametric statistic which is used to measure inter-rater agreement among rankings.

$$W = \frac{\text{Variance of column totals}}{\text{Maximum possible variance of column totals}}$$

If there is 'perfect agreement', w is 1.0 and if there is 'perfect disagreement', W will be zero or close to zero (Geert van den Berg 2016). The statistic W was calculated using SPSS software.

3 Results

3.1 Ranking of the scenarios, actors, goals and sub-goals of food security

3.1.1 Scenarios

Overall as well as across the categories of persons, self-sufficiency was ranked higher than a trade-based scenario for food security. Trinidad and Tobago, however, ranked trade-based food security over self-sufficiency, which was the choice made by respondents of Barbados and Belize [see Appendix 2, Tables 6, 7, 8].

3.1.2 Actors

Overall, in descending order, the ranking of the actors was Government, farmers, local business and, then, external entities. Whereas Belize gave farmers top rank, Barbados and Trinidad and Tobago placed Government first. Based on countries, all respondents agreed that the local business sector was more important than external entities/foreign sector.

Influencers felt that government was most important with policymakers and planners/technocrats identified farmers as most important. All participants by category felt that local business was more important than external entities [see Appendix 2, Tables 6, 7, 8].

3.1.3 Goals of food security

Overall, economic goals were ranked most important with physical next and, then, political with socio-cultural ranked least important. Each country ranked the goals differently and, so too, there was no consistency across category of persons [see Appendix 2, Tables 6, 7, 8].

For category of persons, Kendall's coefficient of concordance $W=0.706$ means that there was a high level of

agreement among policymakers, planners/technocrats and influencers.

For countries, Kendall's coefficient of concordance $W=0.567$ means that there was less agreement among countries than there was among category of persons.

3.1.4 Sub-goals of food security

Noting that the ranking of sub-goals was possible for only the 21 persons who participated in the AHP, it was discovered that the most important sub-goals were as follows:

- For physical goals: post disaster food security;
- For political goals: ensuring a stable food supply;
- For economic goals: having optimum levels of productivity;
- For socio-cultural goals: decreasing Chronic Non-Communicable Diseases (CNCDs) and obesity.

This view was also obtained for category of persons. However, across countries, though the same was obtained for the first three goals, Belize chose reducing poverty as its top priority and Trinidad and Tobago and Barbados selected

Table 5 Government expenditure on health for Trinidad and Tobago, Belize and Barbados, 1995–2014

Year	Government expenditure on health								
	Health expenditure, public (% of GDP)			Health expenditure, public (% of government expenditure)			Health expenditure per capita (current US\$)		
	Trinidad and Tobago	Belize	Barbados	Trinidad and Tobago	Belize	Barbados	Trinidad and Tobago	Belize	Barbados
1995	2.6	2.6	3.5	9.4	10.5	11.4	216.49	127.21	447.48
1996	2.4	2.0	3.5	8.2	8.2	10.5	216.61	108.98	462.00
1997	2.3	2.3	3.3	6.4	8.9	9.5	208.33	115.72	490.44
1998	2.0	2.2	3.2	5.8	7.7	9.9	200.08	113.56	526.21
1999	2.3	2.0	3.3	7.9	6.1	9.9	253.42	112.39	564.43
2000	2.0	2.1	3.4	6.8	6.5	9.9	268.01	133.72	595.97
2001	2.2	2.6	3.7	7.5	7.4	10.2	305.05	153.94	629.15
2002	2.6	2.5	4.0	9.6	7.4	10.1	352.32	155.77	672.51
2003	2.6	2.6	3.8	8.9	8.5	10.0	448.51	166.87	698.67
2004	2.6	2.5	3.7	9.1	8.0	10.3	521.58	168.36	734.16
2005	2.6	2.6	3.5	9.4	9.3	9.2	647.67	175.14	763.74
2006	2.2	2.7	3.4	6.7	9.2	10.2	625.10	184.27	825.34
2007	2.3	3.0	3.8	8.1	10.6	10.0	790.07	205.89	928.29
2008	2.1	3.3	4.1	8.8	11.5	10.5	922.85	227.66	996.66
2009	3.2	3.9	4.1	8.5	12.9	11.0	925.58	247.34	1026.94
2010	2.9	3.9	4.0	8.1	13.1	9.7	805.14	253.95	980.96
2011	2.6	3.7	4.2	7.2	13.4	10.1	878.25	253.19	1035.87
2012	2.8	3.6	4.8	7.6	12.5	10.7	989.21	254.89	1137.95
2013	2.9	3.8	4.9	7.5	13.4	10.7	1047.77	273.27	1146.95
2014	2.9	3.9	4.7	7.6	13.8	10.9	1090.99	278.58	1146.04

Source: The World Bank (2016)

decreasing CNCs and obesity [see Appendix 2, Tables 9, 10, 11].

For category of persons, Kendall's coefficient of concordance $W=0.567$ means that there was a moderate level of agreement among policymakers, planners/technocrats and influencers.

For countries, Kendall's coefficient of concordance $W=0.706$ means that though there was a high level of agreement among category of persons, there was more agreement than among countries.

4 Discussion

The results of this study are novel, as while reviewing the literature on food security in general and, more specifically, the Caribbean, no similar studies in research design, methods or findings were discovered. The use of the Analytical Hierarchy Process (AHP) and Point Score Analysis (PSA) are not common in the region for studies in either the fields of agriculture or information, so this study can serve to share these methods. The use of the process, the AHP, for food security planning in the Caribbean has not been done nor has it not been documented and published to date.

Food security, through a self-sufficiency scenario, was ranked higher overall except for Trinidad and Tobago who, because of the oil-based economy, favoured trade-based food security. Belize, which had more agricultural development and greater levels of self-sufficiency, believed that farmers were the most important actors as opposed to Barbados and Trinidad and Tobago where the Government has greater say in the levels of food security as trade-based food security depended on the availability of foreign exchange.

Regarding the major goals, economic goals were ranked highest. This may explain why most studies on food security are undertaken from an economic point of view. Though the definition of food security has been expanded to include socio-cultural aspects, this notion is probably more relevant to already food secure nations who are able to deal with food security at a higher level, not at a basic level. Physical goals were the next highest ranked and, then, political with socio-cultural goals ranked least important in general.

The ranking of the sub-goals reflected the state of issues in the countries. Based on GDP, Belize still had a lot of poverty (3.0 USD billion) compared to Trinidad and Tobago—26.4 USD billion and Barbados 6.9 USD billion (CIA 2013).

In terms of socio-cultural goals, Barbados and Trinidad and Tobago had health issues of over-nutrition which is a critical concern in these two countries and, as a consequence, obesity and CNCs [Trinidad and Tobago 80.2 | Barbados 84.2 | Belize 65.4 -Deaths by CNCs as a % of the total number of deaths in 2012] (The World Bank 2016).

Henry (2016, p. 194) claims that “unchecked, obesity in the Caribbean will soon reach proportions which are uncontrollable”. There was already an increasing trend in Government expenditure on health for the three countries from 1995 to 2014. See Table 5.

In terms of physical goals, post disaster recovery would be important to Barbados, being in the hurricane belt and Trinidad and Tobago where there have been major flooding crises in recent years.

Optimum levels of productivity, the highest ranked economic goal, would be relevant to all Caribbean countries as this would ensure maximum income, whether persons were in agricultural production or earning income to afford food.

Ensuring a stable food supply was ranked the most important political goal. Brathwaite (2009, 2011) concurs as he considers that food security is imperative for national security.

5 Conclusion

The self-sufficiency scenario was ranked higher overall except for Trinidad and Tobago. Belize believed that farmers were most important to them as opposed to Barbados and Trinidad and Tobago where the Government has greater say in the levels of food security.

Regarding the major goals, economic goals were ranked highest with physical next and, then, political with socio-cultural ranked least important. The ranking of the sub-goals reflected the state of issues in the country with poverty high in Belize and CNCs prominent issues in the other two countries.

This study fills a gap in the literature in terms of the information behaviour of policymakers and decision making in food security planning. A more meaningful and greater appreciation of the ranking of food security goals in the context the Caribbean by examining three Caribbean countries, Trinidad and Tobago, Belize and Barbados with varying resource bases was determined.

Despite the standardised definition of food security, this study illustrated how decision makers in the Caribbean actually ranked the goals of food security. Thus, inferences could be made on how this may bias their approach to identifying their information needs, information seeking and information use to support their decision making.

The implications of the rankings of the food security goals and sub-goals for searching and using information should be seen in the context that motivation and attitude would affect information seeking strategies and prioritising use of time and effort in some areas and not others.

When there is limited time to find information and data (and noting Zipf's Principle of Least Effort in his 1949 book, *Human Behavior and the Principle of Least Effort* people

naturally adopt a course of action which allows them to use the least effort predicting that people seeking information will expend the least effort, even if it means compromising on quality or quantity (Case 2002, 2005)), without a formal structure for monitoring with set indicators and means of collecting such, priority will be given to the collection and uses of data based on the goals and perspectives prioritised. These findings illustrate the 'bias' in managing information and where balance would be needed if policy is to treat with all aspects of food security.

The model of information flow and support for an enhanced level of food security, a novel one, illustrates that all the communication takes place concurrently, so choices on what information to collect, organise and use are critical as there are always time and resource constraints in reality.

An area where this kind of research is extremely important is with extension officers. In order to advise stakeholders/farmers in current information paradigm of overload and context of appropriate and timely information, extension officers must be information literate. Using a similar framework to the one identified in this study would reveal how they conceptualise and prioritise food security in terms of the work they do, their use of information and perception of their level of competency in finding information and the extent to which information literacy training would be relevant to them.

It is strongly recommended that CARICOM investigate and determine what criteria and indicators should be collected relevant to the region and not necessarily follow the generalised international criteria of FAO.

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Compliance with ethical standards

Conflict of interest The author declares that she has no conflict of interest.

Ethics approval and consent to participate All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed consent Informed consent was obtained from all individual participants included in the study.

Availability of data and material The datasets used and/or analysed during the current study are available from the corresponding author on reasonable requests.

Appendix 1: Analytical Hierarchy Process (AHP) Questionnaire

Rank the levels of the hierarchy

Scenario: Compare the relative Importance with respect to: Attaining a preset level of food security:

Scenarios	Trade-based Food Security	Food Self- Sufficiency /Sustainability of the Environment
Trade-based Food Security	1	
Food Self- Sufficiency /Sustainability of the Environment		1

Participants: Compare the relative Importance with respect to: Attaining a preset level of food security:

Participants	Government	Farmers	Local Business	Foreign Sector
Ranking				

Participants				
	1			
		1		
			1	
				1

Broad Objectives: Compare the relative Importance with respect to: Attaining a preset level of food security:

Broad Objectives	Physical	Political	Economic	Socio-Cultural
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Ranking				
---------	--	--	--	--

Broad Objectives				
	1			
		1		
			1	
				1

Physical Goals: Compare the relative Importance with respect to: Attaining a preset level of food security:

Physical Goals	Food is Safe	Post Disaster Food Security	Minimum nutritional requirements	Sustainable Food Production	Adequate Food Distribution
Ranking					

Physical Goals					
	1				
		1			
			1		
				1	
					1

Political Goals: Compare the relative Importance with respect to: Attaining a preset level of food security:

Political Goals	Eradicate Hunger and Malnutrition	Ensure a Stable Food Supply	Reduce Foreign Dependency
Ranking			

Political Goals			
	1		
		1	
			1

Economic Goals: Compare the relative Importance with respect to: Attaining a preset level of food security:

Economic Goals	Reduce Food Import Bill	Optimum Levels of Productivity	Manage Food Prices	Fair Price to Farmers
Ranking				

Economic Goals				
	1			
		1		
			1	
				1

Socio-Cultural Goals: Compare the relative Importance with respect to: Attaining a preset level of food security:

Socio-Cultural Goals	Reduce Poverty	Decrease CNCDS and obesity	Satisfy /food habits/preferences	Maximise Employment Opportunities	Increase Consumption of Local Foods
Ranking					

Socio-Cultural Goals					
	1				
		1			
			1		
				1	
					1

Appendix 2: ranking of scenarios, actors and food security goals

See Tables 6, 7, 8, 9, 10 and 11.

Table 6 Ranking of scenarios, actors and food security goals using combined AHP and PSA ranking—overall sample

No. of respondents	Methodology					
	AHP		PSA		ALL	
	21		61		82	
	Value	Rank	Value	Rank	Value	Rank
Trade-based Approach to Food Security	30	2	54	2	84	2
Self-sufficiency, sustainability and environmental approach to food security	33	1	66	1	99	1
Farmers	65	2	129	2	194	2
Government	73	1	130	1	203	1
Local business	48	3	101	3	149	3
Foreign sector	24	4	41	4	65	4
Physical	70	1	81	4	151	2
Political	33	4	116	1	149	3
Economic	55	2	110	2	165	1
Socio-cultural	52	3	94	3	146	4

$n = 82$

Table 7 Ranking of scenarios, actors and food security goals by country using combined AHP and PSA ranking—overall sample

No. of respondents	Country					
	BAR		BEL		TT	
	26		26		30	
	Value	Rank	Value	Rank	Value	Rank
Trade-based approach to food security	26	2	33	2	25	1
Self-sufficiency, sustainability and environmental approach to food security	37	1	39	1	23	2
Farmers	62	2	83	1	49	2
Government	69	1	76	2	58	1
Local Business	56	3	57	3	36	3
Foreign Sector	23	4	25	4	17	4
Physical	53	2	55	4	43	2
Political	49	4	68	1	32	4
Economic	53	2	63	2	49	1
Socio-cultural	55	1	55	4	36	3

$n = 82$

Table 8 Ranking of scenarios, actors and food security goals by category of persons using combined AHP and PSA ranking—overall sample

No. of respondents	Status					
	Policy makers		Planners/Tech		Influencers	
	14		16		52	
	Value	Rank	Value	Rank	Value	Rank
Trade-based approach to food security	15	2	19	2	50	2
Self-sufficiency, sustainability and environmental approach to food security	18	1	20	1	61	1
Farmers	38	1	43	1	113	2
Government	36	2	40	2	127	1
Local business	25	3	34	3	90	3
Foreign sector	11	4	13	4	41	4
Physical	28	2	38	1	85	4
Political	24	4	26	4	99	2
Economic	29	1	35	2	101	1
Socio-cultural	29	1	31	3	86	3

n = 82**Table 9** Ranking of detailed food security goals using AHP

Category	Goals	All	
		Value	Rank
Physical	Food is safe	48	5
	Post disaster food security	91	1
	Minimum nutritional requirements	55	4
	Sustainable food production	58	3
	Adequate food distribution	62	2
Political	Eradicate hunger and malnutrition	39	2
	Ensure a stable food supply	54	1
	Reduce foreign dependency	33	3
Economic	Reduce food import bill	52	2
	Optimum levels of productivity	72	1
	Manage food prices	46	3
	Fair price to farmers	40	4
Socio-cultural	Reduce poverty	79	2
	Dec CNCDs and obesity	84	1
	Satisfy/food habits/preferences	33	5
	Maximise employment opportunities	57	4
	Increase consumption of local foods	62	3

n = 21

Table 10 Ranking of detailed food security goals by category of persons using AHP

Category	Goal	Status					
		Policymakers		Tech/Planners		Influencers	
		Value	Rank	Value	Rank	Value	Rank
Physical	Food is safe	9	5	16	5	23	4
	Post disaster food security	21	1	38	1	32	1
	Minimum nutritional requirements	11	4	21	4	23	4
	Sustainable food production	19	2	21	4	18	55
	Adequate food distribution	15	3	23	2	24	2
Political	Eradicate hunger and malnutrition	11	2	13	3	15	2
	Ensure a stable food supply	13	1	22	1	19	1
	Reduce foreign dependency	6	3	13	3	14	3
Economic	Reduce food import bill	13	2	20	2	19	3
	Optimum levels of productivity	18	1	28	1	26	1
	Manage food prices	10	3	17	3	19	3
	Fair price to farmers	9	4	15	4	16	4
Socio-cultural	Reduce poverty	21	1	31	2	27	2
	Dec CNCDs and obesity	18	2	33	1	33	1
	Satisfy/food habits/preferences	8	3	14	5	11	5
	Maximise employment opportunities	14	5	20	4	23	4
	Increase consumption of local foods	14	5	22	3	26	3

 $n = 21$ **Table 11** Ranking of detailed food security goals by country using AHP

Category	Goal	Country					
		BAR		BEL		TT	
		Value	Rank	Value	Rank	Value	Rank
Physical	Food is safe	15	5	18	3	15	5
	Post disaster food security	30	1	31	1	30	1
	Minimum nutritional requirements	18	4	22	2	15	5
	Sustainable food production	21	2	17	5	20	3
	Adequate food distribution	20	3	17	5	25	2
Political	Eradicate hunger and malnutrition	14	2	13	2	12	3
	Ensure a stable food supply	17	1	19	1	18	1
	Reduce foreign dependency	11	3	10	3	12	3
Economic	Reduce food import bill	19	2	17	2	16	3
	Optimum levels of productivity	24	1	25	1	23	1
	Manage food prices	13	4	14	4	19	2
	Fair price to farmers	14	3	14	4	12	4
Socio-cultural	Reduce poverty	25	2	27	1	27	2
	Decreasing CNCDs and obesity	32	1	20	4	32	1
	Satisfy/food habits/preferences	9	5	16	5	8	5
	Maximise employment opportunities	15	4	22	2	20	3
	Increase consumption of local foods	24	3	20	4	18	4

 $n = 21$

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