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Origins of Sustainable Consumption of Organic Food: A Fuzzy Decision-Making Trial and Evaluation Laboratory Approach

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ABSTRACT

The paper aims to explore the crucial antecedents of consumer behaviour toward sustainable consumption of organic food. The integrated fuzzy set theory and Decision-Making Trial and Evaluation Laboratory (DEMATEL) methods, with experts' suggestion approach were adopted.The results reveal the six origins of sustainable consumption of organic foods, namely, the government support and guidance, mass media agents, education and research institutions, and consumer demographics (educational level, income status and age). The study grants an alternative approach for sustainable consumption theory using a fuzzy-set theory and DEMATEL methods.

Keywords: Fuzzy DEMATEL, Marketing strategies.

INTRODUCTION

The organic food production system is becoming an important strategic choice for countries in the context of climate change and food security crisis (Feil *et al.,* 2020; Luu, 2019; Severo *et al.,* 2021). Increasing organic food consumption is often considered a more sustainable food supply system and enhanced sustainability in the food system (Mørk *et al.,* 2017). Organic food consumption is a symbol of the ethical value system and consumers still face specific resistance in the process, which is formerly supply oriented, are now needs (Kushwah *et al.,* 2019; Vega-Zamora *et al.,* 2019). Researchers in developed countries have examined the impact of various factors in both individual and social aspects on consumption practices of consumer, however, researches related to sustainable purchase behaviour are limited in Asian countries, especially in organic food area (Liobikiene *et al.,* 2016; Wang *et al.,* 2014). Organic food is not a prevalent issue among research on sustainable consumption (Anantharaman, 2018; Dong *et al.,* 2018; Kang *et al.,* 2017). Some authors mentioned sustainable consumption, but in different products, the others analyzed organic food purchase behavior without sustainable context (Azzurra *et al.,* 2019). Most previous research has predominantly focused on individual consumer attitude, behaviour or choice (Choudhary *et al.,* 2019). This study grants significant enablers or determinants for sustainable behaviour on organic food among consumers in the situation of low transformation among consumption habits toward actual sustainable consumption behaviour (Joshi *et al.,* 2019).

The consumption behavior of organic foods has become one of the most popular academic and practical topics in the past few years (Minton *et al.,* 2018; Scalco *et al.,* 2017; Testa *et al.,* 2019). Although previous studies strove to propose appropriate approaches to identify sustainable consumption enablers with microeconomic theory approach and behavioral economics theory (Anantharaman, 2018; Luu, 2019),

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these methods had not considered linguistic ambiguity in the complexity of real problems and the interdependence among attributes of the consumption process and consumer psychology (Tseng *et al.*, 2018). Because of the vagueness of human judgments, more scholars try to combine DEMATEL with fuzzy logic as fuzzy set theory supplies a solution to uncertainty in these complex systematical problems (Bellman and Zadeh, 1970; Wu, 2012). Besides, consumers' organic food consumption behavior is a complex process, black box decoding process involves a large number of complexly linked criteria and factors, which might be resolved effectively by the DEMATEL method (Raval *et al.*, 2021; Torma *et al.*, 2018).

The paper uses a fuzzy set theory and DEMATEL method to approach sustainable consumption in a manner that goes beyond expert opinions. The study grants an alternative approach for sustainable consumption theory using a fuzzy-set theory and DEMATEL methods. The paper grants data on the influencing mechanism of each criterion on the whole system on organic food consumption behaviour, providing multi-faceted insight, deepening understanding related to the sustainable consumption behaviour of organic food, as the foundation for proposing effective marketing strategies, promoting sustainable consumption of organic food in a step-by-step manner.

From sustainable development perspectives, sustainable consumption refers to goods and services consumption behavior that responds to actual needs and future generation needs (World Commission on Environment and Development, 1987). Sustainable consumption behaviour might be presented in the four key dimensions, focusing on the ecological and socio-economic impacts of consumption behaviours (Geiger *et al.*, 2017). Organic products are generally regarded as healthier, safer, better tasting, and more nutritious than conventionally produced products (Luu, 2019).

The theory of planned behavior and value theory has adopted sustainable consumption behavior studies, based on perceived value effects on personal moral norms, beliefs and attitudes (Han *et al.*, 2020; Scalco *et al.*, 2017). The social cognitive theory is incorporated into the framework of reciprocal determinism to understand sustainable consumer behavior, based on the assumption of the individual capability of control over their actions with environmental occurrences (Phipps *et al.*, 2013).

Consumer Demographic Aspects

Sustainable consumption has mainly focused on green consumer socio-demographic profiling (Kwon and Ahn, 2020). Consumer demographic aspect, namely, age, education level, income, and family characteristics mainly focus on recent findings (Luu, 2019). Previous studies show that older people are, more likely to consume sustainably because they receive knowledge from surrounding sources (Azzurra *et al.*, 2019). People with higher education are more likely to express positive attitudes towards organic products (Singh and Verma, 2017). Organic food price is a crucial barrier for sustainable consumption behavior, higher-income households are also more likely to form positive attitudes and to purchase more organic food (Bryła, 2016). Previous studies that have used demographic predictors of behavior are ambiguous, and there have been inconsistencies in the findings of previous literature (Coderoni and Perito, 2020; Sun *et al.*, 2019).

Psychological Aspects

The psychological aspect reflects different customer psychology features about sustainable consumption (Joshi *et al.*, 2019; Sharma *et al.*, 2017; Wang *et al.*, 2018). Numerous scholars report a weak linkage between attitude/intention and behavior

related to green behavior (Chekima *et al.*, 2017; Tripathi *et al.*, 2016). Socio-psychological factors might explain environmentally conscious consumer behavior effectively (Coderoni and Perito, 2020). However, a small section of the existing research focuses on using socio-psychological factors in the explanation of consumer sustainable behavior (Srivastava and Chawla, 2017). Thus, psychological factors might provide insight into the role of individual factors for sustainable consumption (Joshi *et al.*, 2019).

Social-Level Aspects

The social-level aspect refers to social conditions that affect green consumption, which provides conditions that facilitate or restrict behavior (Han, 2020). The social condition aspect affects customer behavior such as consumption environment, environmental pollution level, and environmental trends (Song *et al.*, 2020). In discussing the social cognitive theory system collectivism and social value, others guidance and the external situation orientation are suitable for summarizing consumer green consumption behavior (Sun *et al.*, 2019). The social-level aspect as one enabler of sustainable consumption is proposed from the combination of structural theory, environmental sociology and consumption sociology (White *et al.*, 2019).

Stakeholders Impact

Stakeholder impact includes regulatory stakeholders, internal stakeholders and market stakeholders, which might influence the organization achievement (Simeone and Scarpato, 2020). Stakeholders participate in the decision-making process or influence the decision-making, whose interests are positively or negatively affected by the decision results (Golob *et al.*, 2018; Torres-Ruiz *et al.*, 2018; Zhuang *et al.*, 2019). Stakeholder impact, namely, government support and guidance, education and research institutions, and the mass media agents are considered to be the crucial stakeholders affecting sustainable consumption behavior (Pacheco-Blanco and Bastante-Ceca, 2016; Testa *et al.*, 2019; Xu *et al.*, 2018).

MATERIALS AND METHODS

Fuzzy DEMATEL

The paper implemented the fuzzy DEMATEL to determine the origins of sustainable consumption behavior and correlations among these antecedents, using linguistic preferences (Tseng *et al.*, 2018). The definition and steps of fuzzy DEMATEL are based on previous procedures (Raval *et al.*, 2021; Tseng *et al.*, 2018).

Step 1: Reviewing the origins of sustainable consumption of organic food, through the comprehensive literature review and experts' suggestions.

Step 2: Prepare the fuzzy pair-wise comparison matrix

A fuzzy scale is adopted for appraising the nexus between construct and criteria with five linguistic terms (low importance; moderate; strong; demonstrated; extreme importance) as shown in Table 1. Each linguistic term has its own corresponding positive Triangular Fuzzy Numbers (TFN), which is presented as a triplet (l, m, u), where $l \leq m \leq u$. Suppose $Z_{ij}^{k} = (l_{ij}, m_{ij}, u_{ij})$, where $l \leq k \leq K$ to be the fuzzy assessment that the *k-th* expert grants the degree to which *i* factor influences *j* factor.

Table 1. Fuzzy linguistics references.

Linguistics references	l	m	u
Low importance	0	0.1	0.3
Moderate	0.1	0.3	0.5
Strong	0.3	0.5	0.7
Demonstrated	0.5	0.7	0.9
Extreme importance	0.7	0.9	1.0

Step 3: Generating fuzzy initial direct relation matrix

The *k* experts develop sets of pair-wise comparison in terms of effects and direction among construct criteria with a defuzzification algorithm, which might transform a fuzzy output of a fuzzy inference system into a crisp output. The algorithm for defuzzification is performed by searching the center of gravity and singletons, the average mean, the left-most maximum and the right-most maximum. The CFCS (Converting Fuzzy data into Crisp Scores) method is adopted, based on determining the fuzzy minimum and maximum of the fuzzy number range, and the total score might be collected as a weighted average. The CFCS method algorithm for defuzzification is as follows:

Standardization of the fuzzy numbers:

$$xl_{ij}^{k} = \frac{\left(l_{ij}^{k} - min\ l_{ij}^{k}\right)}{\Delta_{min}^{max}},\ 1 \le k \le K \quad (1)$$

$$xm_{ij}^{k} = \frac{\left(m_{ij}^{k} - min\ l_{ij}^{k}\right)}{\Delta_{min}^{max}},\ 1 \le k \le K \quad (2)$$

$$xu_{ij}^{k} = \frac{\left(u_{ij}^{k} - min\ l_{ij}^{k}\right)}{\Delta_{min}^{max}},\ 1 \le k \le K \quad (3)$$

Where, $\Delta_{min}^{max} = max\ u_{ij}^{k} - min\ l_{ij}^{k}$

Calculation of left and right normalized values:

$$xls_{ij}^{k} = \frac{xm_{ij}^{k}}{\left(1 + xm_{ij}^{k} - xl_{ij}^{k}\right)} \quad (4)$$

$$xus_{ij}^{k} = \frac{xu_{ij}^{k}}{\left(1 + xu_{ij}^{k} - xm_{ij}^{k}\right)} \quad (5)$$

Calculation of the total normalized value:

$$x_{ij}^{k} = \frac{\left[xls_{ij}^{k}\left(1 - xls_{ij}^{k}\right) + xus_{ij}^{k}\right]}{\left(1 + xus_{ij}^{k} - xls_{ij}^{k}\right)} \quad (6)$$

Compute the crisp value:

$$BNP_{ij}^{k} = min\ l_{ij}^{k} - x_{ij}^{k}\Delta_{min}^{max},\ 1 \le k \le K \quad (7)$$

Get integrated score by averaging the crisp scores of all K assessments:

$$= \frac{1}{K}\sum_{k}^{1 \le k \le K} BNP_{ij}^{k} \quad (8)$$

The initial direct-relation matrix $A = \left[a_{ij}\right]$ is gathered, where A is an $n \times n$ non-negative matrix, *aij* reflects the direct effect of factor *i* on factor *j*, and when *i*=*j*, the diagonal elements *aij*= 0. Besides, the causal effect of each pair of factors can be mapped by drawing an influence map between each pair of factors.

Step 4: Compute the normalized direct relation matrix

Computation of the normalized direct-relation matrix $D = \left[d_{ij}\right]$, in every element in matrix *D* is complying with $0 \le d_{ij} \le 1$; also, all principal diagonal elements are equal to 0:

$$D = \frac{1}{max\left(max\sum_{j=1}^{n} a_{ij},\ 1 \le j \le n;\ max\sum_{i=1}^{n} a_{ij},\ 1 \le i \le n\right)} Z \quad (9)$$

Step 5: Develop the total relation matrix

The total relation matrix *T* is acquired, where *T* is an $n \times n$ identity matrix. The element t_{ij} presents the indirect effects that criterion *i* have on criterion *j*. Thus, the T matrix indicates the total relationship among all pairs of system factors. This matrix is computed by using the Matlab software:

$$T = D(I - D)^{-1} \quad (10)$$

Step 6: Develop the causal diagram

Calculating the Driving power (D) and dependence power (R) based on the total relation matrix by summing the rows and columns, respectively. Subsequently, the causal interrelationships diagram can be drawn by arranging the attributes adopting the coordinates (D+R, D-R). Therefore, (D+R) is used to express the horizontal axis, which is called "Prominence", to present the importance of attributes. Adopting (D-R) as a vertical axis represents the "Relation" and displays the cause and effect relation among the attributes. If an attribute's (D-R) has a positive value, the attribute belongs to a causal group; in contrast, if the attribute possesses a negative value for (D-R), it becomes an effect group (Tseng *et al.*, 2019).

Sample and Data Collection

A small sample is required to decide on the Fuzzy Dematel method, as it is not a statistically based technique (Chou *et al.*, 2012). In this study, a sample consists of 11

experts selected for interviews, including five professors with more than five years of research experience in customer behavior, three organic food store owners with more than five years of business experience, and three local consumer representatives with more than five years of using organic food. Respondents are voluntary and are informed that their responses would remain anonymous and confidential. The survey is based on purposive sampling and conducted between September and December 2020. The data is gathered by a direct interviewing method with an on-the-job interview approach, which is considered apposite for Vietnamese culture, where communication is primarily through interpersonal interaction. Furthermore, in emerging economies as Vietnam, an on-the-job interview method is needed to control the quality and reliability of data. The response rate in this study is 94.79%. Table 2 shows the sample representativeness.

Measurement

Regarding consumer psychological aspect (A1), four criteria were selected: Perceived consumer effectiveness (C1), attitude towards sustainable consumption (C2), perceived knowledge about sustainability (C3), and environmental concern (C4) (CurrásPérez et al., 2018; Joshi *et al.*, 2019; Luu, 2019; Sharma *et al.*, 2017; Taufique and Vaithianathan, 2018; Wang *et al.*, 2014).

Three criteria measure consumer demographic aspect (A2): Educational level, income status and consumer age (Luu, 2019; Paco and Lavrador, 2017; Sun *et al.*, 2019). Educational level (C5) means that highly educated people report higher environmental knowledge levels (Geng *et al.*, 2017; Joshi and Rahman, 2017; Luu, 2019; Mancini *et al.*, 2017). Income status (C6) affects the environment perceived validity (Wang, 2017). Consumer age (C7) is positively related to sustainable consumption (Bulut *et al.*, 2017; Luu, 2019).

The social-level aspect (A3) mentions the social conditions that affect sustainable consumer consumption, including consumption environment (C8), environmental pollution level (C9), and environmental trends (C10) (Luu, 2019; Minton *et al.*, 2018; Song *et al.*, 2020; Sun *et al.*, 2019).

The impact of stakeholders (A4) on consumer behavior consists of the impact of support and guidance from Government (C11), mass media (C12), education and

Table 2. Sample characteristics.

Demographic characteristics	Frequency	Percentage
Gender		
Male	7	63.64
Female	4	36.36
Age		
25-34 years	3	27.27
34-44 years	5	45.46
> 45 years	3	27.27
Level of education		
Professor in economics	1	9.09
Associate professor in economics	7	63.64
Other	3	27.27
Experience		
1. 6-10 year	3	27.27
2. 11-15 years	7	63.64
3. 15> years	1	9.09

research institutions (C13) (Luu, 2019; Pacheco-Blanco and Bastante-Ceca, 2016; Torres-Ruiz *et al.*, 2018; Xu *et al.*, 2018).

Table 3 shows the critical antecedents of sustainable consumption behavior of organic food, which are reviewed from previous studies and experts' suggestions.

RESULTS

The Fuzzy Delphi Method (FDM) Result

The summaries of FDM are shown in Tables 4, 5, and 6 along with their weight and threshold for screening out attributes. The initial set of sustainable consumption of organic food is evaluated based on experts' experience and judgment. After the evaluation, the linguistic terms are transformed into corresponding triangular fuzzy numbers as shown in Table 1. The FDM applied to refine the important enablers, which are obtainable with the threshold of 0.730, which reveals 13 enablers are accepted and presented in Table 4.

In the next stage, five proposed aspects were facsimiled for the experts' redefinition. Table 5 shows the Delphi panel with important weight and ranking of aspects. Results indicate that four aspects have an important level above the threshold of 0.755, including consumer's psychological aspect (A1), demographic aspect (A2), social-level aspect (A3), and stakeholder impact (A4).

The final results are shown in Table 6 with four significant attributes and 13 criteria employed to analyze in the DEMATEL and provide implication for practices.

DEMATEL Result

The experts' evaluations of inter-relationships among aspects are presented on fuzzy linguistic scales. Then, these empirical data must be converted into triangular fuzzy numbers, as indicated in Tables 7 and 8. These numbers possess incomparable and incomputable features; thus, the proposed procedures must be followed to resolve these vague meanings as precise crisp values.

Once crisp values are obtained, the DEMATEL is used to examine inter-relationships and the driving and dependence power through a cause-and-effect diagram. Table 9 shows the inter-relationship matrix of four aspects: consumer psychological aspect (A1), demographic aspect (A2), social-level aspect (A3), and stakeholder impact (A4). This inter-relationship matrix is converted into cause-and-effect inter-relationships, as shown in Table 10. D is the accumulation of rows, and R presents the accumulation of columns. In case (D-R) is a positive value, aspects are categorized into cause groups; otherwise, they belong to effect groups. A cause-and-effect diagram is then generated by mapping the dataset on (D+R), (D-R).

Figure 1 shows that the consumer demographic aspect (A2) and stakeholder impact (A4) belong to the cause group, whereas the effect group includes the psychological aspect (A1) and social-level aspect (A3). As a result, the consumer demographic aspect (A2) and stakeholder impact (A4) are crucial aspects of sustainable consumption. Figure 1 shows the interrelationships among the four attributes. A4 has a substantial impact on the psychological aspect (A1) and medium impact on the social-level aspect (A3), while the social-level aspect (A3) has a medium impact on the psychological aspect (A1). The effect of the consumer demographic aspect (A2) on the psychological aspect (A1) is medium, while the effect of the demographic aspect (A2) on the social-level aspect (A3) is weak. Consumer demographic aspect (A2) and stakeholder impact (A4) have no relationship with each other.

The initial and overall reciprocal relationship matrix is shown in Tables 11 and 12. The cause-and-effect diagram of the criteria may be developed based on driving and dependence power. Therefore, support and guidance from government (C11), mass media (C12), education and research

Table 3. Proposed measurement.

Aspects		Criteria
Consumer psychological aspect (A1)	C1	Consumer perception of consumption effectiveness
	C2	Attitude towards sustainable consumption behaviour
	C3	Consumer perception of sustainability knowledge
	C4	Environmental concern
Consumer demographic aspect (A2)	C5	Educational level
	C6	Income status
	C7	Consumer age
Social-level aspect (A3)	C8	Consumption environment
	C9	Environmental pollution level
	C10	Environmental trends
Stakeholder impact (A4)	C11	Support and guidance from Government
	C12	Mass media
	C13	Education and research institutions

Table 4. The Fuzzy Delphi Method (FDM) screening out for enablers.

Initial practices	l_p	u_p	D_p	Decision
C1	0.334	0.916	0.778	Accepted
C2	0.349	0.901	0.767	Accepted
C3	0.323	0.927	0.785	Accepted
C4	0.021	0.854	0.652	Unaccepted
C5	0.327	0.927	0.785	Accepted
C6	0.012	0.863	0.659	Unaccepted
C7	0.034	0.841	0.644	Unaccepted
C8	0.334	0.916	0.778	Accepted
C9	0.344	0.906	0.770	Accepted
C10	0.365	0.885	0.757	Accepted
C11	(0.002)	0.877	0.668	Unaccepted
C12	0.355	0.895	0.763	Accepted
C13	0.344	0.906	0.770	Accepted
C14	0.375	0.875	0.750	Accepted
C15	0.365	0.885	0.757	Accepted
C16	0.323	0.927	0.785	Accepted
C17	0.365	0.885	0.757	Accepted
C18	(0.022)	0.897	0.681	Unaccepted
C19	0.002	0.873	0.665	Unaccepted
C20	(0.016)	0.891	0.677	Unaccepted
C21	(0.016)	0.891	0.677	Unaccepted
	Threshold		0.730	

Table 5. The Fuzzy Delphi Method (FDM) for aspects.

	l_p	u_p	D_p	Decision
A1	0.177	0.927	0.785	Accepted
A2	0.156	0.906	0.770	Accepted
A3	0.177	0.927	0.785	Accepted
A4	0.135	0.885	0.757	Accepted
A5	0.133	0.891	0.677	Unaccepted
	Threshold		0.755	

Table 6. The Fuzzy Delphi Method (FDM) result for aspects and criteria.

Aspect		Criteria		
		Initial set	Final set	Practices
A1	Consumer psychological aspect	C1	C1	Perceived consumer effectiveness
		C2	C2	Attitude towards sustainable purchasing
		C3	C3	Perceived knowledge about sustainability
		C5	C4	Environmental concern
A2	Consumer demographic aspect	C8	C5	Educational level
		C9	C6	Income status
		C10	C7	Age
A3	Social-level aspect	C12	C8	Consumption environment
		C13	C9	Environmental pollution level
		C14	C10	Environmental trends
A4	Stakeholder impact	C15	C11	Support and guidance from the government
		C16	C12	Mass media
		C17	C13	Education and research institutions

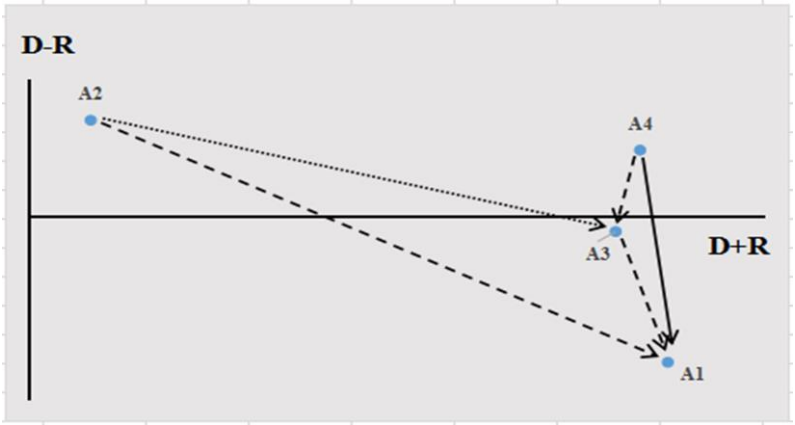

Figure 1. Causal interrelationships diagram among the aspects.

institutions (C13), educational level (C5), income status (C6) and consumer age (C7) are six causal criteria for sustainable consumption.

Figure 2 and Table 13 show the driving and dependence power among 13 criteria with their groups. The finding pays attention to six criteria, which were derived from causal aspects demographic aspect (A2) and stakeholder impact (A4) and belong to causal group from DEMATEL result including support and guidance from government (C11), mass media (C12), education and research institutions (C13), educational level (C5), income status (C6), and consumer age (C7).

DISCUSSION

The study reveals two attributes of the causal group, namely, consumer demographic aspect and stakeholder impact. In particular, stakeholder impact has a significant impact on the effect group two factors, including the consumer psychological and social-level aspects, which demonstrates the role of stakeholders in consumers and the community in promoting sustainable consumption of organic food (Zhuang *at el.*, 2019). Besides, the consumer demographic aspect is also

Table 7. Defuzzification procedure from experts.

	A1				A2				A3				A4			
A1	[	1.000	1.000	1.000]	[	0.000	0.100	0.300]	[	0.000	0.100	0.300]	[	0.000	0.100	0.300]
A2	[	0.500	0.700	0.900]	[	1.000	1.000	1.000]	[	0.500	0.700	0.900]	[	0.500	0.700	0.900]
A3	[	0.500	0.700	0.900]	[	0.300	0.500	0.700]	[	1.000	1.000	1.000]	[	0.300	0.500	0.700]
A4	[	0.700	0.900	1.000]	[	0.300	0.500	0.700]	[	0.500	0.700	0.900]	[	1.000	1.000	1.000]

		xl	xm	xr		xl	xm	xr		xl	xm	xr		xl	xm	xr	
A1	[	1.000	0.600	0.200]	[	0.000	0.000	0.000]	[	0.000	0.000	0.000]	[	0.000	0.000	0.000]
A2	[	0.000	0.000	0.000]	[	1.000	0.900	0.700]	[	0.500	0.600	0.600]	[	0.500	0.600	0.600]
A3	[	0.000	0.000	0.000]	[	0.300	0.400	0.400]	[	1.000	0.900	0.700]	[	0.300	0.400	0.400]
A4	[	0.400	0.400	0.200]	[	0.300	0.400	0.400]	[	0.500	0.600	0.600]	[	1.000	0.900	0.700]

	xls	xrs	xls	xrs	xls	xrs	xls	xrs
A1	1.000	0.333	0.000	0.000	0.000	0.000	0.000	0.000
A2	0.000	0.000	1.000	0.875	0.545	0.600	0.545	0.600
A3	0.000	0.000	0.364	0.400	1.000	0.875	0.364	0.400
A4	0.400	0.250	0.364	0.400	0.545	0.600	1.000	0.875

	zij	zij	zij	zij
A1	0.667	0.000	0.000	0.000
A2	0.500	0.875	0.576	0.576
A3	0.500	0.378	0.875	0.378
A4	0.678	0.378	0.576	0.875

Table 8. Initial direct relationship matrix of attributes.

	A1	A2	A3	A4
A1	0.688	0.315	0.350	0.384
A2	0.427	0.771	0.403	0.314
A3	0.530	0.278	0.738	0.402
A4	0.595	0.243	0.510	0.750

Table 9. Total interrelationship matrix of attributes.

	A1	A2	A3	A4
A1	2.902	1.843	2.397	2.257
A2	3.039	2.310	2.676	2.435
A3	3.169	2.041	2.919	2.548
A4	3.469	2.183	3.023	2.955

Table 10. Driving and dependence power of attributes.

	D	R	D+R	D-R
A1	9.398	12.579	21.976	(3.181)
A2	10.461	8.377	18.837	2.084
A3	10.677	11.015	21.692	(0.337)
A4	11.630	10.195	21.825	1.434
Max			21.976	2.084
Min			18.837	(3.181)
Average			21.083	0.000

Table 11. Initial interrelationship matrix of criteria.

	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13
C1	.733	0.516	0.389	0.537	0.261	0.260	0.253	0.401	0.441	0.351	0.225	0.278	0.242
C2	.551	0.724	0.437	0.486	0.278	0.297	0.306	0.469	0.490	0.453	0.349	0.383	0.317
C3	.516	0.568	0.741	0.551	0.345	0.310	0.338	0.383	0.403	0.471	0.343	0.381	0.333
C4	.483	0.551	0.493	0.715	0.278	0.261	0.288	0.433	0.505	0.434	0.399	0.382	0.384
C5	.434	0.503	0.473	0.466	0.778	0.420	0.267	0.416	0.489	0.471	0.328	0.377	0.379
C6	.343	0.434	0.437	0.503	0.398	0.776	0.357	0.401	0.457	0.439	0.346	0.365	0.295
C7	.380	0.377	0.406	0.465	0.399	0.418	0.786	0.453	0.406	0.369	0.278	0.379	0.259
C8	.480	0.515	0.507	0.550	0.381	0.364	0.338	0.774	0.542	0.489	0.430	0.519	0.417
C9	.465	0.517	0.492	0.620	0.363	0.293	0.269	0.471	0.738	0.524	0.484	0.535	0.450
C10	.500	0.532	0.507	0.552	0.362	0.275	0.286	0.539	0.594	0.745	0.501	0.501	0.467
C11	.463	0.552	0.557	0.550	0.433	0.347	0.268	0.570	0.509	0.576	0.776	0.536	0.536
C12	.478	0.547	0.505	0.484	0.310	0.292	0.234	0.521	0.491	0.525	0.415	0.769	0.485
C13	.431	0.500	0.507	0.517	0.450	0.191	0.235	0.487	0.526	0.476	0.416	0.453	1.000

identified as the influential variable in the group of proposed attributes. Consumer demographic aspects affect community psychology and behavior, but this effect is weaker than the stakeholder impact. This shows that, as customer demographic characteristics change, their psychology for sustainable consumption changes, thereby changing consumption trends in the

Table 12. Total interrelationship matrix of criteria.

	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13
C1	0.552	0.557	0.505	0.569	0.375	0.336	0.318	0.497	0.525	0.490	0.397	0.444	0.417
C2	0.588	0.659	0.578	0.633	0.427	0.385	0.368	0.572	0.600	0.570	0.471	0.521	0.486
C3	0.594	0.648	0.638	0.656	0.447	0.396	0.381	0.569	0.598	0.585	0.479	0.531	0.498
C4	0.585	0.641	0.596	0.677	0.433	0.384	0.369	0.574	0.610	0.576	0.486	0.529	0.504
C5	0.594	0.653	0.611	0.657	0.528	0.424	0.378	0.588	0.626	0.599	0.489	0.544	0.519
C6	0.555	0.615	0.581	0.637	0.449	0.465	0.378	0.563	0.596	0.570	0.472	0.520	0.484
C7	0.541	0.584	0.555	0.609	0.435	0.395	0.435	0.552	0.567	0.539	0.444	0.504	0.460
C8	0.651	0.709	0.667	0.726	0.502	0.448	0.421	0.695	0.687	0.652	0.547	0.613	0.569
C9	0.643	0.702	0.658	0.730	0.494	0.431	0.405	0.641	0.710	0.651	0.551	0.610	0.569
C10	0.662	0.720	0.675	0.735	0.505	0.437	0.416	0.666	0.703	0.700	0.565	0.617	0.584
C11	0.687	0.756	0.714	0.768	0.540	0.470	0.433	0.701	0.721	0.704	0.634	0.651	0.623
C12	0.629	0.690	0.644	0.691	0.473	0.420	0.389	0.634	0.656	0.636	0.527	0.632	0.562
C13	0.636	0.699	0.660	0.712	0.509	0.412	0.398	0.643	0.677	0.643	0.539	0.596	0.659

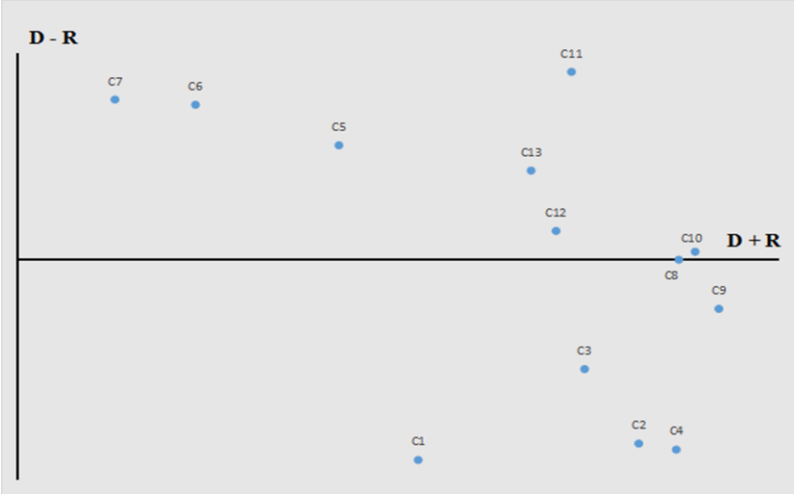

Figure 2. Cause and effect diagram of criteria for practical improvement.

Table 13. Driving and dependence power of criteria.

	D	R	D+R	D-R
C1	5.982	7.916	13.898	(1.934)
C2	6.858	8.635	15.493	(1.777)
C3	7.020	8.081	15.101	(1.060)
C4	6.965	8.799	15.764	(1.835)
C5	7.209	6.117	13.326	1.093
C6	6.886	5.403	12.289	1.483
C7	6.619	5.087	11.706	1.532
C8	7.887	7.895	15.783	(0.008)
C9	7.796	8.276	16.072	(0.481)
C10	7.985	7.916	15.900	0.069
C11	8.403	6.604	15.006	1.799
C12	7.582	7.313	14.895	0.269
C13	7.782	6.933	14.715	0.849
Max			16.072	1.799
Min			11.706	(1.934)
Average			14.611	0.000

community and towards sustainable consumption goals (Sun *et al.*, 2019).

Consumer demographic variables reflect consumer characteristics, which affect consumption behavior (Luu, 2019). In this study, consumer educational level, income status and age are found to associate with sustainable consumption of organic food (Paco and Lavrador, 2017). The consumer demographic aspect might lead to greater awareness of consumer behavior influences on the environment and society (Bryła, 2016). However, its impact on psychology and social-level aspect is negligible, which is caused by the specific characteristics of organic food-related to green and safe products (Testa *et al.*, 2019).

Stakeholder impact in the causal group is found to associate significantly with consumer psychological and social-level aspects. The participation of stakeholders might help adjust consumer behavior more positively, create a sustainable consumption community for organic food, which is not yet quite popular with all customers in the market (Chekima *et al.*, 2017; Scalco *et al.*, 2017; Simeone and Scarpato, 2020).

The findings show that two aspects of the causal group, namely, consumer demographic aspect and stakeholder impact influence the consumer psychological aspect and social-level aspect. Besides, the social-level aspect has a significant impact on the customer psychological aspect. The result proves that a sustainable consumption community may affect consumer psychology and social responsibility (Nosi *et al.*, 2020).

The study indicates six attributes of the causal group are considered as the crucial factors for sustainable consumption behavior, including government support and guidance, mass media agents, education and research institutions, consumer educational level, income status, and age (Luu, 2019).

CONCLUSIONS

The study grants an alternative approach for sustainable consumption research using the fuzzy DEMATEL method. The finding reveals the two enablers of the causal group that stakeholders need to consider to build effective marketing strategies, namely, consumer demographic variable and stakeholder impact. These two attributes affect two other aspects of the effect group, including consumer psychological and social-level aspects. Besides, 13 criteria are classified into an autonomous quadrant, dependent quadrant, independent quadrant, and linkage quadrant. Six criteria from the measurement scale of two causal aspects demographic and stakeholder impact are classified into the causal area, with government support and guidance, mass media agents, education and research institutions, and consumer demographics (educational level, income and age), which are crucial criteria for sustainable consumption of organic food, that might translate into policy implications.

The study has certain limitations. The first limitation is relevant to the sample bias with small sample size and purposive sampling technique. Consumption sustainability depends on multiple sets of factors that conjointly determine an impact on environmental, social, and economic preservation. Although this study adopted the fuzzy DEMATEL to capture a general picture of sustainable consumption behavior, there is a demand to comprehend consumer prospects to engage in and maintain sustainable behavior, looking at sustainability in its entirety.

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ریشه های مصرف پایدار مواد غذایی ارگانیک: یک آزمون و ارزیابی تصمیم گیری فازی با رویکرد آزمایشگاهی

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چکیده

هدف این مقاله بررسی سوابق مهم رفتار مصرف کننده در زمینه مصرف پایدار مواد غذایی ارگانیک است. به این منظور، نظریه مجموعه های فازی یکپارچه و روش آزمایشگاهی آزمون و ارزیابی تصمیم گیری همراه با پیشنهادهای متخصصان به کار گرفته شد. نتایج کار، 6 ریشه مصرف پایدار مواد غذایی ارگانیک را آشکار ساخت که عبارت بودند از حمایت و راهنمایی های حکومتی، عوامل رسانه‌های جمعی، نهاد های آموزشی و تحقیقاتی، و ویژگی های جمعیت شناسی مصرف کننده(شامل سطح آموزش، وضعیت درآمد، و سن). این پژوهش با استفاده از نظریه مجموعه ای فازی و روشهای DEMATEL، رویکرد جایگزینی را برای نظریه مصرف پایدار ارایه می کند.