Developing Sustainable Waste Management Practice: Application of Q Methodology to Construct New Strategy Component in Limbe – Cameroon

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Abstract: The most important motivation for developing new waste management strategy and policy relates to the waste management behavior of individuals. Education led campaigns and capacity building programmes involving third sector organizations in waste management are gaining momentum, in some major cities in Cameroon. There is however, a need to use research methodologies to investigate elements of waste management behavior to understand how to change behaviour permanently. Although the use of quantitative research methods to quantify or measure human attitude and behavior is subject to debate, to drive the research agenda, this research work uses Q methodology which combines both quantitative and qualitative research methods in generating understanding about waste management attitudes and behavior in Limbe, Cameroon. Limbe was chosen in the study because of the increase in the third sector organizations with waste management objectives with the possibility to generate knowledge that can contribute to policy formulation and the construction of a new strategy component based on sustainable waste management practices. In this study, 30 participants were chosen by stratified random sampling technique from three different residential areas e.g. the high, medium and low income and provided with a Q study information pack. Principal Component Analysis resulted in eight factors representing distinctive behavioral patterns to household waste management in Limbe. The result from this study shows a statistically significant proportion of residents in Limbe are willing to go "green" but are in need for information on sustainable waste management practices e.g. in composting, recycling, reuse, reduce, waste prevention and minimization. In this light, Q methodology was able to identify potential ambassadors to promote the sustainable waste management agenda through an education led campaign and capacity building in Limbe. The results of this research will influence government policies and actions in the construction of a new waste strategy component for the wider community in Cameroon.

Keywords: Public perception, sustainable waste management, Q methodology, composting, education, capacity building, third sector organizations.

INTRODUCTION

There is no simple reason why people are motivated to adopt sustainable waste management behaviour. It is probably due to a mix of factors –including practical opportunities or difficulties (such as lack of accessible facilities), pessimistic or optimistic personality traits (such as believing that individual recycling can make a difference), or well- defined sense of civic responsibility and finally general socio-cultural norms [1]. Research [2, 3] indicates that the request by Government for people to change their behaviour supposes that behaviour is something that can be adjusted at will. Notwithstanding, the question of how to understand individual attitudes and behaviour and more significantly, how to introduce meaningful policies, is particularly problematic in the realm of household waste management [4]. New behaviours, prompted by interventions, need to become 'social norms' to be truly effective and successful [5]. However, this requires an evaluation of the different methodological framework to better understand householder's attitudes and behaviour, particularly in Cameroon where a majority of people live on less than $2 a day [6, 7]. It is for this reason that this paper uses Q methodology to evaluate public attitudes to household waste management in Limbe, Cameroon in order to generate knowledge that can contribute to policy formulation and the construction of a new strategy component based on sustainable waste management practices.

The need to match research methods to waste management problems has been recognised by the government in England [8]. The Waste Resources Evidence Programme (WREP) [8] sets to drive the agenda by utilizing a wider range of methodology to investigate long standing waste management issues, such a methodology as Q methodology.

Q methodology is a way of revealing patterns and links in opinions that cannot be revealed by nonstatistical techniques. It establishes logical patterns by identifying individuals who share attitudes, gives a structure to subjective opinion and has the potential to uncover insights into major social groupings [9, 10]. Watts and Stenner [11] amplify the benefits of working with smaller groups of people when using Q when they indicate that using large numbers of participants in a Q study can be problematic as "it can easily negate many of the subtle nuances, complexities, and hence many of the essential qualities contained in the data".

AN OVERVIEW OF Q METHODOLOGY

Q-methodology provides a foundation for the systematic study of subjectivity, people's viewpoints, beliefs, attitudes, feelings, opinions, and the like [12-15]. In a Q-

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methodological study participants are presented with a sample of statements about some topic, called the Q-set. A preselected group of respondents, called the P-set, are asked to rank-order the statements from their individual point of view, according to some preference or feeling about them. By Q-sorting people give their subjective meaning to the set of statements, and so reveal their subjective viewpoint [14, 16]. Stephenson [17] presented Q-methodology as an inversion of conventional factor analysis, in the sense that Q correlates persons instead of tests.

Despite the fact that quantitative based research is essential in order to expand the available evidence base [18], much emphasis has been placed on 'hard' outcomes that can be observed in fairly straightforward ways, such as waste diverted from landfill, or increased recycling participation but with little concern on the 'soft' outcomes - such as changes in personal feelings, awareness, knowledge, skills or capacities - which have enabled individuals to change their own behavior [19]. This is what this research achieved through Q-methodology. In practice, what Q does is to analyze people's responses to a series of statements in a way that groups them in underlying common patterns of response. These groups of response patterns are then taken to comprise several discourses, i.e. ways of ''seeing and talking about something'' [20] which are seen to underlie responses.

Q methodology is not a statistical procedure for providing indicators of mental occurrences. To a certain extent, its original data –its "pristine events" [21] –consists of specific individuals operating with the objects in the Q-sample and in relation to the field conditions of the concrete situation. The entire procedure is nonetheless subjective from top to bottom. The Q-sample statements are matters of opinion rather than fact, hence subjective in that sense. They are also self – referential, not in the sense of the self taking itself as an object of reflection [22], but in the sense that any assertion implicates the person who expresses it. Brown [10] has reiterated the fact that Q methodology can reveal the main shared viewpoints on a particular subject but cannot provided information about the proportion of the population that adheres to any of these viewpoints.

The importance of Q-methodology lies in revealing genuine opinion clusters of the study participants. Once these opinions are identified, the occurrence in a larger population can then be tested by using survey and standard variance analytical methods. The outcome of Q-studies is not the creation of comprehensive classification scheme; but to find something material that is worthy of classification [23]. Q methodology has been used in environmental research e.g. attitudes to waste [24]; attitudes to environmental issues [25]; to examine farmer's goals and management styles and the implications for advancing biologically based agriculture [19].

MATERIALS AND METHODS

The Q method includes both qualitative and quantitative procedures. According to [26], qualitative procedures generate information about people's perceptions, or why they take certain decisions and behave as they do. Secondly, it helps to identify conceptual similarity and to distinguish patterns by identifying those opinions, ideas or feelings that are repeated across individuals, even though they may be expressed in different forms [27]. The qualitative procedure included the development of 50 Q statements (S) (see Table **1**) from focus groups, expert opinion, literature survey and interviews. Selection of 30 participants was done by stratified random sampling technique and later, the administration of the Q-study, Q sorting and post sort interviews. Scaled questions most disagree to most agree (-5 to +5) were used for the Q-sort. The finding were then used to set an agenda for further quantitative research to find out whether the views expressed are indeed representative of the views of others. In this light, input of participants Q sorts were entered using a Qcom.exe programme, correlation of the Q sorts using SPSS for windows V 11.5, extraction of Q sorts using Principal Component Analysis, rotation of the extracted factors using Varimax with Kaiser Normalization to identify significant uncorrelated factors [9]. At the end of each Q-sort, participants were asked to complete a response sheet, which asked questions concerning their thoughts regarding the wording of the statements [23].

Principal Component Analysis (PCA) a cluster analytical technique was used to analyze the Q sorts to produce a correlation matrix hence find association among the different Q-sorts. With the cluster analytical technique, each participant had an equal opportunity to cluster to any one of the factors [23]. In this study, the majority clustered to either factor 1 or 2. Cluster analytical technique was followed by Varimax to identify significant, uncorrelated factors [9]. On this basis, when significant factor loadings were considered to be equal to or greater than 0.400 [28] all the Q sorts loaded significantly on 8 factors for Limbe (see Table **2**) which accounted for 72.1% (see Table **3**). By convention, only (unrotated) factors with eigenvalues greater than or equal to one as shown in Table **3** were significant and retained for further analysis"[29]. The eight factors underwent further analysis through 'Weighting Calculations' that merges the Q-sorts to produce a reconstructed Q- sort grid. In this regard, consideration was given to factor score [30], consensus and divergent statements, transcripts (qualitative data) from post sort interviews and focus group discussions. According to Brown [12] differences between two or more factor scores are very significant because it helps identify which statements has some degree of common ranking across factors as well as a high degree of disagreement between factors.

RESULTS

Using Principal Component Analysis is this study each participant had an equal opportunity to cluster to any one of the factors (see Table **2**). However, in naming the factors, factor one 'environmentally concerned information seeker' has a number of variables associated with measures relating to the acquisition of information on pro-environmental behavior (S12, S13) and green lifestyle (S48, S49, S50). A similar approach was used in naming the other factors.

Factor 1, 'Environmentally Concerned Information Seeker'

Factor 1 had the largest number of loaded participants with 9 statistically significant participants of which 7 were pure loadings (see Table **2**). It is described as majority discourse. It had 18.5% of total variance as shown in Table **3**.

Table 1. Q Statements and Item Score (Ranking) for Limbe

	Statements	Factors							
		1	2	3	4	5	6	7	8
1	Waste is anything without value	0	-2	0	-2	+5	+2	0	+5
2	Clear instructions are provided on how to compost my household waste	0	-2	-2	-1	+4	0	-3	+4
3	Doing what my parents think I should do is important to me	-1	-2	+3	-2	+3	-1	0	+2
4	Doing what the municipal authority thinks I should do is important to me	-4	-3	+2	-3	-5	-4	0	+1
5	I think recycling household waste is everybody's responsibility	-2	-1	-5	-5	-4	-2	-1	-1
6	I think composting biodegradable household waste is everybody's responsibility	0	+1	-3	-3	-3	+1	-2	0
7	Diverting household waste away from landfill is important	+1	+1	-3	-3	+2	+1	-3	-5
8	I am aware of the benefits of recycling	+2	0	+3	-2	+5	-1	+2	-4
9	I am aware of the benefits of composting	-1	+1	+2	+3	-1	-3	0	-2
10	I am aware of the price of compost	-5	-3	0	+4	-1	-4	+1	-5
11	I am aware of the existence of markets for compost	-5	-4	-1	+3	-1	-5	+3	+3
12	I think that learning changes behavior	+4	+4	+5	0	+4	+2	+1	+3
13	I think that information and awareness campaigns change behavior	+4	+2	+4	-1	+4	+4	-1	+3
14	Active and effective participation in curbside recycling schemes is good	0	0	+2	0	-1	+4	-2	+1
15	Incentives to encourage recycling are important	0	-1	+1	0	+3	0	-4	-3
16	I think home composting has economic and environmental benefits	+3	+1	-1	-2	+3	-2	-1	-1
17	I am aware of the role of community based organizations in composting	-3	-4	+1	-1	+3	-3	0	-4
18	I am aware of the role of municipal councils in waste collection and disposal	0	-1	+4	0	0	-2	+1	+2
19	I think public /private partnership is good in waste management	-3	-1	+5	-1	-5	0	-1	-1
20	I buy organic food when I can	-4	-5	-2	+1	0	+2	+1	-4
21	I buy goods with the minimum of packaging when I can	-4	-5	-1	0	0	+3	0	+4
22	Incinerators should be located far away from the population	-1	0	+3	-3	-2	-1	-2	+4
23	I have great passion for a clean environment	+3	+3	+3	-5	+2	+1	-5	+2
24	I think recycling is a moral obligation	+1	0	-1	-4	+2	+4	+1	0
25	I think junk mail is wasteful	-3	-4	0	-1	-2	+5	-3	+2
26	I know how to compost household waste	-2	-3	-4	-4	+2	0	-4	-2
27	I think a community composting scheme is necessary	0	-2	-3	+1	+2	0	+3	-2
28	I re- use plastic bags when I can	-3	-3	-4	+2	+1	-1	+3	-3
29	We need to develop new waste management technologies	-1	-1	+2	-1	+1	-2	-1	-1
30	I think second hand goods are better	-2	0	0	+2	0	-3	-3	0
31	I prefer using recycled paper	-2	-2	-2	+2	0	-2	-3	-3
32	I would recycle more if I was aware of the benefits	0	-1	+1	+2	0	-2	-4	-3
33	I would compost more if I was aware of the benefits	+1	+1	+1	+1	-1	0	+2	-1
34	I would recycle more if provided with free recycling bin	-1	0	+2	0	+4	+1	+1	0
35	I compost more if provided with free compost bin	+1	0	-1	-1	+1	0	0	+1
36	Over-consumption is wasteful	-1	-1	+4	+1	0	-1	+5	-2
37	I would compost more if I am taught on how it should be done	+3	-3	+1	+1	+1	+1	-2	+3
38	Bad smells discourage composting	-2	0	-2	0	-4	-1	+2	+1
39	Recycling is a personal decision	+1	+2	+1	0	-3	-3	+4	-1
40	I do think I should be told by municipal authorities to compost my waste	-1	+1	-3	+2	-3	-5	-1	-2
41	Encouraging people to pay as they throw will prevent throw away	+2	+2	-1	+3	+1	-4	0	0
42	Recycling is time consuming	+1	+1	0	+3	+1	-1	+2	0
43	Composting is a dirty activity	+2	+2	0	+5	+1	+1	-1	0
44	Composting will stop the waste problem	+1	+3	-1	+5	-3	+2	+1	+1
45	Legislation can help the waste problem	+2	+3	-4	+1	-2	+1	+4	-1
46	I do think waste is a resource	+2	+4	+1	-2	-2	0	+5	0
47	Discouraging fly tipping can help the waste problem	+3	+2	-2	+1	-2	+3	+2	+1
48	Composting is the responsibility of women	+4	+5	-5	+4	-1	+5	-2	+1
49	Avoiding compost made from peat can help the environment	+5	+4	0	-4	0	+3	-4	+2
50	I think the participation of youths in composting is a moral obligation	+5	+5	0	+4	-1	+3	-5	+5

Table 2. Rotated Component Matrix

	Component							
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
P4	***.847**	.079	.131	-.032	-.181	.253	-.095	.064
P3	***.785**	.299	.174	.134	-.009	.189	-.005	.077
P2	***.769**	.244	-.154	.152	.066	.221	-.005	.061
P5	***.769**	.328	.045	-.033	-.034	-.055	.096	.207
P23	***.748**	.225	.082	-.099	.046	.093	.009	.116
P6	***.744**	.033	.177	.111	.089	-.140	.050	-.076
P29	***.611**	.573	-.126	-.039	-.008	-.021	.075	.196
P9	**.503**	.126	-.367	.020	-.189	.191	.063	-.428
P26	**.482**	.192	-.058	.217	.394	.027	.415	-.032
P22	.371	***.774**	.031	-.137	-.110	.160	.060	.225
P30	.215	***.765**	-.190	-.075	.073	.174	-.107	.087
P27	.420	***.765**	-.111	-.158	.010	.128	.144	.032
P14	.225	***.654**	.413	.134	.009	-.173	-.184	-.019
P28	.411	***.629**	-.045	-.079	-.483	.120	.042	-.014
P16	.179	.072	***.735**	-.160	.049	.096	-.020	.073
P17	.047	.001	***.729**	.201	.046	-.162	-.089	-.035
P8	-.066	.412	**-.572**	-.126	-.163	-.039	-.070	-.141
P19	-.313	-.139	**.523**	**.401**	.192	.045	-.285	-.287
P20	.045	-.160	**.508**	**.477**	-.034	.327	.148	-.354
P13	-.156	.197	.016	***-.734**	.093	-.038	.056	-.037
P15	-.010	-.006	.304	***.689**	.227	.035	-.092	.178
P18	.027	.446	.033	**.454**	.356	.420	-.236	.073
P21	.008	.014	.111	.095	***.810**	.042	.029	.042
P1	-.029	.216	-.223	.194	**-.570**	.017	.474	.222
P7	.286	.168	-.166	.251	.088	***.770**	.001	.128
P10	.179	.138	.325	-.387	-.119	**.548**	.300	.093
P24	-.092	-.313	.025	-.151	-.106	.082	***.698**	-.092
P11	.294	.440	-.174	-.235	.158	-.069	**.571**	-.029
P12	.184	.110	.145	.012	-.068	.328	-.197	***.762**
P25	.260	.206	-.183	.337	.024	-.055	.227	**.599**

Extraction method: Principal component analysis.
Rotation method: Varimax with Kaiser Normalization.
Note: Statistically significant factor loadings in bold.
* Pure loadings.

Discourse from Factor 1

The views expressed by this discourse as shown in Table **4** disagree with having any knowledge of the existence of markets or price for compost. This goes to confirm the fact that discourse 1 is an effective information seeker. However, (S49) strongly agree that avoiding compost made from peat can help the environment hence considered an environmentally concerned individual. In the case of Limbe, it can be made possible through education and awareness campaigns. This discourse is biased with the belief that composting is the responsibility of women (S48).

Factor 2, 'Keen Recycler'

Factor 2 had 5 statistically significant pure loaded participants (see Table **2**). It had 14% of total variance (Table **3**).

Discourse from Factor 2

Discourse 2 from Table **5** strongly acknowledges the role of gender in composting although it has gender bias. It considers waste as a resource, a position which all the factors in the Limbe case study strongly disagree with. The discourse strongly agrees with the idea that avoiding compost made from peat can help the environment. While disagreeing with

Table 3. Total Variance Explained

Component	Initial EIGENVALUES			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	8.409	28.031	28.031	8.409	28.031	28.031	5.543	18.476	18.476
2	3.825	12.750	40.780	3.825	12.750	40.780	4.187	13.955	32.431
3	2.079	6.931	47.711	2.079	6.931	47.711	2.793	9.310	41.741
4	1.908	6.359	54.070	1.908	6.359	54.070	2.330	7.766	49.507
5	1.556	5.188	59.258	1.556	5.188	59.258	1.790	5.966	55.473
6	1.403	4.676	63.935	1.403	4.676	63.935	1.678	5.593	61.066
7	1.296	4.319	68.254	1.296	4.319	68.254	1.677	5.591	66.657
8	1.176	3.919	72.172	1.176	3.919	72.172	1.655	5.515	72.172

Extraction method: Principal component analysis.

Table 4. Most Negative and Positive Statements for Factor 1

Most Negative Statements (-5 and-4)			Most Positive Statements (+5 and+4)		
4	Doing what the municipal authority thinks I should do is important to me	-4	12	I think that learning changes behavior	+4
10	I am aware of the price of compost	-5	13	I think that information and awareness campaigns change behavior	+4
11	I am aware of the existence of markets for compost	-5	48	Composting is the responsibility of women	+4
20	I buy organic food when I can	-4	49	Avoiding compost made from peat can help the environment	+5
21	I buy goods with the minimum of packaging when I can	-4	50	I think the participation of youths in composting is a moral obligation	+5

Table 5. Most Negative and Positive Statements for Factor 2

Most Negative Statements (-5 and-4)			Most Positive Statements (+5 and+4)		
11	I am aware of the existence of markets for compost	-4	12	I think that learning changes behavior	+4
17	I am aware of the role of community based organizations in composting	-4	46	I do think waste is a resource	+4
20	I buy organic food when I can	-5	48	Composting is the responsibility of women	+5
21	I buy goods with the minimum of packaging when I can	-5	49	Avoiding compost made from peat can help the environment	+4
25	I think junk mail is wasteful	-4	50	I think the participation of youths in composting is a moral obligation	+5

the fact that junk mail is wasteful it is unaware that it can be used as a feedstock to balance the carbon –nitrogen ratio during composting.

Factor 3, 'Information Seeker'

Factor 3 had 5 statistically significant loaded participants with 2 pure loadings (see Table **2**). It had 9.3% of total variance as shown in Table **3**.

Discourse from Factor 3

Discourse 3 from Table **6** considers over consumption a negative wasteful attitude. However, it suggests that stakeholder's involvements have an important role in the sustainable waste management of household waste. This discourse disclosed the absence of any knowledge in composting, recycling and re-use. Discourse 3 is of the belief that leaning, information and awareness campaigns can kick start the behavior change paradigm as indicated by a strong support from statement (S12, S13). However, objector statement (S48) was considered very controversial from a feed back response involving a female human right activist.

> *"Although some women may see it as an abuse of human right to consider composting a responsibility of women, I do however think that culturally, it fits well with some societies in Cameroon but you can't generalize it".*

Table 6. Most Negative and Positive Statements for Factor 3

Most Negative Statements (-5 and-4)			Most Positive Statements (+5 and+4)		
5	I think recycling household waste is everybody's responsibility	-5	12	I think that learning changes behavior	+5
26	I know how to compost household waste	-4	13	I think that information and awareness campaigns change behavior	+4
28	I re- use plastic bags when I can	-4	18	I am aware of the role of municipal councils in waste collection and disposal	+4
45	Legislation can help the waste problem		19	I think public /private partnership is good in waste management	+5
48	Composting is the responsibility of women	-5	36	Over-consumption is wasteful	+4

The following quote was extracted from a post sort interview with a female 52 year old piggery owner in a low income residential area.

> *"We have always been responsible for all household chores while our husbands are away as bread winners. There is nothing new suggesting that composting is the responsibility of women. Backyard composting has existed for centuries and still goes on today. We produce organic waste from left over vegetables and fruits, cocoyam peelings, feed our animals with some of the cooked and uncooked foodstuffs from our harvest and search for firewood, plough the soil and fetch for drinking water, so there is nothing wrong with composting. It is part of our tradition; I think women can do it better if provided with incentives as with the case of veterinary services to their piggery and poultry owners".*

Factor 4, 'Contended Independent'

Factor 4 had 5 statistically significant loaded participants with 2 pure loadings (see Table **2**). It had 7.8% of total variance as shown in Table **3**. Factors 4 had some correlation with Factor 3 by sharing two participants (P19, P20) (see Table **2**).

Discourse from Factor 4

Discourse 4 from Table **7** is characterized by the strong belief that recycling household waste is unnecessary as enough is being done by others to clean up the environment (S5 and S23). The discourse considers composting a dirty activity (S43) with a strong belief that is the responsibility of women (S48). This puts into question the belief that composting is the responsibility of women as indicated in discourse 4 with very strong objection in discourse 3. Notwithstanding, statement (S5) strongly disagrees that recycling household waste is everyone's responsibility and disagrees not strongly that recycling is a moral obligation. The non involvement in recycling by many households in Limbe was linked to these beliefs.

Factor 5, 'Keen Learner'

Factor 5 had 2 statistically significant pure loaded participants (see Table **2**). It had 6.0% of total variance as shown in Table **3**.

Discourse from Factor 5

This discourse from Table **8** highlights the participant's relatively low knowledge in household waste when it indicates that waste is anything without value. The discourse however expresses concern on how knowledge can be acquired but disagrees strongly that stakeholders can make any difference. The discourse however, strongly agrees with learning, information and awareness campaign as a means of changing behavior especially when it comes to NIMBYISM. This is in agreement with Jackson [31] who indicated that publicity or information campaigns have been widely used for achieving public interest goals but remarks that they are less effective than other forms of learning. This is because research has shown that learning by trial and error, observing how others behave and modeling our behavior on what we see around us provide more effective and more promising avenues for changing behaviors than information and aware-

Table 7. Most Negative and Positive Statements for Factor 4

Most Negative Statements (-5 and-4)			Most Positive Statements (+5 and+4)		
5	I think recycling household waste is everybody's responsibility	-5	10	I am aware of the price of compost	+4
23	I have great passion for a clean environment	-5	43	Composting is a dirty activity	+5
24	I think recycling is a moral obligation	-4	44	Composting will stop the waste problem	+5
26	I know how to compost household waste	-4	48	Composting is the responsibility of women	+4
49	Avoiding compost made from peat can help the environment	-4	50	I think the participation of youths in composting is a moral obligation	+4

Table 8. Most Negative and Positive Statements for Factor 5

Most Negative Statements (-5 and-4)			Most Positive Statements (+5 and+4)		
4	Doing what the municipal authority thinks I should do is important to me	-5	1	Waste is anything without value	+5
5	I think recycling household waste is everybody's responsibility	-4	2	Clear instructions are provided on how to compost my household waste	+4
19	I think public /private partnership is good in waste management	-5	8	I am aware of the benefits of recycling	+5
34	I would recycle more if provided with free recycling bin	-4	12	I think that learning changes behavior	+4
38	Bad smells discourage composting	-4	13	I think that information and awareness campaigns change behavior	+4

ness campaigns [31]. Transcripts from a post sort interview with a female compost agent and resident in a low income residential area indicates that:

> *I live in a poor neighborhood with no waste collection service consequently the waste is clandestinely dumped at night at our door step. The odour is intoxicating, the flies, mosquitoes and rodents are unbearable. There is no composting plan here. Please you can come over a have a look? I think a composting plant will help reduce the organic fraction in the waste and make our community bett*er.

Factor 6, 'Contended Independent'

Factor 6 had 2 statistically significant pure loaded participants (see Table **2**). It had 5.6% of total variance as shown in Table **3**.

Discourse from Factor 6

This discourse from Table **9** is similar to discourse 4 because of the belief that composting is a responsibility of women (gender bias). The discourse expresses particular concern on the 'throw away culture' and disagrees with the idea that pay as you throw will prevent throw away. Transcripts from a post sort interview involving a 49 year old senior official working for an oil refinery and resident of a high income residential area states that:

> *"I throw because I have plenty and I would not if I have got only very little. This is my life; I don't need to pay for what I throw"*

From field investigation, we found out that there was no significant correlation between wealth and throw away culture in Limbe. This is because household waste recycling was higher in this high income residential area. The example described above in the post sort interview was an isolated case.

Factor 7, 'Pragmatist'

Factor 7 had 2 statistically significant loaded participants with 1 pure loading (see Table **2**). It had 5.6% of total variance (see Table **3**).

Discourse from Factor 7

The views from this discourse (Table **10**) lead to more practical outcome. The discourse recognizes waste as a resource and thinks over consumption is a waste of resources. The discourse agrees though not strongly that recycling is a personal decision (S39) but disagrees with incentives as a tool to encourage recycling (S15).

Factor 8, 'Skeptic'

Factor 8 had 2 statistically significant loaded participants with 1 pure loading (see Table **2**). It had 5.6% of total variance (see Table **3**).

Discourse from Factor 8

This discourse from Table **11** is characterized by cynical views on recycling. It expresses a greater willingness to buy goods with a minimum of packaging and at the same time it strongly disagrees of having any knowledge of the benefits of recycling. It also agrees strongly that waste is anything without value. The discourse shows little concern for the

Table 9. Most Negative and Positive Statements for Factor 6

Most Negative Statements (-5 and-4)			Most Positive Statements (+5 and+4)		
4	Doing what the municipal authority thinks I should do is important to me	-4	13	I think that information and awareness campaigns change behavior	+4
10	I am aware of the price of compost	-4	14	Active and effective participation in curbside recycling schemes is good	+4
11	I am aware of the existence of markets for compost	-5	24	I think recycling is a moral obligation	+4
40	I do think I should be told by municipal authorities to compost my waste	-5	25	I think junk mail is wasteful	+5
41	Encouraging people to pay as they throw will prevent throw away	-4	48	Composting is the responsibility of women	+5

Table 10. Most Negative and Positive Statements for Factor 7

Most Negative Statements (-5 and-4)			Most Positive Statements (+5 and+4)		
15	Incentives to encourage recycling are important	-4	26	I know how to compost household waste	+4
23	I have great passion for a clean environment	-5	36	Over-consumption is wasteful	+5
26	I know how to compost household waste	-4	39	Recycling is a personal decision	+4
32	I would recycle more if I was aware of the benefits	-4	45	Legislation can help the waste problem	+4
49	Avoiding compost made from peat can help the environment	-4	46	I do think waste is a resource	+5

Table 11. Most Negative and Positive Statements for Factor 8

Most Negative Statements (-5 and -4)			Most Positive Statements (+5 and +4)		
7	Diverting household waste away from landfill is important	-5	1	Waste is anything without value	+5
8	I am aware of the benefits of recycling	-4	2	Clear instructions are provided on how to compost my household waste	+4
10	I am aware of the price of compost	-5	21	I buy goods with the minimum of packaging when I can	+4
17	I am aware of the role of community based organizations in composting	-4	22	Incinerators should be located far away from the population	+4
20	I buy organic food when I can	-4	50	I think the participation of youths in composting is a moral obligation	+5

environment by disagreeing strongly with the diversion of waste from landfill. The following is a quote from post sort interview with a 41 year old female resident near the disbanded new market open dump in Limbe. She strongly disagrees to the diversion of household waste from landfill.

> *My family has lived close to this open dump for so many years and benefited a lot from recovered materials. My children have always recovered reusable items for our home and now the open dump is no more. It is a hobby to my children. The new "so called controlled landfill at Karata" located many kilometers from were we live, is virtually impossible for my children to continue with their hobby.*

Overview of Consensus and Divergent Statements

The results of this study reveal that some factors were more important than others as shown in the Table **12**. These conclusions were drawn from the discourses of the eight factors. The study also reveals some consensus and divergent views as shown in Tables **13** and **14**. These conclusions were based on the 'Weighting Calculations' in SPSS that merges the Q-sorts to produce a reconstructed Q- sort grid as represented in Table **1**.

Table 12. Most Important Factors in the Study

Factor	Description
1	Environmentally concerned information seeker
2	Keen recycler
3	Information seeker
5	Keen learner

DISCUSSION

The consensus views in Limbe highlights the role of altruism (S24, S6, S7, S50), information and awareness campaigns (S13), education (S12), active and effective participation to composting and recycling schemes (S14). The divergent views acknowledge the absence of prior knowledge on sustainable consumption (S20, S36), markets and price for compost (S10, S11), and non participation in waste minimization and prevention (S7, S21, S25, S28) and recycling and reuse (S25, S30, S31). However, information and awareness campaigns (S13) were considered an important driver in behavior.

Group discussions in this work revealed that the participants from the different residential areas had different perceptions of household waste and how to manage it. More than 50% of the participants from the high income residential areas indicated that they sorted their waste into different material categories as against 30% in the middle income and less than 10% in the low income residential areas. With regards to composting, less than 33% indicated that they compost at home. The reasons for this negative behavior could be linked in part to the lack of information, education and capacity building on composting. Nevertheless, other issues such as the lack of information for markets for compost and other recyclables were contributing factors.

There was a greater willingness (more than 70%) to undertake composting in the nearest future. However, some participant's from the low income residential areas were skeptical of composting as the organic fraction was used to feed their domestic animals e.g. pigs, goats etc. Participants from the high income residential areas were also worried about their health regarding a composting facility in their neighborhood although more than 50% agreed with the proximity principle.

Table 13. Consensus Statements

	Statements	Factors							
		1	2	3	4	5	6	7	8
13	I think that information and awareness campaigns change behavior	+4	+2	+4	-1	+4	+4	-1	+3
12	I think that learning changes behavior	+4	+4	+5	0	+4	+2	+1	+3
50	I think the participation of youths in composting is a moral obligation	+5	+5	0	+4	-1	+3	-5	+5
49	Avoiding compost made from peat can help the environment	+5	+4	0	-4	0	+3	-4	+2
48	Composting is the responsibility of women	+4	+5	-5	+4	-1	+5	-2	+1

Table 14. Divergence Statements

	Statements	Factors							
		1	2	3	4	5	6	7	8
20	I buy organic food when I can	-4	-5	-2	+1	0	+2	+1	-4
11	I am aware of the existence of markets for compost	-5	-4	-1	+3	-1	-5	+3	+3
10	I am aware of the price of compost	-5	-3	0	+4	-1	-4	+1	-5
17	I am aware of the role of community based organizations in composting	-3	-4	+1	-1	+3	-3	0	-4
21	I buy goods with the minimum of packaging when I can	-4	-5	-1	0	0	+3	0	+4
4	Doing what the municipal authority thinks I should do is important to me	-4	-3	+2	-3	-5	-4	0	+1

Nevertheless, the feeling from group discussions with Q in Limbe was generally positive because the participants learned from the interactive sessions and were prepared to adopt pro-environmental behavior; minimize and prevent waste generation, reduce, recycle and reuse and compost the biodegradable fraction in the household waste. These feelings were in line with [32, 33], who reported that appropriate opportunities, facilities and knowledge from education programmes to recycle or compost influence attitudes and through that, behavior. According to [32] factors that contribute to positive attitudes, increasing recycling and composting behavior are:

- Specific and individual information, consequences and impacts (institutional type);
- Belief about significant effects (institutional type);
- Easy and user-friendly systems (technological type);

While acknowledging the drivers to pro-environmental behavior mentioned above, the results have led to the development of a pilot project on an education led campaign to provide information and raise awareness and capacity building in composting. This will take on board the third sector organizations in Limbe, using second hand computers from the UK. According to [34], second hand computers can be a driving force in the socio-economic development especially in the agricultural and horticultural sectors of Cameroon and Sub-Saharan African in general. Third sector organizations (27 in Douala and 13 in Limbe) are being provided with 200 used computers on a rolling basis to access the on-line information in an attempt to promote best practice on source separation, recycling and the composting of household organic waste for use in agriculture, horticulture and landscaping. The computers which are expected to be replaced by 200 more after 2-3 years are also expected to enhance the exchange of useful information about producers and sellers of compost in Cameroon [34].

Computer education on composting can create awareness to a large percentage of the population, whose main economic activity is agriculture with less than $2 in a day. This will in a long term create job opportunities and help solve the problem of unemployment and social exclusion especially amongst youths [34]. It is on this basis that the results of this research were used to design a five year pilot project (see Table **15**) aimed at creating awareness on a low- cost method for composting household organic waste through education and capacity building in third sector organizations, using on-line information systems [34]. The overriding aim of the pilot project is to reduce the cost of production and increase profits, increase confidence in composted materials among end users, specifiers and blenders and help producers provide products that are safe, reliable and of high performance.

CONCLUSIONS

Results from this work indicate that Q methodology provided evidence for understanding behavioral trends to household waste management in Limbe in particular, the requirement to provide clear information to all parties. This indicates that Q methodology can be used with confidence in waste management research. For success it will be necessary to provide information by a range of media concerning quality assurance in composting to accelerate the uptake of this product. However, adopting sustainable waste management practices e.g. for composting will depend partly on public perception of compost as a resource and not waste. For this to be achieved, this study proposes the following recommendations: changing the mindsets of the residents to perceive waste as a resource rather than something without value; make the awareness raising process simple, accessible and easy. It will be necessary to provide information in a range of media, e.g. newsletters on quality assurance to win confidence of the compost users. The initial result of this research

Table 15. Strategic Plan for Computer Allocation and Reuse in Limbe - Cameroon [34]

Years	Tasks
2009	Scoping the evidence from primary research, assessing risks, uncertainties and barriers
2010	Make a request from potential donors and present options and advice to administrative and policy makers in Limbe and Douala, Cameroon
2011	Education and capacity building- Third sector organizations, private sector and local government
2012	Implementing with delivery partners
2013	Monitoring and evaluation

has led to the design of a five year pilot project where computer, internet based education on composting will be used in Limbe.

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