STAT3613 Marketing Engineering Group Project

University Catering Services at HKU

Yujia Cheng, Qingxu Zhang, Shaoxiong Zheng

December 2, 2018

Table of Contents

1. Introduction

a. Background and motivation.

There are currently more than 10 catering services varying from Hong Kong style fast food restaurants, cafe, to a vegan restaurant at The University of Hong Kong. It is of interest how HKU students feel about the current campus catering system and whether their needs have been satisfied with regards to the whole set of canteens on campus. This study aims to offer insights on HKU students' needs towards catering services and design a new canteen to meet the unsatisfied students' needs with the maximized market value.

b. Precise objectives.

- Segment HKU students with regards to their preferences when dining on campus.
- Figure out whether the needs of each segment have been met by the current set of catering services at HKU.
- Design a new canteen to generate the maximized market value with regards to a specific segment of students' preferences.

2. Methods

a. Target

This project is targeted at HKU students as the university catering services mainly focus on serving this group of people.

b. Sampling

- Sampling method: volunteer sampling. Participants volunteer to become part of the study when exposed to the survey via social media.
- Sample size: 53
- Response rate: 100%
- Sample questionnaire: attached

c. Data collection procedure*s*

- Mode of data collection: Questionnaire
- Time of data collection: 14 November 2018 - 18 November 2018
- Place of data collection: Online (WeChat)

d. Statistical methods

- Factor analysis is used to find whether there are any underlying factors behind the attributes of canteens
- MDS unfolding is applied to gain insights of object's preference for catering services.
- Cluster analysis is utilized to segment the surveyed subjects.
- Correspondence analysis is used to find out attributes of canteens percepted by students.
- Conjoint Analysis is used to find out the importance of essential factors when designing a new canteen.

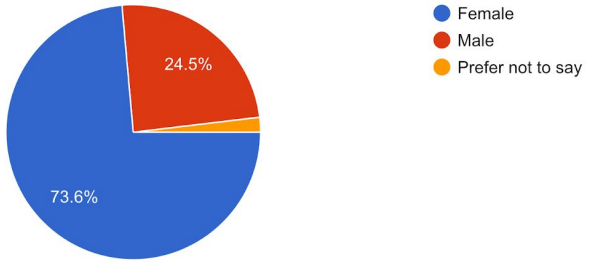
3. Results

a. Summary statistics

Backgrounds information of respondents are shown as follows:

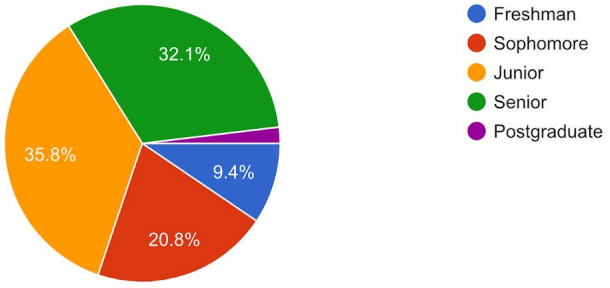
1. Gender

53 responses



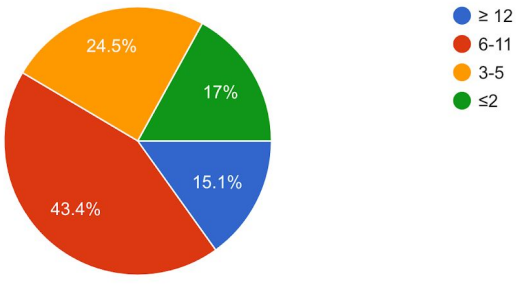
2. Year at HKU

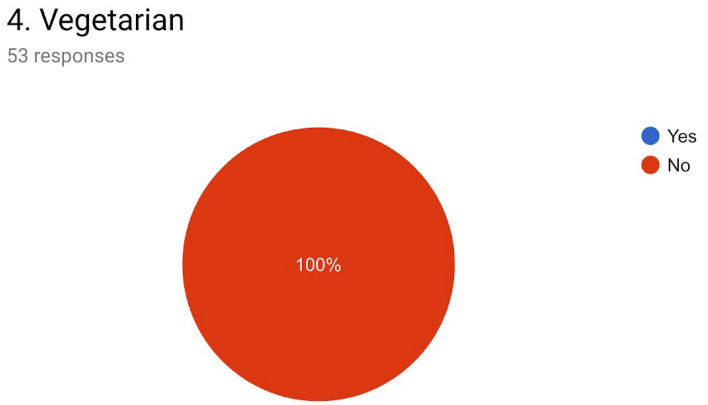
53 responses

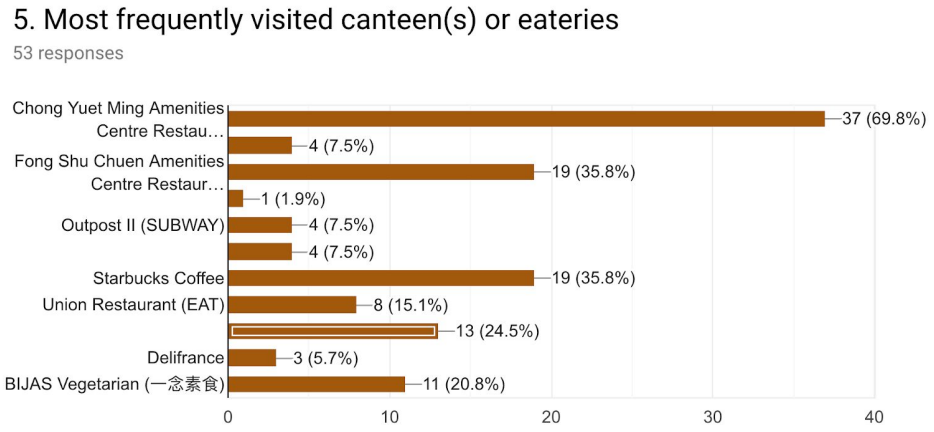


3. Frequency of eating at a restaurant on campus in a week

53 responses







b. Factor Analysis - Any underlying factors behind the attributes of canteens?

In our survey, customers were asked about their evaluations on 7 attributes (Display, Quantity, Service-Efficiency, Environment, Taste, and Value-to-Price) of a canteen. Now we want to see whether there are significant correlation or redundancy among the seven to figure out whether we could summarize the variables with fewer dimension.

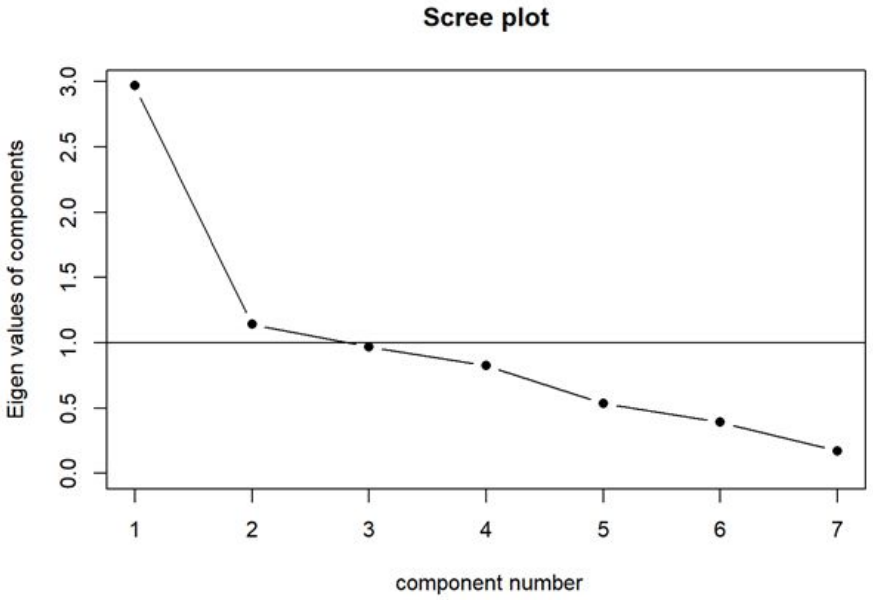
- Correlation matrix of attributes

	location	value to price	efficiency	taste	quantity	display	envir
location	1.00	0.21	0.08	0.11	-0.09	-0.11	0.15
value to price	0.21	1.00	0.34	0.10	0.38	0.51	0.35
efficiency	0.08	0.34	1.00	0.39	0.44	0.40	0.21
taste	0.11	0.10	0.39	1.00	0.19	0.33	0.32
quantity	-0.09	0.38	0.44	0.19	1.00	0.56	0.45
display	-0.11	0.51	0.40	0.33	0.56	1.00	0.73
envir	0.15	0.35	0.21	0.32	0.45	0.73	1.00

- Determine the number of factors in our solution

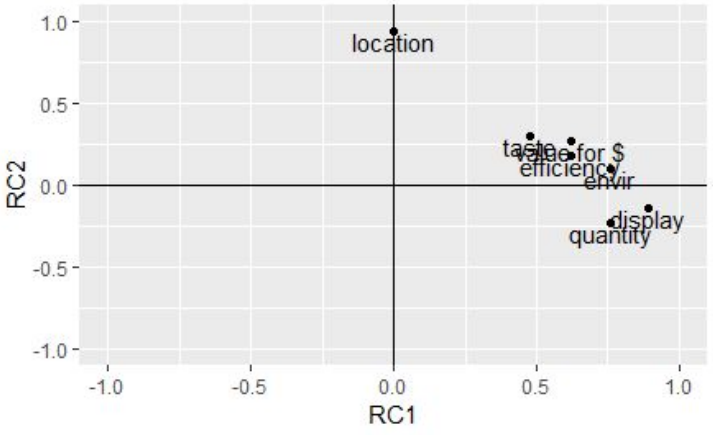
First assume there are 7 dimensions involved.

```
##                         PC1  PC2  PC3  PC4  PC5  PC6  PC7
## SS loadings            2.97 1.14 0.97 0.83 0.53 0.39 0.17
## Proportion Var         0.42 0.16 0.14 0.12 0.08 0.06 0.02
## Cumulative Var         0.42 0.59 0.73 0.84 0.92 0.98 1.00
## Proportion Explained   0.42 0.16 0.14 0.12 0.08 0.06 0.02
## Cumulative Proportion 0.42 0.59 0.73 0.84 0.92 0.98 1.00
```



It turns out that two factors can explain 59% of the total variance and the eigenvalues of any other factors are not significant (all <1). So we assume there are 2 underlying factors behind the 7 variables and plot their positions with rotation.

- Analyze a 2-factor solution



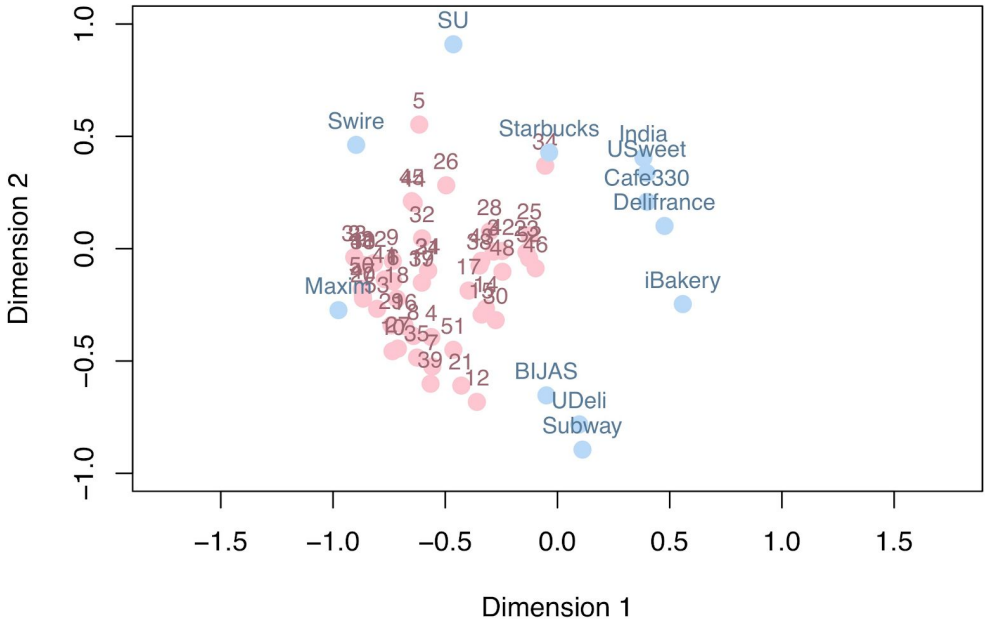
One of the factors appears to be location and the other factor seems to be the overall quality of a restaurant since it could not differentiate the other 6 attributes very well, regarding the food it provides, service efficiency and environment, etc. In addition, it appears that Display and Quantity are slightly more related while Service Efficiency, Environment, Taste and Value for Price are more related to each other.

```
## Standardized loadings (pattern matrix) based upon correlation matrix
##              RC1   RC2   h2   u2 com
## location    0.00  0.94 0.89 0.11 1.0
## value for $ 0.62  0.27 0.46 0.54 1.4
## efficiency  0.62  0.18 0.42 0.58 1.2
## taste       0.48  0.30 0.32 0.68 1.7
## quantity    0.76 -0.23 0.63 0.37 1.2
## display     0.89 -0.14 0.81 0.19 1.1
## envir       0.76  0.10 0.58 0.42 1.0
##
##                        RC1  RC2
## SS loadings           2.95 1.16
## Proportion Var        0.42 0.17
## Cumulative Var        0.42 0.59
## Proportion Explained  0.72 0.28
## Cumulative Proportion 0.72 1.00
```

From the above analysis of underlying factors, we have a look at some underlying relationships among the attributes. However, on planning a new restaurant, the 2-factor solution seems too generic and not very instructional. When possible, we do analysis based on all specific variables to get more detailed information.

c. MDS of preference: Which canteen do students prefer?

From the responses of Question 6 ‘What are the 3 canteens/eateries that you would recommend to others’ we can draw a perceptual map of objects (canteen) and subjects (students) as shown below

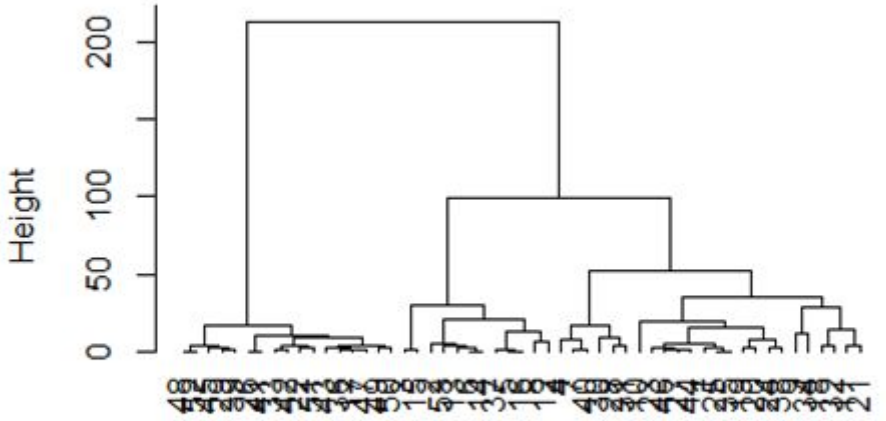


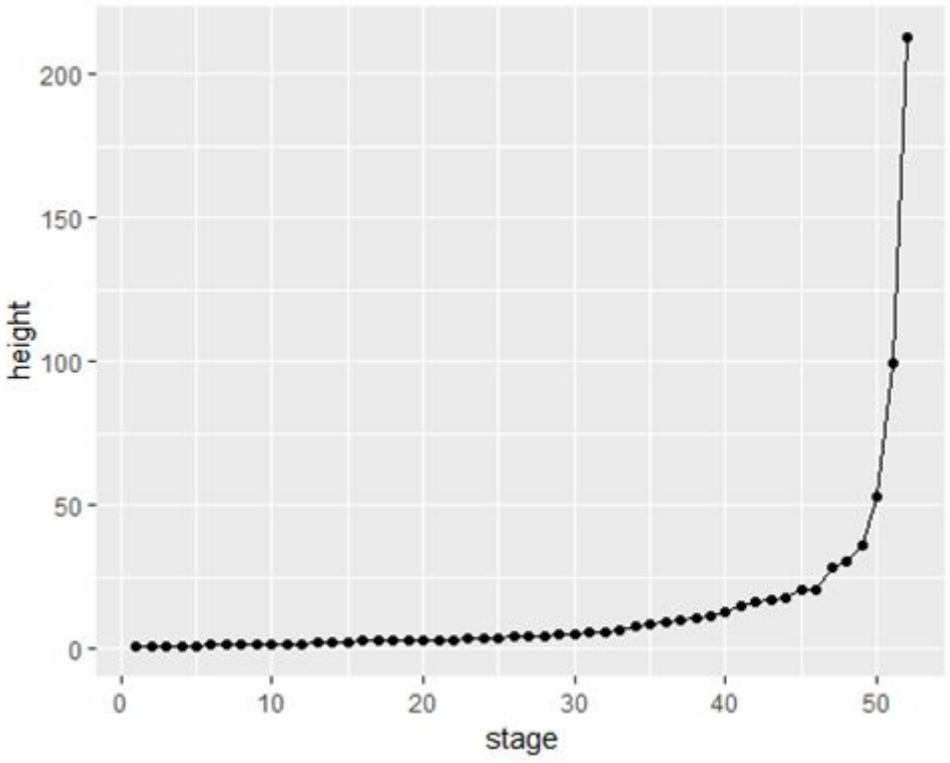
Findings:

- Maxim is the most popular canteen, followed by Swire.
- Few people like SU, which is also the canteen of low reputation in the campus.
- Starbucks, India, USweet, Cafe330, and Delifrance are competitors (foreign flavors)

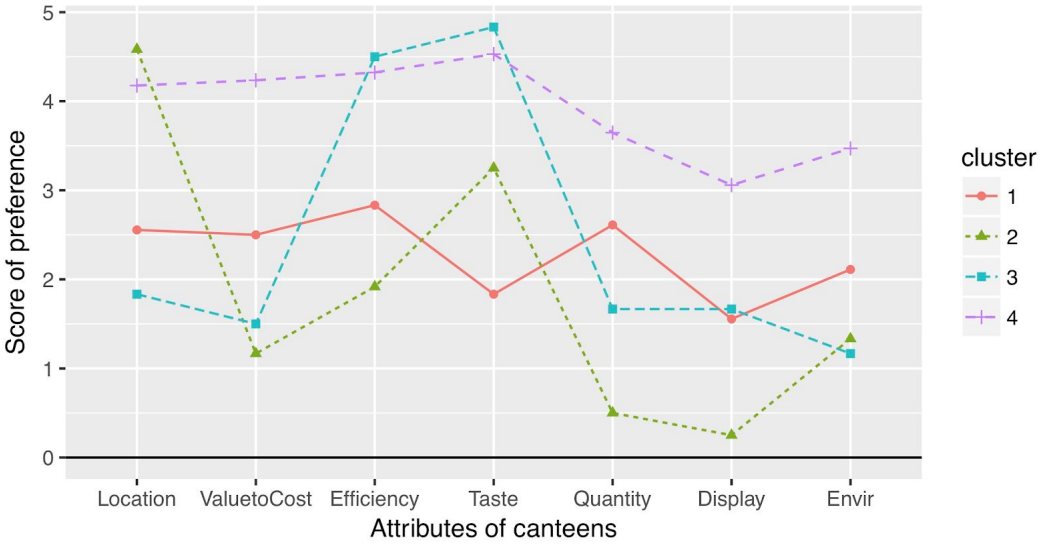
d. Cluster Analysis: How many clusters of students?

From a preliminary look at the survey responses, evaluations of the 7 factors vary much. This variation can lead to different types of ideal canteens. To understand different types of customers, we first cluster the customers by their conception of the importance of canteen attributes (large values indicating more importance). Then we study their profile (frequency of using canteen service, most visited canteen).





From the stage-height plot, we find the first significant height jump appears between the last fourth and third points. We choose a 4-cluster solution.



Cluster size is 18, 12, 6, 17 respectively.

The plot above shows the mean values of attribute importance evaluated by the 4 clusters of customers. It not only helps differentiate and interpret the 4 clusters but also indicates the ideal type of catering service for this group of customers. We may interpret the 4 groups as “General”, “Convenient”, “Efficient” and “Demanding”.

- “General” (Group 1) assign a medium score (around 2-3) to all features. Relatively, they care about location, efficiency, and quantity.

- "Convenient" (Group 2) especially cares about location and taste. Relatively they do not care so much about the environment, efficiency, and value for price and not at all care about quantity and display.
- "Efficient" (Group 3) care the most about efficiency and taste and do not care much about any other feature.
- "Demanding" (Group 4) assign high importance for all values (all features score over 3). Relatively they care slightly more about taste, efficiency, value for price and location than quantity, display and environment.

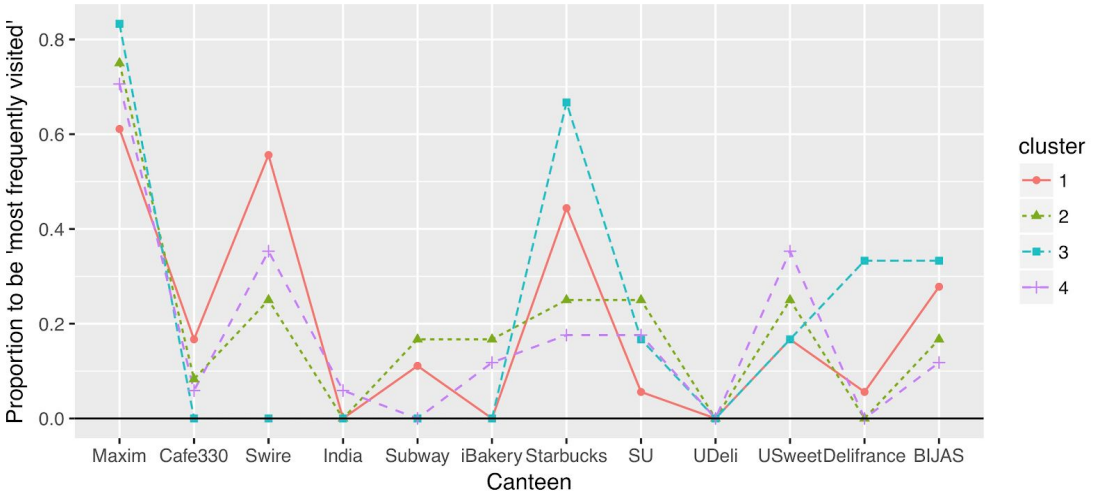
We can also check whether our respondents eat frequently on campus so that they can provide valid evaluations of the current catering service.

	0-2	3-5	6-11	12-more
G 1: General	"22.2%"	"22.2%"	"44.4%"	"11.1%"
G 2: Convenient	"16.7%"	"33.3%"	"41.7%"	"8.3%"
G 3: Efficient	"16.7%"	"33.3%"	"33.3%"	"16.7%"
G 4: Demanding	"17.6%"	"17.6%"	"41.2%"	"23.5%"

It turns out that more than 80% of respondents from each group eat more than 3 times a week on campus.

e. Cluster vs frequently visited canteens

Then we can further investigate the most frequently visited canteens for each of the four clusters.

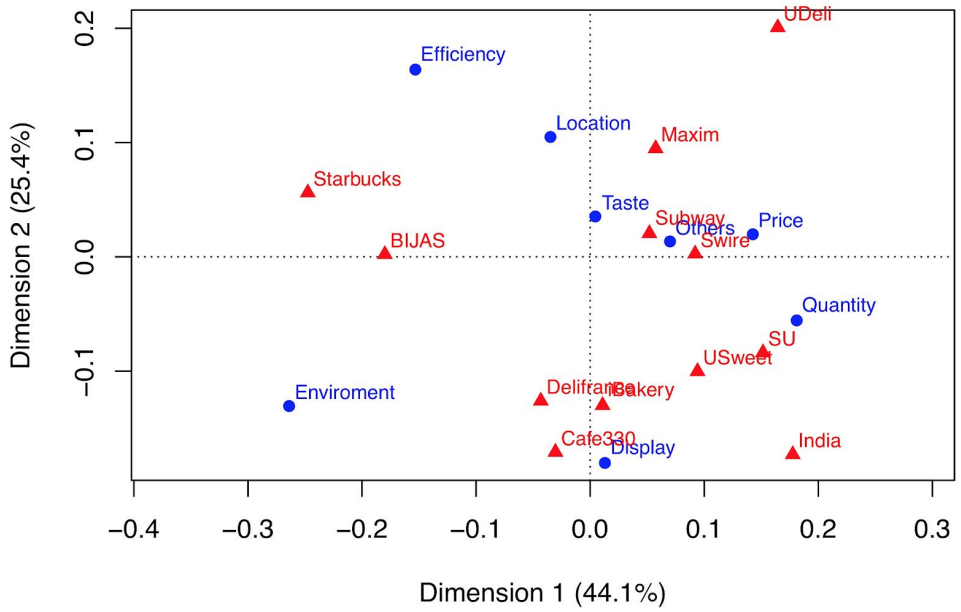


The plot above shows the proportion of a certain group frequently visit a particular canteen. It shows the status quo of the customers' campus catering experience.

- Group 1 (General): Maxim > Swire > Starbucks >40%
- Group 2 (Convenient): Maxim > 30% > Swire=Starbucks=SU=USweet
- Group 3 (Efficient): Maxim > Starbucks > 60% > Delifrance = BIJAS >30%
- Group 4 (Demanding): Maxim > Swire=USweet> 30%

f. Correspondence Analysis: What are the attributes of the canteens?

According to the responses of Question 7 'Why would you recommend the above restaurants' we can apply correspondence analysis to plot a perceptual map of canteen and attributes.



Findings are summarized below:

- Two dimensions explain almost 70% percent, moderately well.

For attributes,

- Dimension 1: primary contributor is Environment, secondary contributor is Quantity. Can be explained as Quantity v.s. Environment.Account for 45.1% +20.1%=65.6% of dimension 1.
- Dimension 2: primary contributor is Display, the secondary contributor is Efficiency. Can be explained as Display v.s. Efficiency. Account for 33.9% +28.6%=62.5% of dimension 2.
- Fitness: the quality values range from a high of 92.4 to a low of 9.2%. Only Taste, Location, and Others have quality values less than 50%.

For canteens

- Dimension 1: Starbucks and BIJAS contribute to over 62%. Dimension 1 can be explained as (Starbucks and BIJAS) vs Others.
- Dimension 2: 5 canteens contribute over average (8.3%). Dimension 2 can be explained as (Cafe330, Delifrance, India) v.s. (Maxim and Udeli), i.e., foreign style food v.s. Hong Kong style food.

From perceptual map

- Group 1: Starbucks, BIJAS. High efficiency and good environment, but expensive and not enough quantity.
- Group 2: Delifrance, Cafe330, iBakery. Good food display, but not efficient and location not convenient.

- Group 3: USweet, SU, India. Good quantity, but inadequate environment and efficiency.
- Group 4: Maxim, Subway, Swire. Convenient location, good taste, and economic price but inadequate environment.
- India canteen is isolated, so is UDeli.

g. Conjoint Analysis: How important are the essential factors of a new canteen?

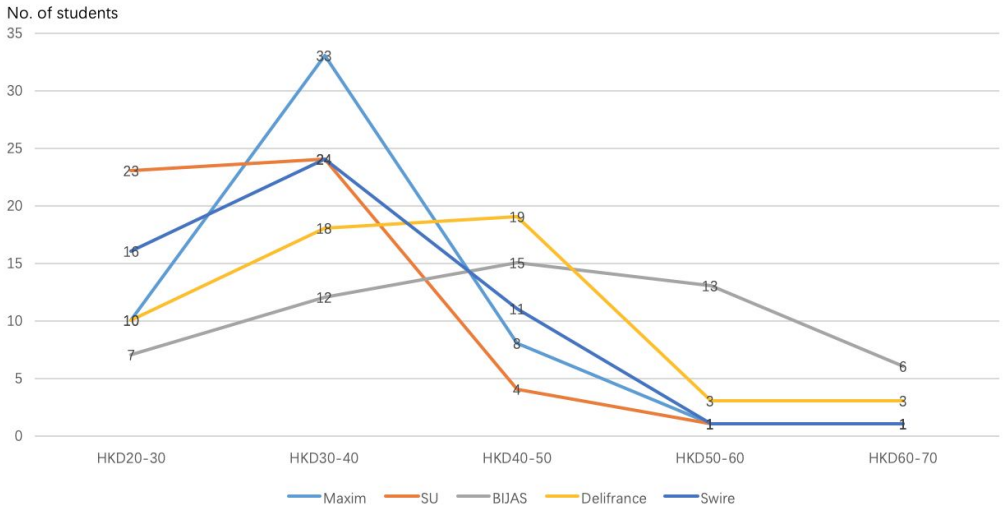
Factor	Level	Part-worth
Food quality	acceptable	-2
	high	2
Price	HKD25-35	1.25
	HKD35-45	-1.25
Waiting time	0-10 min	1.25
	10-20 min	-1.25

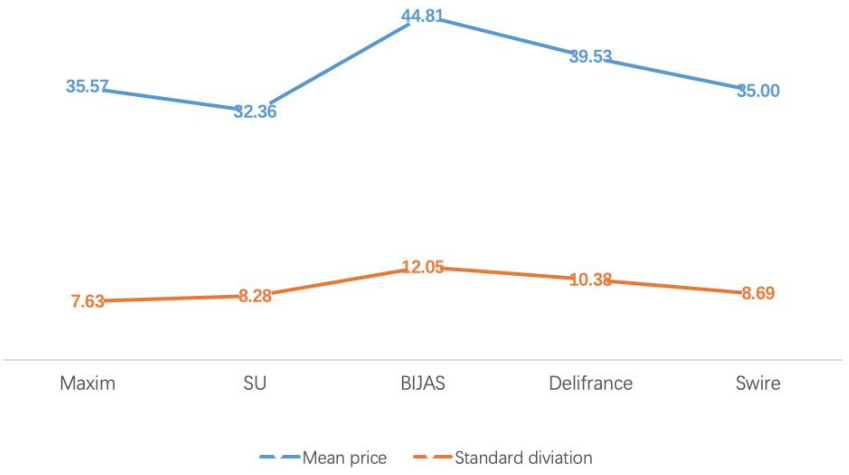
Relative importance of the above part-worths are:

Food quality=44% > Price = Waiting time=28%

h. Pricing reference summaries

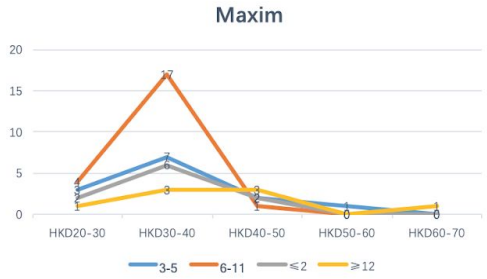
The maximum acceptable price level for five major canteens are shown below



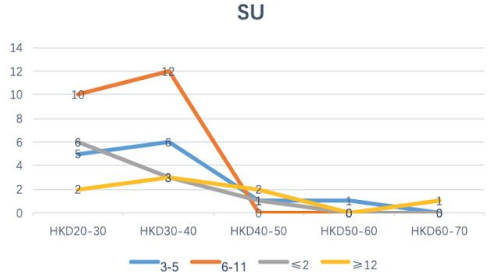


- In general, the desired maximum price level for customers is 30 - 40 HKD.
- BIJAS is regarded as the most prestigious and customers are willing to pay a premium for BIJAS. Price elasticity of BIJAS is the lowest.
- SU is regarded as the least prestigious restaurants with the lowest mean price that customers are willing to pay. The price of meals at SU is quite elastic. Customers' price sensitivity towards Swire is similar to that of SU, while customers tend to accept the higher price of Swire rather than SU

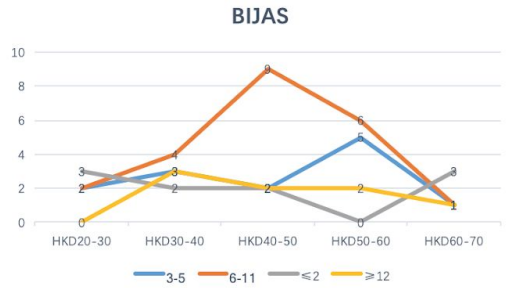
When considering market value, the frequency of using on-campus catering services of each customer has to be taken into account. There are 5 frequency group of surveyed subjects with regards to their frequency of dining on campus.



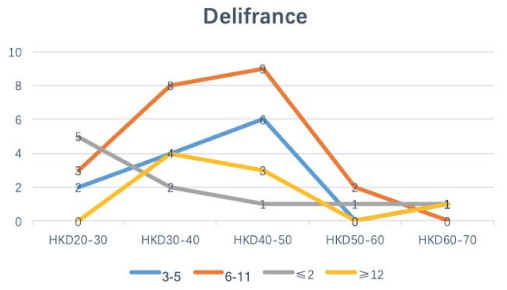
Frequency	HKD20-30	HKD30-40	HKD40-50	HKD50-60	HKD60-70	Total
3-May	3	7	2	1	0	13
6-Nov	4	17	1	0	0	22
≤2	2	6	2	0	0	10
≥12	1	3	3	0	1	8
Total	10	33	8	1	1	53



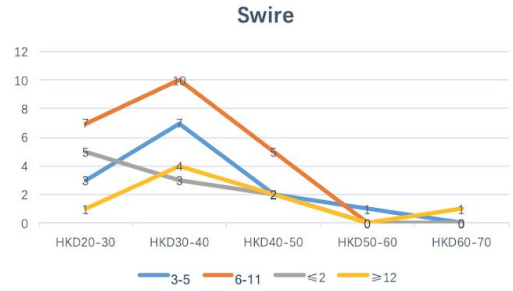
Frequency	HKD20-30	HKD30-40	HKD40-50	HKD50-60	HKD60-70	Total
3-5	5	6	1	1	0	13
6-11	10	12	0	0	0	22
≤2	6	3	1	0	0	10
≥12	2	3	2	0	1	8
Total	23	24	4	1	1	53



Frequency	HKD20-30	HKD30-40	HKD40-50	HKD50-60	HKD60-70	Total
3-5	2	3	2	5	1	13
6-11	2	4	9	6	1	22
≤2	3	2	2	0	3	10
≥12	0	3	2	2	1	8
Total	7	12	15	13	6	53



Frequency	HKD20-30	HKD30-40	HKD40-50	HKD50-60	HKD60-70	Total
3-5	2	4	6	0	1	13
6-11	3	8	9	2	0	22
≤2	5	2	1	1	1	10
≥12	0	4	3	0	1	8
Total	10	18	19	3	3	53



Frequency	HKD20-30	HKD30-40	HKD40-50	HKD50-60	HKD60-70	Total
3-5	3	7	2	1	0	13
6-11	7	10	5	0	0	22
≤2	5	3	2	0	0	10
≥12	1	4	2	0	1	8
Total	16	24	11	1	1	53

Generally, the maximum acceptable prices of the entire surveyed population are in line with the maximum acceptable prices of each frequency group. Thus, for catering services similar to Maxim, the suggested price range is HKD 30-40. For catering services similar to SU, the suggested price range is HKD 20-40. For catering services similar to BIJAS, the suggested price range is HKD 30-60. For catering services similar to Delifrance, the suggested price range is HKD 30-50. For catering services similar to Swire, the suggested price range is HKD 30-40.

4. Marketing Decision

Obj 1. Segmentation of the customers

According to our cluster analysis based on the Euclidean distance (derived from customer conception of canteen attribute importance), customers of HKU canteens are divided into 4 clusters. They are group 1 "General", caring about all 7 attributes of a canteen but do not assign high importance to any of the attributes; group 2 "Convenient", caring about location the most and taste the second; group 3 "Efficient", caring about taste and service efficiency the most; group 4 "Demanding", caring about all attributes and assign relatively high scores to each attributes. The cluster sizes are 18, 12, 6, 17 respectively.

Obj 2. Match: Do current canteens match students' needs?

We can summarize findings in previous sections into the table below

Cluster	**Cluster size**	**Preferred attributes**	**Frequently visited canteens and their attributes**
General	18	All	Maxim (Location, Taste, Price) Swire (Taste, Price) Starbucks (Most efficiency on campus)
Convenient	12	Location Taste	Maxim (Location, Taste, Price) Swire (Taste, Price) Starbucks (Efficiency) SU (Quantity, Price)
Efficient	6	Efficiency Taste	Maxim (Location, Taste, Price) Starbucks (Efficiency) Delifrance (Display, Taste) BIJAS (Taste)
Demanding	17	All	Maxim (Location, Taste, Price) Swire (Taste, Price)

The demand of both efficiency and taste of Cluster 3 'Efficient' has not been satisfied by the current catering services. There could be a potential market to meet their demand.

Obj 3. Design a new canteen to generate the maximized market value and to satisfy a specific segment of students' preferences

With regards to results of objective 2, we want to design a new canteen satisfying both efficiency and taste. To maximize the group of possible customers, we want the

new canteen not to be too away from the ideal type of other clusters. Based on observation, Maxim is one of the most visited canteens of each group and satisfies most attributes that customers care about, except efficiency. Moreover, it is inducted that the low efficiency of Maxim is primarily due to the large volume of customers.

As a result, a new canteen similar to Maxim is proposed to satisfy the customers' needs and this canteen is required to offer at least equally efficient service as Maxim. Meanwhile, this new canteen would naturally increase the efficiency of Maxim as it shares the volume of customers visiting Maxim. This new canteen would not only match the ideal type of the third cluster but also benefit customers from all other 3 clusters since Maxim is one of the most visited canteens of all 4 clusters. In particular, the price range is HKD 30-40 with regards to the price reference section.

5. Limitations

Limitations of our projects are mainly in three aspects.

- Sampling

  First, our sample size is relatively small, only 53 respondents, while there are more than 150,00 full-time students at HKU. Second, the sampling method is volunteering sampling through online social media, which could result in both sampling bias and response bias. Finally, respondents may quickly complete the survey carelessly so that some responses are not accurate reflection of their opinions. A long-term and face-to-face survey can be a better method.

- Model

  In multidimensional scaling, we assume that all respondents have the same evaluation metrics for all canteens, but this may not be realistic in real life.

- Marketing Decision

  Our decision is based on the current situation in the canteen market at HKU. However, the opening of our proposed canteen may affect the existing market. Thus, our expectation such as revenue volume of customers may not be achieved.

- Factor

  1) Ambiguity of the definitions

  The definition of "tasty food" could be highly personal and related to the marketing strategies of a canteen (daily specials, regional food, food type, etc). In this survey, we do not provide the respondents with clear criteria for "tasty food" so the customer evaluations are based on their own intuition.

  2) Changeable attributes and those not immediately changeable

  Some attributes of HKU canteens are not changeable. For instance, location is an important attribute but a university canteen cannot choose its site freely. In addition, some attributes may be an accumulative effect over a long time. For example, the efficiency of a canteen might not be high at the beginning since it takes time for the staff to get used to their new working environment and their new jobs.

6. Conclusion

In this project, we want to understand the customer preference of HKU catering service and the customer evaluation of the current canteens.

Seven variables regarding canteen attributes are involved in this study. After performing factor analysis, we find that location is an isolated attribute while all the others (Display, Quantity, Service-Efficiency, Environment, Taste, and Value-to-Price) do not distinguish significantly from each other. Then multidimensional scaling is applied to draw a perceptual map to show the preference of subjects (students) on objects (canteens). We also study the segmentation of the customers of HKU canteen service and divide them into 4 clusters. Correspondence analysis is performed to study the attributes of each canteen. Then we compare the attributes of the most visited canteens of each cluster with their ideal types. It is found that there is no canteen accommodate the demand of both high “efficiency” and great “taste”.

With further analysis of the current catering service, we decide to design a new canteen similar to Maxim with improved efficiency. In particular, the price range is HKD 30-40 with regards to the price reference section.

Attached: questionnaire

HKU Catering Service Survey

* Required

Student Profile

1. **Gender** *

   Mark only one oval.

   - ◯ Female
   - ◯ Male
   - ◯ Prefer not to say

2. **Year at HKU** *
Mark only one oval.

- ◯ Freshman
- ◯ Sophomore
- ◯ Junior
- ◯ Senior
- ◯ Other: _____

3. **Frequency of eating at a restaurant on campus in a week** *
Mark only one oval.

- ◯ ≥ 12
- ◯ 6-11
- ◯ 3-5
- ◯ ≤2

4. **Vegetarian** *
Mark only one oval.

- ◯ Yes
- ◯ No
- ◯ Other: _____

5. **Most frequently visited canteen(s) or eateries** *
Check all that apply.

- [ ] Chong Yuet Ming Amenities Centre Restaurant (Maxim's FOOD2)
- [ ] Chong Yuet Ming Amenities Centre Cafeteria - Cafe 330 (New Life Support Enterprises Ltd.)
- [ ] Fong Shu Chuen Amenities Centre Restaurant (Asia Pacific Catering Corporation Ltd.)
- [ ] HKU Halal Food Corner (Ebeneezer's Kebabs & Pizzeria)
- [ ] Outpost II (SUBWAY)
- [ ] Outpost III (Tung Wah Group Hospital (TWGHs) iBakery)
- [ ] Starbucks Coffee
- [ ] Union Restaurant (EAT)
- [ ] HKUSU Cafeteria B (U-Deli 賞味軒)/HKUSU Cafeteria C (U-Sweet 小食皇)
- [ ] Delifrance
- [ ] BIJAS Vegetarian (一念素食)

What do you think about the current canteens/eateries?

In the next question, please find out the 5 most important attributes when you choose to dine in a canteen from A-H (listed as follows) and rate the importance of those attributes. (1= most important, ..., 5=least important)

Attributes
A. location 餐廳位置便利程度
B. Value for price 價格相對價值
C. Service efficiency (in terms of waiting time) 服務效率
D. Taste of food 食物味道
E. Quantity of food 食物份量
F. Display of food 食物賣相
G. Other attribute of the food (please specify in the next question) 其他食物相關因素（請于下個問題說明）
H. Dining environmetn/decoration 就餐環境

6. **Rate the attributes with a scale (1=most important, ..., 5=least important)**
   Check all that apply.

	1	2	3	4	5
A位置近	☐	☐	☐	☐	☐
B性價比	☐	☐	☐	☐	☐
C效率高	☐	☐	☐	☐	☐
D味道	☐	☐	☐	☐	☐
E分量	☐	☐	☐	☐	☐
F賣相	☐	☐	☐	☐	☐
G其他食物因素	☐	☐	☐	☐	☐
H環境	☐	☐	☐	☐	☐

7. **What are the 3 canteens/eateries that you would recommend to others? （1= the most recommended, 2 =a little bit less than or equally recommended than 1, 3= less than 2 or equal to 2)**
Check all that apply.

	1	2	3
Chong Yuet Ming Amenities Centre Restaurant (Maxim's FOOD2)	☐	☐	☐
Chong Yuet Ming Amenities Centre Cafeteria - Cafe 330 (New Life Support Enterprises Ltd.)	☐	☐	☐
Fong Shu Chuen Amenities Centre Restaurant (Asia Pacific Catering Corporation Ltd.)	☐	☐	☐
HKU Halal Food Corner (Ebeneezer's Kebabs & Pizzeria)	☐	☐	☐
SUBWAY	☐	☐	☐
iBakery	☐	☐	☐
Starbucks Coffee	☐	☐	☐
Union Restaurant (EAT)	☐	☐	☐
HKUSU Cafeteria B (U-Deli 賞味軒) - Administered by HKUSU	☐	☐	☐
HKUSU Cafeteria C (U-Sweet 小食皇) - Administered by HKUSU	☐	☐	☐
Delifrance	☐	☐	☐
BIJAS Vegetarian (一念素食)	☐	☐	☐

8. **Why would you recommend the above restaurants?**
Check all that apply.

	Recommend Restaurant 1	Recommend Restaurant 2	Recommend Restaurant 3
Good taste of food 食物味道好	☐	☐	☐
Good quantity of food 食物份量充足	☐	☐	☐
Good display of food 食物賣相好	☐	☐	☐
The food fits my other requirement mentioned above 食品符合我之前提到的要求	☐	☐	☐
Acceptable price 價格合理	☐	☐	☐
Location 餐厅位置便利程度	☐	☐	☐
Good overall service efficiency (in terms of waiting time) 整體服務效率好	☐	☐	☐
Good dining environmen/decoration 就餐環境好	☐	☐	☐

For the next question, please rank the preference of the following hypothesised catering services (service A to service F) with scales (1=most preferable, ..., 6=least preferable). The service models are as follows.

A. Acceptable food, HKD25-35, 10-20min waiting time

B. High-quality food, HKD35-45, 10-20min waiting time

C. High-quality food, HKD35-45, 0-10min waiting time

D. Acceptable food, HKD35-45, 0-10min waiting time

E. Acceptable food, HKD25-35,0-10min waiting time

F. High-quality food, HKD25-35, 10-20min waiting time

9. **Rank the preference of catering services (A-F) with scales(1=most preferable, ..., 6=least preferable)** *

Check all that apply.

	1	2	3	4	5	6
A	☐	☐	☐	☐	☐	☐
B	☐	☐	☐	☐	☐	☐
C	☐	☐	☐	☐	☐	☐
D	☐	☐	☐	☐	☐	☐
E	☐	☐	☐	☐	☐	☐
F	☐	☐	☐	☐	☐	☐

10. **How much at most would you pay for your lunch (one person size) at the following restaurants?** *

Mark only one oval per row.

	HKD20-30	HKD30-40	HKD40-50	HKD50-60	HKD60-70
Chong Yuet Ming Amenities Centre Restaurant (Maxim's FOOD2)	◯	◯	◯	◯	◯
Union Restaurant (EAT)	◯	◯	◯	◯	◯
BIJAS Vegetarian (一念素食)	◯	◯	◯	◯	◯
Delifrance	◯	◯	◯	◯	◯
Fong Shu Chuen Amenities Centre Restaurant (Asia Pacific Catering Corporation Ltd.)	◯	◯	◯	◯	◯