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Online food delivery apps vs Dine-in restaurants Interpretive Structural Modelling study

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ABSTRACT
Purpose – The decision of whether to sit at the comfort of your house and order in or to visit the restaurant you like and experience the uniqueness the restaurant provides is influenced by various attributes of the
online food delivery apps as well as the restaurants. The purpose of this paper is to determine how these attributes influence each other and how they collectively affect the decision.

Design/methodology/approach – The analysis has been done through responses sought from the general public in India. The questionnaire related to the food delivery apps and restaurants was administered to the sample population. Interconnection among impactful characteristics has been analysed by using a qualitative technique called interpretive structural modelling (ISM). The procedure of applying ISM method has been automated and provided it as package "ISM" using R software.
Findings – In general, it is very complex job to determine the most attribute the impacts a consumer's decision the most. By applying ISM, we can see that all 10 attributes are independent of each other and influence a consumer's decision making process equally.

Research limitations/implications – Though ISM provides an organized modelling framework yet its results are considered less statistically significant. Therefore, it would be interesting to concatenate the present findings with the findings of any analytical methodology; which gives statistically significant results.

Practical implications – The present proposal deals with the interpretation of the attributes and their contextual relationship but with more effective and efficient manner. It can help management to understand the complexity of relationship amongst attributesmore accurately and precisely. Having recently exited the COVID-19 pandemic, it is imperative to understand what characteristics exactly would influence a consumer to shift back todining in at restaurants rather than ordering food online. This study is, therefore, an effort and a helping hand in making the hassle free calculations for obtaining intermediate matrices and doing eventual calculations.

Social implications – n numbers of parameters can be selected to analyse the interrelationship of any project/study. Eradication human errors in applying transitivity law or applying any other operation in solving problem. The package created here can save precious time of users. Provides well-formatted and readable excel output files that make interpretation easier.

Originality/value –Online restaurant aggregators and food delivery apps have become very relevant post the events of the COVID-19 pandemic. Therefore, it becomes imperative to study various interrelated quality attributes of the software. On the similar platform, ISM is a widely used technique and just to provide a helping hand in quantification of the qualitative attributes this paper facilitates the readers with algorithm developed using R software.
Keywords Decision making, Qualitative research, Quantitative methods, Interpretive structural modelling, Analytical models

I. INTRODUCTION

This report is about a research on "Consumer perception on food apps" where the

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objectives of this research is to examine and analyse the factors that most deeply influence the decision a consumer takes whether to order in or dine out. The world was in danger in December 2019 when a viral pandemic broke out in the Chinese city of Wuhan. Humanity was in peril because of its explosive expansion and growth. Governments from all across the world decided to close all public locations, including but not limited to restaurants, in response to the pandemic's rapid spread. Businesses all across the world came close to being temporarily halted and shut down. Lockdowns were announced everywhere; restaurants were likely the first to experience lockdowns and closures. Simply put, the restaurants were compelled to close for a few months.Although online restaurant aggregator are not a new concept and already has a long history, its demand post-COVID has increased drastically. BeforeCOVID-19 hit, consumers requested delivery 63% of the time, but that percentage has surged to an astounding 88% post-pandemic. In events of this shift in demand, it has become increasingly important and relevant for restaurant business to understand what attributes are of most importance when a consumer is making a decision between ordering online or visiting a restaurant. Attributes such as "Safety" definitely affect the decision, but another very important reason of this shift in demand was that people had become accustomed to staying in their houses and were overall less enthusiastic about visiting restaurants. They would rather choose "Convenience" over "Ambience and Service". In this paper, our aim is to study what attributes other than "Safety", can influence a consumer's decision.It is imperative to investigate on this topic, particularly from the perspective of those who are ultimately affected by it. Understanding a consumer's perception on the said topic and working towards fulfilling their needs is the key to increasing sales for a restaurant business.

II. LITERATURE REVIEW

The purpose of the research paper we studied was to expose the underlying framework of problems with college students taking online courses during the COVID-19 pandemic. The study's overall approach involves a field survey and a review of published studies for the purpose of gathering and analysing data. Issues have been identified through the discussion of literature and professional opinion. To identify intra-issue linkages and examine the underlying structure, interpretive structural modelling (ISM) is performed. Using a method called cross impact matrix multiplication applied to classification (MICMAC analysis), problems are categorised according to the strength of their driving-dependence relationships. According to the literature review, students who take online programmes deal with 21 key problems. According to ISM, the most pressing problems include a lack of institutional policies, a lack of regulatory policies, the stress of a pandemic, and an unexpected (unplanned) start to online classes. According to the results of the MICMAC analysis, there is no autonomous problem, four problems (i.e., connectivity problems, reluctance to use technology, a lack of institutional rules, and stress from the pandemic scenario) are independent, six other problems are reliant, and the remaining eleven problems are linking. This is an important study that will help society, parents, students, and regulators comprehend the current issue. It is an innovative endeavour that makes a framework and a diagram of issue classification for literature.

III. RESEARCH METHODOLOGY

Concept of ISM: Interpretive Structural Modelling (ISM) is the method by which several, related, or unrelated essentials are merged into one coherent whole. As a result, ISM is a technique that has a multi-level and hierarchical structure and seeks connections between the factors that are taken into account. By reformatting the chaotic tangle of data into a comprehensible and well-defined model, this crucial method benefits managers, academics, and individuals alike (structure). However, there are no statistically reliable models available through ISM. These models are comprehensive, effective, and generate a structured/graphical representation that is useful in significantly advancing the pursuit of predetermined aims without necessitating any additional, irrelevant information.

These steps of decision-making have been taken in order to put ISM into practise:

1. ascertain the objective that a firm/company would trying to accomplish through ISM;
2. explore distinguish elements (attributes) that may be useful for analysis;
3. determine relative relationship among the elements;
4. develop structural self-interaction matrix (SSIM);
5. convert SSIM into initial reachability matrix (IRM);
6. obtain final reachability matrix (FRM) and partition reachability matrix (RM);
7. develop canonical matrix (CM);
8. develop pictorial view; and

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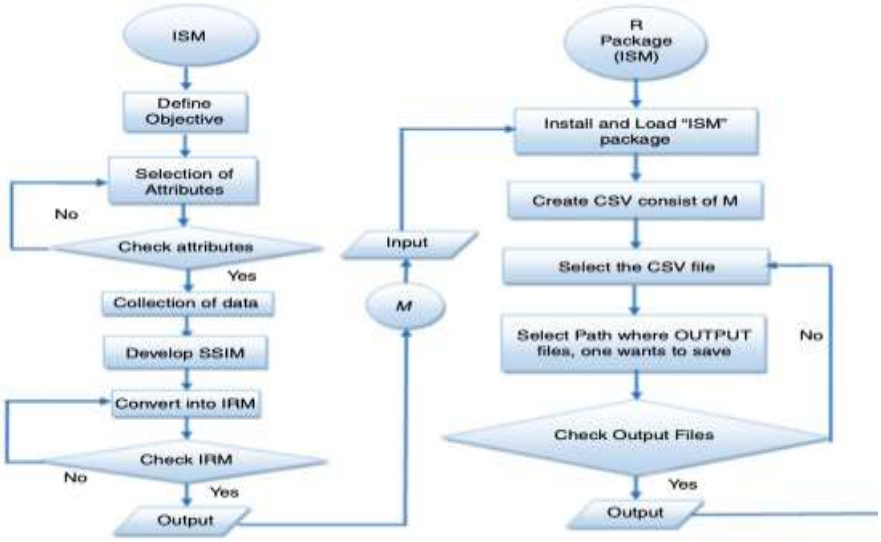
9. analyse the established ISM.

As per the decision steps of ISM discussed in Section 2 and in Figure 1 (Block 1), the study has been processed as follows.

Step 1: "Examining the interrelationship of attributes that are significant for comparing online food apps vs dine-in restaurants" – the objective.

Figure 1.
Flow-chart of the study



Step 2: The attributes which are directly responsible for impacting the decision between ordering online or visiting the restaurant can also be impactful to each other. Here, we have considered 10 various attributes for this study. Details of these 10 attributes are mentioned in Table I.

Table I.
10 attributes that impact a consumer's decision

Sl. no.	Attributes	Description	Sl. no.	Attributes	Description
1	Convenience	Convenience includes the ease of ordering, food apps make it easier to sit and home and order food with the click of a few buttons on your device.	6	User-Friendliness	The interface of apps such a Swiggy, Zomato make it extremely simple to order food. They have various options that are not too complex.
2	Variety	Customers can choose food items from multiple stores at the same time and have options, in contrary to dine-in where foods from multiple restaurants cannot be accessed.	7	Ability to track orders	The orders can be tracked on an app and thus customers know exactly when their order is about to reach them.
3	Offers and Discounts	The customers are inclined towards the price deductions they receive on orders, that are almost always available. This notion of cheaper food through ordering online	8	Better customer experience	Some customers think they are more valued and the overall experience through apps is much better than an in person

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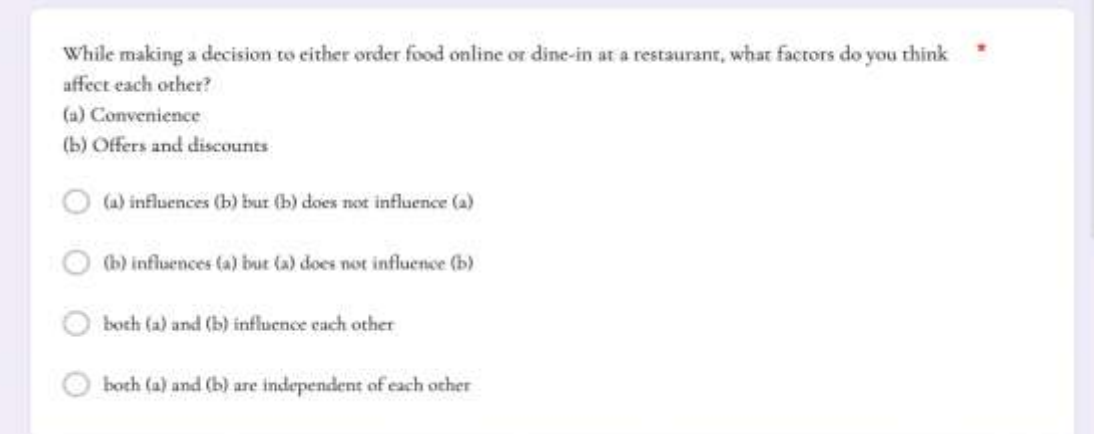
		despite the delivery fee make apps more preferred.			manager.
4	Waiting time		9	Warm and Freshly made food	Customers do feel that the freshness of the food that arrives is actually better than that of a dine in restaurant.
5	Accessibility	Accessibility refers to the ease of connecting with multiple restaurants and ordering food	10	Ambience and service	The preference of apps rather than dining in actually proves that the customers who filled out our google form do not consider the ambience to be of too much importance. They would rather stay home and enjoy the doorstep delivery service provided by food apps.

Step 3: We collected primary data by circulating a survey form to a sample population consisting of people with all demographics. Here is an example of a question:



Our research sample was a data set of 113 responses.

Step 4: Further in this study, relative responses among the impactful parameters have been acquired by computing the collected opinion in the survey. Consumers' opinion helps us to identify and portray the appropriate relationship among these attributes. By using pair-wise comparison methodology, we define that either these variables are "influencing" other variables or are getting "influenced" by other variables. Four symbols have been defined that demonstrate the association between two elements i and j (say):

1. V: element i influencing element j;
2. A: element j influencing element i;
3. X: elements i and j influencing each other; and
4. O: elements i and j are not associated.

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And using these symbols (VAXO), a matrix called SSIM has been obtained that delineates the association among 10 parameters. Table II is representing SSIM.

Table II.
Structural self-interactive matrix (SSIM)// VAXO matrix

SSIM // VAXO matrix										
Code	1	2	3	4	5	6	7	8	9	10
1	1	A	X	A	X	X	X	X	X	X
2		1	A	A	A	V	X	X	A	V
3			1	X	V	X	V	A	X	A
4				1	X	X	A	V	A	A
5					1	V	X	V	X	V
6						1	X	V	X	X
7							1	V	X	X
8								1	X	X
9									1	X
10										1

Step 5: Once the SSIM has been achieved, next step is to convert this matrix into IRM. This matrix consists of 1s and 0s that is attained by converting symbols (i.e. VAXO) by following specified sets of rules:

1. when (i, j)th entry presents V: convert the particular (i, j)th entry by "1" and (j, i)th entry by "0";
2. when (i, j)th entry presents A: convert the particular (j, i)th entry by "1" and (i, j)th entry by "0";
3. when (i, j)th entry presents X: convert the particular (i, j)th entry by "1" and (j, i)th entry by "1"; and
4. when (i, j)th entry presents O: convert the particular (i, j)th entry by "0" and (j, i)th entry by "0".

Figure 2 represents the converted SSIM into IRM by using the above mentioned rules. This IRM is an input ("M") for Block 2 (as mentioned in Figure 1), i.e. we created a comma separated (.csv) excel file. This step is a crucial and important step that leads to use the package called "ISM" that has been built in R software.

Figure 2.
Initial reachability matrix (IRM)

Initial Reachability matrix										
Code	1	2	3	4	5	6	7	8	9	10
1	1	0	1	0	1	1	1	1	1	1
2	1	1	0	0	0	1	1	1	0	1
3	1	1	1	1	1	1	1	0	1	0
4	1	1	1	1	1	1	0	1	0	0
5	1	1	0	1	1	1	1	1	1	1
6	1	0	1	1	0	1	1	1	1	1
7	1	1	1	1	1	1	1	1	1	1
8	1	1	1	0	0	0	0	1	1	1
9	1	1	1	1	1	1	1	1	1	1
10	1	0	1	1	0	1	1	1	1	1

Step 6: R being open source software is used extensively by individuals these days. This software entrenched with many dimensions offers statistical tools, sophisticated graphics abilities, machine learning algorithms and many more. It also creates a platform that enables individuals to create new things. Using this facility of R, we have developed Package "ISM". This package resolves two most time consuming efforts that can be explained such as:

1. It provides FRM that is accomplished by transitivity law of mathematics. Transitivity law states that if one attribute (say X) is related to attribute (say Y) and attribute Y is related to another attribute (say Z) then attribute X is positively related to attribute Z. Figure 3 is a pictorial representation of the computed excel

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file named "ISM_Matrix" that demonstrate the interrelationship among 13 attributes of food delivery apps vs dine-in restaurants where the highlighted 1s (in light green) are worked out by applying the transitivity law.

2. Partitioning RM is a process where three different sets have been obtained on the basis of the behaviour of the attributes. These sets can be defined as:

- Reachability set: it is a set of all those attributes that are influencing other variables.
- Antecedent set: it is a set of all those attributes that are influenced by other variables.
- Intersection set: this set contains elements of intersection of reachability set and antecedent set.

Figure 3.
Final reachability matrix (FRM)

A1	A2	A3	A4	A5	A6	A7	A8	A9	A10
1	1	1	1	1	1	1	1	1	1
1	1	1	1	1	1	1	1	1	1
1	1	1	1	1	1	1	1	1	1
1	1	1	1	1	1	1	1	1	1
1	1	1	1	1	1	1	1	1	1
1	1	1	1	1	1	1	1	1	1
1	1	1	1	1	1	1	1	1	1
1	1	1	1	1	1	1	1	1	1
1	1	1	1	1	1	1	1	1	1
1	1	1	1	1	1	1	1	1	1

Figure 4.
Level partition of each iteration

Variable_Names	Reachability_Set	Antecedents_Set	Intersection_Set	Level
A1	A1 A2 A3 A4 A5 A6 A7 A8 A9 A10	A1 A2 A3 A4 A5 A6 A7 A8 A9 A10	A1 A2 A3 A4 A5 A6 A7 A8 A9 A10	1
A2	A1 A2 A3 A4 A5 A6 A7 A8 A9 A10	A1 A2 A3 A4 A5 A6 A7 A8 A9 A10	A1 A2 A3 A4 A5 A6 A7 A8 A9 A10	1
A3	A1 A2 A3 A4 A5 A6 A7 A8 A9 A10	A1 A2 A3 A4 A5 A6 A7 A8 A9 A10	A1 A2 A3 A4 A5 A6 A7 A8 A9 A10	1
A4	A1 A2 A3 A4 A5 A6 A7 A8 A9 A10	A1 A2 A3 A4 A5 A6 A7 A8 A9 A10	A1 A2 A3 A4 A5 A6 A7 A8 A9 A10	1
A5	A1 A2 A3 A4 A5 A6 A7 A8 A9 A10	A1 A2 A3 A4 A5 A6 A7 A8 A9 A10	A1 A2 A3 A4 A5 A6 A7 A8 A9 A10	1
A6	A1 A2 A3 A4 A5 A6 A7 A8 A9 A10	A1 A2 A3 A4 A5 A6 A7 A8 A9 A10	A1 A2 A3 A4 A5 A6 A7 A8 A9 A10	1
A7	A1 A2 A3 A4 A5 A6 A7 A8 A9 A10	A1 A2 A3 A4 A5 A6 A7 A8 A9 A10	A1 A2 A3 A4 A5 A6 A7 A8 A9 A10	1
A8	A1 A2 A3 A4 A5 A6 A7 A8 A9 A10	A1 A2 A3 A4 A5 A6 A7 A8 A9 A10	A1 A2 A3 A4 A5 A6 A7 A8 A9 A10	1
A9	A1 A2 A3 A4 A5 A6 A7 A8 A9 A10	A1 A2 A3 A4 A5 A6 A7 A8 A9 A10	A1 A2 A3 A4 A5 A6 A7 A8 A9 A10	1
A10	A1 A2 A3 A4 A5 A6 A7 A8 A9 A10	A1 A2 A3 A4 A5 A6 A7 A8 A9 A10	A1 A2 A3 A4 A5 A6 A7 A8 A9 A10	1

Under this procedure, attributes levelled as "1" have their reachability set equal to intersection set. And once those identical set have been achieved then their corresponding attributes have been extracted out as top level and continued this iterative process until all attributes have attained their level as per the mentioned condition.

Figure 4 is an excel file named as "ISM_Output" which contains all reachability sets, antecedent sets and intersection sets along with the column "Level" of each and every step. In column "Level", the green marked cells are those which have been extracted because they met the condition, i.e. reachability and intersection sets were identical.

IV. INTERPRETATIONS AND FINDINGS

According to our 113 responses by consumers of all demographics, attributes such as A1 (Convenience), A2 (Variety), A3 (Waiting time), A4 (Offers and discounts), A5(Accessibility), A6 (User friendliness), A7 (Ability to track orders), A8 (Better customer experience), A9 (Warm and freshly made food), A10 (Ambience and service) are highlighted having level 1 after first iteration therefore these are the most impacted attributes. Hence from this analysis, it can be interpreted that the convenience, variety, waiting time, accessibility, user friendliness, ability to track orders, better customer experience, warm and freshly made food and ambience and service are all independent of each other and influence a consumer's decision making process equally.

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