

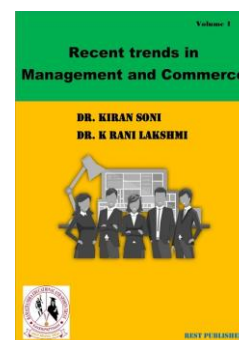


Recent trends in Management and Commerce

Vol: 1(3), 2020

REST Publisher; ISSN: 978-81-936097-6-7

Website: <http://restpublisher.com/book-series/rmc/>



Smart Restaurant Management using the DEMATEL Method

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Abstract. Customers can choose their favourite cuisine from a menu that is displayed on the button's screen thanks to the smart restaurant technology. The customer's choices are communicated to the restaurant assistant. Four functions—menu, meal ordered, confirmation, and bill request—will be offered via the digital menu. Fast-Service Restaurants (QSRs) with multiple locations can manage service speed effectively by automating organization continuous operations for quick, precise outcomes. The hardware as well as software that restaurant owners use to manage every aspect of their business, including taking orders, managing the floor plan, reservations, going to report on sales, conducting inventory levels, scheduling staff, and pricing their menus, is known as a restaurant point of sale (POS) system. Often a restaurant is like this Receives orders from multiple platforms, Update manually Creates a task from all these sites POS orders are a hassle. Smart Restaurant POS for you allows All such food Orders from orders Accept channels, without interrupting them Allows you to manage. In an intelligent restaurant system, the customer orders by touching a touch screen module placed at each table. The first screen of the block is the welcome screen. After that the A menu screen will appear. This page Contains information about Menu item and its price. Research significance: In this research, we provide a smart dining management system that is both effective and user-friendly. This system will do Use technologies like mobile and online applications, the internet of things (IoT), near-field contact (NFC) sensors, and cloud computing to find solutions to the major issues that restaurants are currently experiencing. Machine learning and device-to-device communication can help restaurants that are inefficient due to human limitations. This smart restaurant The management system achieves this by offering two interfaces for two different user types in restaurants: a web site for patrons and restaurant workers and an android mobile application. A restaurant management system automates food ordering, billing, and inventory control, enabling the manager to run the business more effectively and efficiently. A menu dictates a company's operations and the personnel needed to operate them. Buying, spending, recruiting and serving all depend on the menu. It fosters a feeling of community and camaraderie. Every town has a few eateries that are well-known to everyone. They are familiar with the location as well as any employees or owners. The feeling of belonging fostered makes the restaurant, in some ways, as significant to the locals as their personal kitchens. An operations manual contains processes and procedures for every aspect of your restaurant. This may not be the most exciting book you'll ever write or read, but it's an important reference if you want to deliver consistent quality over time. Method: DEMATEL (Decision Making Trial and Evaluation Laboratory) They are divided into analysis using the Nonmetal mineral product industry, General equipment manufacturing, Mining and washing of coal, Textile industry, Food manufacturing industry It is the interaction between the factors Visualized and assesses dependent relationships Through the structural model Also deals with identifying important. Evaluation parameters Smart Restaurant, Restaurant Automation, Device-to-Device Communication, Near Field Communications based, Smart Cities and Cloud Computing Result: Smart Restaurant Management in Smart Restaurant is got the first rank whereas is the Restaurant Automation is having the Lowest rank. Conclusion: Smart Restaurant Management in Smart Restaurant is got the first rank whereas is the Restaurant Automation is having the Lowest rank.

Keywords: MCDM, Smart Restaurant, Restaurant Automation, Device-to-Device Communication, Near Field Communications based, Smart Cities and Cloud Computing.

1. INTRODUCTION

Systematic management of smart restaurants. The system will address important issues that restaurants are currently facing by utilising technologies including cloud computing, near field contact (NFC) sensors, mobile and online applications, and the Internet of Things (IoT). Due to human constraints, restaurants have numerous inefficiencies that can be remedied through technology and device-to-device connectivity. Smart Restaurant Management System (SRMS) uses mobile smart devices, near field telecommunication (NFC) sensors, proximity sensors, mcu and cloud computing. The goal of this smart restaurant system's development at a university lab is to create a commercially viable product. It was created as a capstone engineering project for Carleton University's final year [1]. Restaurant food waste is primarily generated during the

preparation phase (45%), by food deterioration (21%), and by customer food waste (34%). Canteens, catering services, motels, and fast food restaurants are not included in the analysis since the study's focus is on unnecessary food waste produced in the hospitality sector, which includes restaurants, bars, and cafeterias with table service. If leftover edible food has been better divided, managed, stored, and/or cooked, we want to use it to reduce avoidable food waste [2]. a restaurant whose patrons eventually get unsatisfied. By presenting customized menus to each consumer depending on their preferences, the online application "Foody" seeks to address these weaknesses and provide accurate and effective services to the customer. The idea is put into practice as a smartphone device leveraging the most recent IT ideas, including artificial intelligence, systems integration, data mining, and predictive analytics. Users may observe food ingredients and accessible tables thanks to images and 3D modelling that display food-related colours, sizes, and other details. The app also provides a big map to the eatery. The table's colour changes to reflect the state of the current reservation. The computer calculates the order and informs the consumer of the waiting time based on each customer's unique culinary recommendations and analysis of their online behaviors. Subjective decisions are made when preparing and allocating food [3]. In Over 13 million people were working in the restaurant industry in the US in 2008, which means it's the biggest employment in the corporate companies and making up nearly 9% of the labour market. According to the 2007 National Restaurant association Data Sheet released by the United States Restaurant Association, the 935,000 restaurants in the US generated \$537 billion in revenue in 2007. With over \$65 billion in annual market sales, casual dining establishments have learned to value their managers as vital human capital because they possess valuable intangible (knowledge, expertise, abilities, etc.) the business [4]. Restaurant customers are becoming more conscious of the environment and want their meals to be greener, thus the food service business has a social obligation to use sustainable methods (Feniger, 2015). Proceed case (Chou et al., 2012). Berezan (2010)'s study on restaurant sustainability also looked at energy use, behavioural goals, and patron impressions (DiPietro, Gregory, & Jackson, 2013), Green features valued by customers are mentioned in Organic alternatives (Poulston & Yiu, 2011), brand messaging (Jeng & Yeh, 2016), hospitality kitchens (Kattara & Zeid, 2002), marketing, and brand perceptions (Jeng & Yeh, 2015). (Billing, Brannon, Shanklin, Howells, & Roberts, 2008). Research on restaurant owners' views and behavior towards the adoption of sustainable practices inside their businesses is, however, lacking [5]. Using the viewpoints of restaurant staff, we analyse the restaurants management system (RMS) in restaurants. Investigating the operational impact of RMS adoption based on business variables and attempting to identify variances. In the survey, 385 employees who were currently employed at a restaurant were included. A structured questionnaire was used to gather the information. RMS facilitated the participants' perceptions of working at restaurants where it was used. When it comes to difficulty-related disclosures, personnel employed by food establishments where RMS was not utilised scored higher than those in those where it was. Operations management enhanced sales and offered quality production and service. by utilising a computer, (p 0.05). Employees operating in chain restaurants also claim that RMS has a very beneficial impact on raising sales and offering a level of production and service [6]. The staff's attitude that menu items are oily particularly alarms restaurant customers. Those working in restaurants who are unfamiliar with allergies could try to address issues. Because to the difficulty in identifying the actual components in a recipe, servers may misrepresent an item's allergen-free status to a customer who has allergies. The National Restaurant Association recently created the "Food Allergy Friend" programmer for allergy diners to use, in an effort to inform servers and food service enterprises about the significance of taking allergic clientele' concerns seriously (Lempert, 2005) [7]. Program for hotel and restaurant managers at the College of North Texas. The objective of the Division of Hotel and Dining Management is to guarantee that graduates are appropriately trained to satisfy the needs of the business. Strong mutually beneficial partnerships between students, professors, and industry enable this. Students have the chance to learn specialized skills necessary for success as manager training in the hospitality sector through the hospitality and restaurant management curriculum. Employers' ratings of employee satisfaction with these skills might help educators assess how well their educational programmers are preparing people for entry-level management roles [8]. Employees' opinions of their coworkers' friendliness and skill had a big impact on their job happiness, which in turn affected organizational commitment. Moreover, there were mediating effects connecting prosocial evaluations and turnover intentions due to these two work attitudes. Notwithstanding these pertinent findings, no investigation has yet looked at how employees' perceptions about their bosses at restaurants are affected by their warmth or sentiments of competence. Researchers need to study how employees rate their managers and the results as a result of the frequent encounters between fast-casual eatery employees and their supervisors at work Such social judgements have the potential to influence the work attitudes and behavioural intentions of frontline staff [9]. Restaurant owners are hesitant to provide staff members with a free training opportunity. Less than 3% of restaurants in each of the three states where researchers performed the exercise let their staff to participate (Roberts, Barrett, Howells, Shanklin, Pilling, & Brannon, 2008). Studying restaurant managers' underlying views towards providing staff with the opportunity to engage in food hygiene education will help us recognise and comprehend their food safety training activities. There has been extensive research done on managerial attitudes and views of food safety initiatives [10]. Although both groups varied Restaurant staff members believed that human resource management was important compared to other aspects of a number of co manager's job. Lack of HR expertise was highlighted by 44% of CEOs as the cause of multi-unit managers' turnover. According to Umbreit's research, internal promotions of unit-level managers were the most effective way to fill multi-unit managerial roles (Umbreit, 1989). The similarities in teaching methods There may be a connection between field supervisors and unit-level managers if the most of district managers go through the system [11]. The success of the business depends on the restaurant management and his or her helper. The senior management is in charge of day-to-day operations,

upholding standards, and maintaining unit profitability. Nobody can contest the significance of unit management staff, with the possible exception of restaurant leadership and the leadership of managers of restaurants. In actuality, until Umbreit's landmark work, little information about multi-unit managers had been published (1987). The essential job responsibilities and distinguishing qualities of the multi-unit manager position were outlined by Umbreit (1989). Additionally, he discovered that transitional issues occurred when roles changed for single-unit managers and that they served as the main source of candidates for multi-unit managers [12]. Restaurant describes the status that food served in eating establishments in terms of Muslim dietary requirements. Additionally, having a Halal certification indicates that the entire process, not just the food, is Halal. As a result, Halal certification is crucial to the Malaysian food service sector. According to Mohd Yus off (2004), having a Halal certification has some advantages. One of them is trust since it enables consumers to make wise purchasing decisions and influences how customers feel (Muhammad Naseer & Perera, 2008). Shafie and Othman (2006), who stress the significance of the manufacturer's claim, lend credence to this. Here, they made the case that mental stability was originally derived from religion in order to draw customers to restaurants, particularly Muslims [13]. Restaurant managers are worried about how satisfied they are with their jobs. In contrast to managers with labor life interests, the results show that individuals with flexible-focus life interests and people with labour life interests have relatively high levels of job satisfaction. Moreover, according to CL1 orientation, full time position and staff members have greater satisfaction with their work than work-focused individuals. When managers were compared by age and tenure, they received the same scores in both two categories [14]. People are the main competitive advantage for restaurant businesses in the restaurant sector. The quality of service and a company's culture are more difficult to imitate than menu and restaurant designs. Another trait of MUR businesses is their propensity to expand by establishing additional locations in foreign markets (Lombardi, 1994). According to Jones (1999), when the MUR industry grows geographically, entirely new sets of issues will surface [15]. Reasons for managers and staff leaving a firm are needed by restaurant company representatives, especially recruiters. To ensure that students are happy with their jobs and are ready to be effective managers, it is crucial for instructors of hospitality management and their students to have a thorough understanding of the reality and requirements of the restaurant sector. Encourage students to identify the career requirements that are crucial to them and look for employers who can meet their demands [16]. The cleanliness of a restaurant and its "safety" are both reflected in the health inspectors' ratings of that restaurant (Cruz, Katz, and Suarez 2001; Irwin et al. 1989). Yet, it is not clear how the study's findings would affect customers' decisions about where to eat. All trustworthy operators place a high premium on providing wholesome food, but the sheer number of eateries with several serious infractions implies that more may be done. Operators may find it helpful to have findings when undertaking risk analyses and deciding how much funding should be devoted discover fresh motivation to provide safe food after better understanding how those results impact their financial situation. Operations with outstanding inspection ratings can use the findings of this research to decide how best to enhance their operation [17].

2. MATERIALS AND METHOD

Smart Restaurant: A virtual restaurant, commonly referred to as a ghost chef or black kitchen, is a restaurant that only accepts orders for delivery and pick-up over the phone and online. Smart restaurants can effectively manage speed of service, especially in multi-location quick service restaurants (QSRs) by automating enterprise-wide continuous operations for fast, accurate results. A digital dining experience allows guests to eat with their devices, eyes and more. The digital dining experience uses technology to enhance the guest experience wherever guests are. A digital buffet digitally by guests using QR codes. Visitors to your restaurant can use the camera on their smartphone to read QR codes from their own tables. Visit How to Scan with QR Code Menu to learn more about this. Except that you can view it on your mobile instead of a printed piece of paper, a digital restaurant for restaurants is identical to a regular menu. The door or the table usually feature a QR code for eateries that use digital menus. On your smartphone, a selection will show when users scan the QR code.

Restaurant Automation: implementing technology to streamline numerous activities in the hospitality industry is known as restaurant automation. This might entail anything from deploying robotics in the kitchen to automating inventory management or consumer orders using point-of-sale software. Customers can send orders to artificial intelligence using automated order-taking (AOT) technology. Orders placed using a variety of languages and dialects can be processed by the technology because it has natural language processing capabilities. Consumers can rapidly request various menu items or make additions. An automat system is a combination of sensors, actuators, and controllers that is created to carry out a task with little to no human involvement. Solenoid, an academic branch of architecture that incorporates mechanical, electrical, and electronic systems, is the field at issue in this situation.

Device-to-Device Communication: Device-to-device (D2D) communication is a term used to describe a method that enables user equipment (UE) to interface with one another with or without the assistance of network infrastructure like access points or base stations. D2D is promising since it makes it possible to communicate with extremely low latency. Devices can communicate with one another directly and across IP networks as well as the World Wide Web using Bluetooth or other protocols. Applications in house automation systems, such as lightbulbs and switches, that demand low data rates are some example of this form of communication.

Near Field Communications based Smart Cities: What is an example of near field interaction? An example of near-field contact is a contactless payment system such as Apple Pay or Google Pay. These payment systems use NFC technology to securely and quickly transfer payment information from your device to the merchant's payment terminal. In order to facilitate communication amongst devices when they contact or are transported within a few centimetres of each other, The pinnacle of connection is near-field communications. Whether you're making payments, collecting business cards, download coupons, or distributing a research paper, NFC makes it simple and quick to transfer data between gadgets with a single touch.

Cloud Computing: Cloud computing is access to computer resources via the web—applications, servers (network equipment and vms), information management, application software, communication infrastructure, & more, all of which are housed in a distant data center run by cloud services. Offered (or CSP) (or CSP). Cloud computing is defined simply as is a spectrum of services supplied over the Internet or "the cloud". This entails using remote servers to store and access data rather than local drives and private storage arrays. The 1960s were when the idea of cloud computing first emerged. The term is derived from the cloud icon that flowcharts and graphs use to represent the Internet. The illustration on the left emphasizes the idea that any computer with an Internet connection has the ability to access technological resources, programmers, and information.

Method: The DEMATEL method addresses a specific issue, pinup binding. Work through problems with a hierarchical structure. Contribute to identifying workable solutions. Structural modeling techniques are used for one reason: interrelationships between organizational components. Dependency identification and context It can affect the basic concept of relationships. and chart direction due to the influence of elements. makes more use of graphs. DEMATEL Based on the basic principle of structure and its visualization, it processes problems by method, analyses them, and solves them. [18]. Modeling this structure, the approach adopts the form of a driven diagram, which is a causal effect for presenting values of influence between interrelated relations and analyzing factors. By analyzing the visual relationship of conditions between systemic factors, all components A causal group and an effect are divided into groups. It also provides researchers with structure between system components. A better understanding of the relationship and complexity is needed for troubleshooting computer problems. can find ways. The DEMATEL system is integrated. Management and emergency response work in tandem. In the manner proposed, it is not necessary to defuzzify obscure numbers before using the DEMATEL method [19]. As a result, it is unclear whether this method will accurately reflect the character. Finally, to get the final results from different aspects Twice in each integrated PPA, we use DEMATEL, which is ours. Decision Testing and Assessment Laboratory (DEMATEL) The DEMATEL method is a powerful method for gathering team knowledge to build a structured model and visualize the causal relationships among subsystems. But crisp values The ambiguity of the real world is an adequate reflection [20]. DEMATEL investigates the relationship between equity and a variety of investment factors and factors, as well as the ANP, which is used to assess their interdependence. Integrates. This section is, first and foremost, detailed. Establishes network relationships before increasing the weight of each ANP factor in comparison to Uses. Third, a systematic data collection process is provided [21]. The DEMATEL method quickly separates the complex set of factors into a sender organization and a receiving institution, and then translates that information into the appropriate strategy for selecting a management tool. Also, the ZOGP model enables businesses to fully utilise their limited funds for planning to develop ideal management systems by combining different configurations with Explicit Priorities [22]. DEMATEL methods. This impact and causality can be attributed to affected group barricades. Therefore, to effectively implement electronic waste management, barriers belonging to a causally Influential subgroup should be given special consideration. Decision-makers must therefore identify hurdles in order to reduce their impact or influence, guarantee that the legal is strong, and ensure that appropriate barriers are in place. Therefore, der methods ISM and DEMATEL methods, the results are somewhat consistent results grated ISM DEMATEL results for e-was determination constraints determine not only the structure of fire but also the structure of the interactions DEMATEL research, specific applications for DEMATEL. as for which DEMATEL is only. categories: factors or only relationships between criteria The first type of clarification is: and causal Group barriers pro or Source for affected group barriers can be considered due. Therefore, in order to effectively implement electronic waste management, barriers belonging to a causal or an influential group should be considered on a priority basis. Therefore, decision makers need to determine obstacles the legal framework is strong make sure there is controllable in order to minimize impact or influence barriers. Therefore, derived from ISM and DEMATEL methods the results are somewhat consistent. The structure of the interactions between these barriers is determined by the integrated ISM DEMATEL results for e-waste management constraints [23]. DEMATEL research, specific applications for DEMATEL. categories: factors or only relationships between criteria The first type of clarification involves identifying the main factors in terms of causal relationships and interrelationship size, while the second involves identifying the criteria for relationship and impact level analysis. DEMATEL method. As a result, the preliminary disadvantage (cluster one) was about topics such as the comparative weights of selection makers in the DEMATEL approach, which now does not take into account linking to team decision-making [24]. Obviously, in a group decision-making hassle, regular decision-makers can always trust their point of view and count on it to be prevalent among other selection-makers. This way, the very last evaluation guides must be close to their judgments, and if the very last assessment effects are close to their critiques, the choice maker is willing to simply accept it; otherwise, they may deny it. It is believed that methods based on unstructured comparisons, such as DEMATEL, play a significant role in the aforementioned discrepancies [25]. DEMATEL is widely accepted for analyzing the overall relationship of factors and classifying factors

into cause-and-effect types. Therefore, this article considers each source as a criterion in decision-making. To deal with a mixture of conflicting evidence, the significance and level of significance of each piece of evidence can be determined using DEMATEL; however, expanding the DEMATEL method with the source theory is required for better conclusions. In this article, instead of the comparative criteria provided by the experts in DEMATEL [26], the corresponding propositions between the bodies of sources are changed. The DEMATEL technique used as well as creating causal relationships between criteria for evaluating the Integrated Multiple Scale Decision Making (MCDM) Outreach Personnel Program integrates DEMATEL and a new cluster-weighted system, in which DEMATEL is a company. The reason for the complexity between the criteria This is to visualize the structure of relationships. It is also used to measure the influence of criteria. Buyukozkan and Ozturkcan integrated ANP and DEMATEL, an innovation in terms of technology. have developed an approach that is for companies. helps determine important Six Sigma Projects and logistics specifically prioritizing these projects helps to identify companies [27].

3. RESULTS AND DISCUSSION

TABLE 1. Smart Restaurant Management

	Smart Restaurant	Restaurant Automation	Device-to-Device Communication	Near Field Communications based Smart Cities	Cloud Computing	Sum
Smart Restaurant	0	1	4	2	2	9
Restaurant Automation	3	0	2	1	1	7
Device-to-Device Communication	2	1	0	3	2	8
Near Field Communications based Smart Cities	2	3	2	0	2	9
Cloud Computing	2	1	1	2	0	6

Table 1 shows that DEMATEL Decision making trail and evaluation laboratory in Smart Restaurant Management with respect to Smart Restaurant, Restaurant Automation, Device-to-Device Communication, Near Field Communications based, Smart Cities and Cloud Computing sum this value.

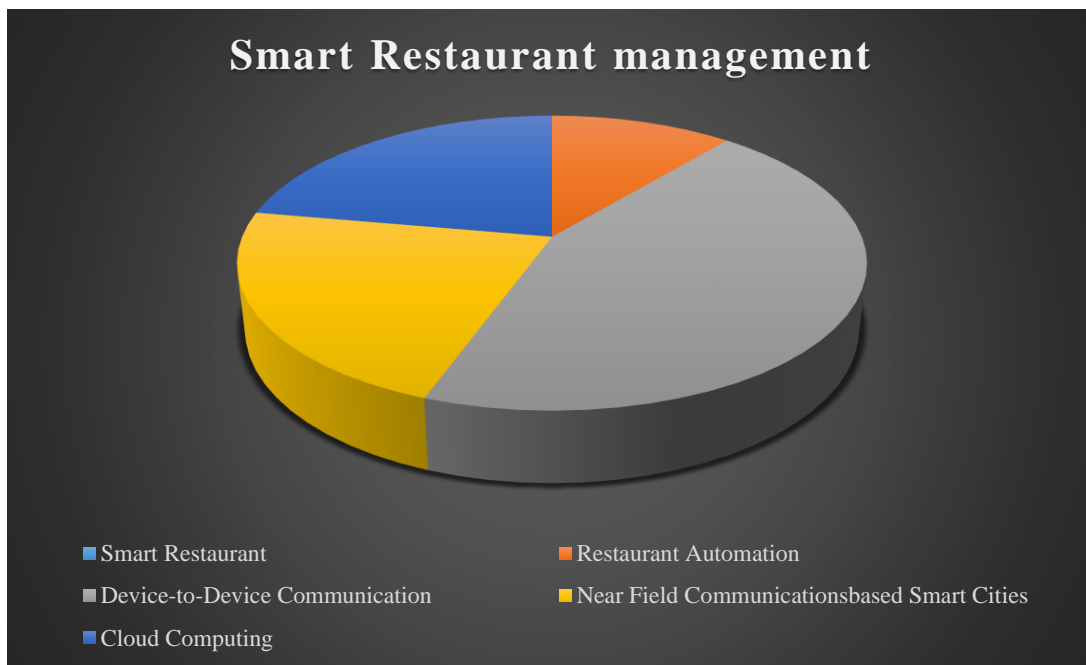


FIGURE 1. Smart Restaurant management

Figure 1 shows the DEMATEL Decision making trail and evaluation laboratory in Smart Restaurant Management with respect to Smart Restaurant, Restaurant Automation, Device-to-Device Communication, Near Field Communications based, Smart Cities and Cloud Computing sum this value.

TABLE 2. Normalization of Direct Relation Matrix

	Smart Restaurant	Restaurant Automation	Device-to-Device Communication	Near Field Communications based Smart Cities	Cloud Computing
Smart Restaurant	0	0.111111111	0.444444444	0.222222222	0.222222222
Restaurant Automation	0.333333333	0	0.222222222	0.111111111	0.111111111
Device-to-Device Communication	0.222222222	0.111111111	0	0.333333333	0.222222222
Near Field Communications based Smart Cities	0.222222222	0.333333333	0.222222222	0	0.222222222
Cloud Computing	0.222222222	0.111111111	0.111111111	0.222222222	0

Table 2 shows that the Normalising of direct relation matrix in with respect to Smart Restaurant, Restaurant Automation, Device-to-Device Communication, Near Field Communications based, Smart Cities and Cloud Computing The diagonal value of all the data set is zero.

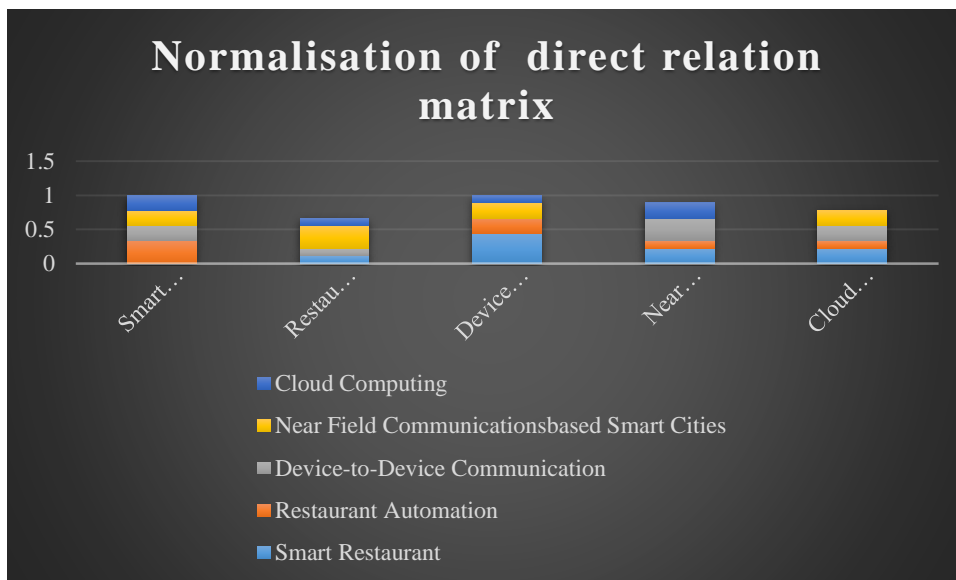


FIGURE 2. Normalization of Direct Relation Matrix

Figure 2 Shows that chart for Normalizing of direct relation matrix Smart Restaurant, Restaurant Automation, Device-to-Device Communication, Near Field Communications based, Smart Cities and Cloud Computing has Different value.

TABLE 3. Calculate the Total Relation Matrix

	Smart Restaurant	Restaurant Automation	Device-to-Device Communication	Near Field Communications based Smart Cities	Cloud Computing
Smart Restaurant	0	0.11111	0.444444444	0.222222	0.222222
Restaurant Automation	0.3333333	0	0.222222222	0.111111	0.111111
Device-to-Device Communication	0.2222222	0.11111	0	0.333333	0.222222
Near Field Communications based Smart Cities	0.2222222	0.33333	0.222222222	0	0.222222
Cloud Computing	0.2222222	0.11111	0.111111111	0.222222	0

Table 3 Shows the Calculate the total relation matrix in Smart Restaurant management with respect to Smart Restaurant, Restaurant Automation, Device-to-Device Communication, Near Field Communications based, Smart Cities and Cloud Computing is Calculate the Value.

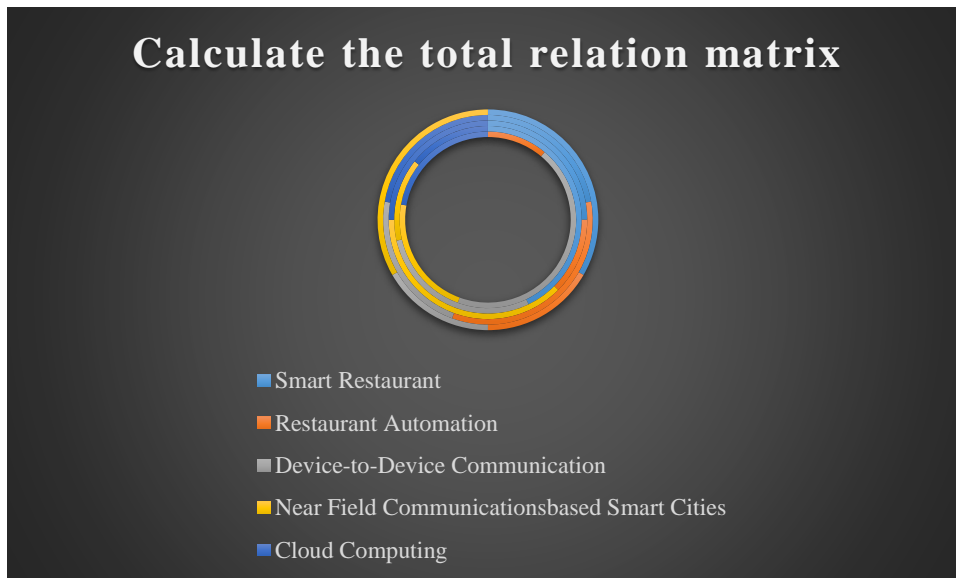


FIGURE 3. Calculate the Total Relation Matrix

Figure 3 shows the Calculate the Total Relation Matrix in Smart Restaurant management with respect to Smart Restaurant, Restaurant Automation, Device-to-Device Communication, Near Field Communications based, Smart Cities and Cloud Computing is Calculate the Value.

TABLE 4. $T= Y(I-Y)-1$, I= Identity matrix

1	0	0	0	0
0	1	0	0	0
0	0	1	0	0
0	0	0	1	0
0	0	0	0	1

Table 4 Shows the $T= Y(I-Y)-1$, I= Identity matrix in Smart Restaurant management with respect to Smart Restaurant, Restaurant Automation, Device-to-Device Communication, Near Field Communications based, Smart Cities and Cloud Computing is the common Value.

TABLE 5. Y Value

0	0.111111	0.444444	0.222222	0.222222
0.333333	0	0.222222	0.111111	0.111111
0.222222	0.111111	0	0.333333	0.222222
0.222222	0.333333	0.222222	0	0.222222
0.222222	0.111111	0.111111	0.222222	0

Table 5 Shows the Y Value in E Smart Restaurant management with respect to Smart Restaurant, Restaurant Automation, Device-to-Device Communication, Near Field Communications based, Smart Cities and Cloud Computing is the Calculate the total relation matrix Value and Y Value is the same value.

TABLE 6. I-Y Value

1	-0.111111	-0.444444	-0.222222	-0.222222
-0.333333	1	-0.222222	-0.111111	-0.111111
-0.222222	-0.111111	1	-0.333333	-0.222222
-0.222222	-0.333333	-0.222222	1	-0.222222
-0.222222	-0.111111	-0.111111	-0.222222	1

Table 6 Shows the I-Y Value Smart Restaurant management with respect to Smart Restaurant, Restaurant Automation, Device-to-Device Communication, Near Field Communications based, Smart Cities and Cloud Computing table 4 $T= Y(I-Y)-1$, I= Identity matrix and table 5 Y Value Subtraction Value.

TABLE 7. (I-Y)-1Value

2.564094701	1.238162	1.961298	1.699092	1.520792
1.550601079	1.924865	1.548393	1.341389	1.200626
1.610770363	1.153705	2.489573	1.627331	1.401006
1.734973013	1.378373	1.790174	2.465285	1.48436
1.306611874	0.923516	1.282323	1.255275	1.956882

Table 7 Shows the (I-Y)-1Value Smart Restaurant Management with respect to Smart Restaurant, Restaurant Automation, Device-to-Device Communication, Near Field Communications based, Smart Cities and Cloud Computing Table 6 shown the Minverse Value.

TABLE 8. Total Relation matrix (T)

	Total Relation matrix (T)				
Smart Restaurant	1.564094701	1.238162	1.961298	1.699092	1.520792
Restaurant Automation	1.550601079	0.924865	1.548393	1.341389	1.200626
Device-to-Device Communication	1.610770363	1.153705	1.489573	1.627331	1.401006
Near Field Communications based Smart Cities	1.734973013	1.378373	1.790174	1.465285	1.48436
Cloud Computing	1.306611874	0.923516	1.282323	1.255275	0.956882

Table 8 shows the Total Relation Matrix the direct relation matrix is multiplied with the inverse of the value that the direct relation matrix is subtracted from the identity matrix.

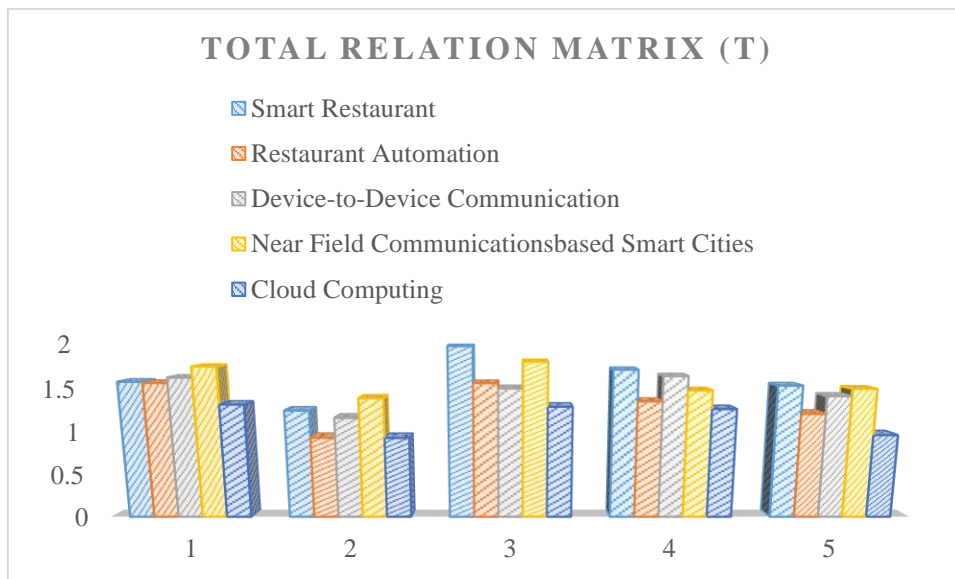


FIGURE 4. Total Relation Matrix (T)

Figure 4 shows The Total Relation Matrix the direct relation matrix is multiplied with the inverse of the value that the direct relation matrix is subtracted from the identity matrix.

TABLE 9. Smart Restaurant Management Ri, Ci Value

	Ri	Ci
Smart Restaurant	7.98344	7.767051
Restaurant Automation	6.565873	5.618621
Device-to-Device Communication	7.282385	8.071762
Near Field Communications based Smart Cities	7.853165	7.388371
Cloud Computing	5.724607	6.563665

Table 9 shows the Smart Restaurant Management Ri, Ci Value Smart Restaurant, Restaurant Automation, Device-to-Device Communication, Near Field Communications based, Smart Cities and Cloud Computing in Smart Restaurant is showing the Highest Value for Ri and Cloud Computing is showing the lowest value. Device-to-Device Communication is showing the Highest Value for Ci and Restaurant Automation is showing the lowest value.

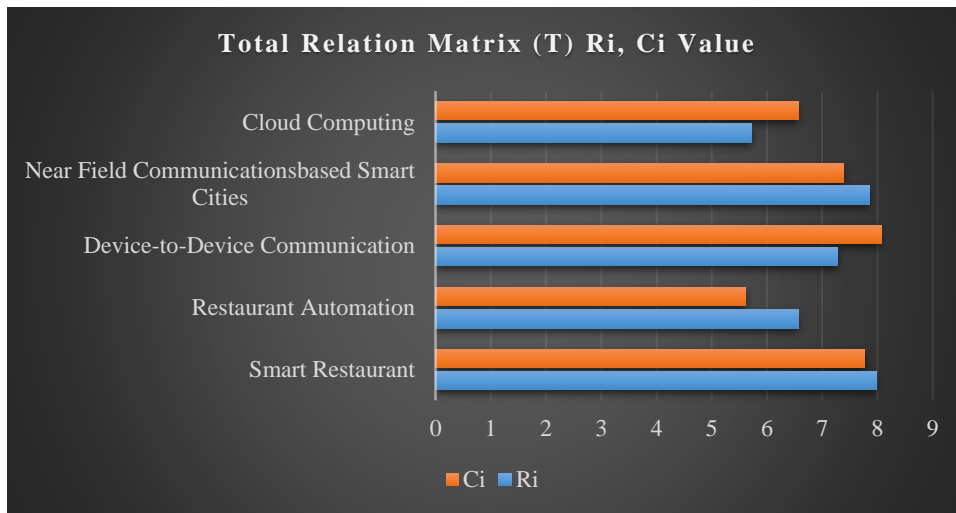


FIGURE 5. Total Relation Matrix (T) Ri, Ci Value

Figure 5 shows the Total Relation Matrix (T) Smart Restaurant Management Ri, Ci Value Smart Restaurant, Restaurant Automation, Device-to-Device Communication, Near Field Communications based, Smart Cities and Cloud Computing in Smart Restaurant is showing the Highest Value for Ri and Cloud Computing is showing the lowest value. Device-to-Device Communication is showing the Highest Value for Ci and Restaurant Automation is showing the lowest value.

TABLE 10. Calculation of Ri+Ci and Ri-Ci to Get the Cause and Effect

	Ri+Ci	Ri-Ci	Rank	Identity
Smart Restaurant	15.75049	0.216389	1	cause
Restaurant Automation	12.18449	0.947252	5	cause
Device-to-Device Communication	15.35415	-0.78938	2	effect
Near Field Communications based Smart Cities	15.24154	0.464794	3	cause
Cloud Computing	12.28827	-0.83906	4	effect

Table 10 shows the Calculation of Ri+Ci and Ri-Ci to Get the Cause and Effect. Smart Restaurant, Restaurant Automation, Device-to-Device Communication, Near Field Communications based, Smart Cities and Cloud Computing. of Smart Restaurant, Restaurant Automation and Near Field Communications based Smart Cities is Showing the highest Value of cause. Device-to-Device Communication and Cloud Computing is showing the lowest Value of effect.

TABLE 11. T Matrix Value

1.564095	1.238162	1.961298	1.699092	1.520792
1.550601	0.924865	1.548393	1.341389	1.200626
1.61077	1.153705	1.489573	1.627331	1.401006
1.734973	1.378373	1.790174	1.465285	1.48436
1.306612	0.923516	1.282323	1.255275	0.956882

Table 11 shows the T Matrix Value Calculate the Average of the Matrix and Its Threshold Value (Alpha) **Alpha 1.416379** If the T matrix value is greater than the threshold value then bolds it.

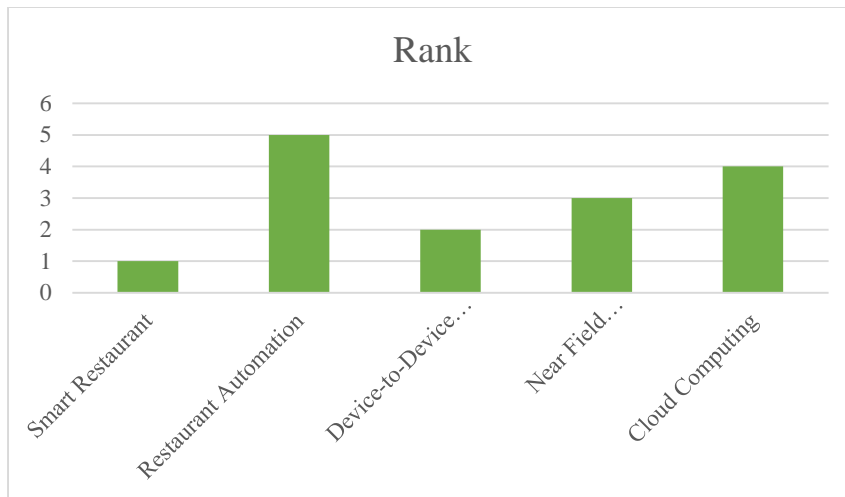


FIGURE 6. Shown the Rank

Figure 6 shows the Rank using the DEMATEL for Smart Restaurant Management in Smart Restaurant is got the first rank whereas is the Restaurant Automation is having the Lowest rank.

4. CONCLUSION

Customers can choose their favorite cuisine from a menu that is displayed on the button's screen thanks to the smart restaurant technology. The customer's choices are communicated to the restaurant assistant. Four functions—menu, meal ordered, confirmation, and bill request will be offered via the digital menu. Fast-Service Restaurants (QSRs) with multiple locations can manage service speed effectively by automating organization continuous operations for quick, precise outcomes. The hardware as well as software that restaurant owners use to manage every aspect of their business, including taking orders, managing the floor plan, reservations, going to report on sales, conducting inventory levels, scheduling staff, and pricing their menus, is known as a restaurant point of sale (POS) system. A menu dictates a company's operations and the personnel needed to operate them. Buying, spending, recruiting and serving all depend on the menu. It fosters a feeling of community and camaraderie. Every town has a few eateries that are well-known to everyone. They are familiar with the location as well as any employees or owners. The feeling of belonging fostered makes the restaurant, in some ways, as significant to the locals as their personal kitchens. Systematic management of smart restaurants. The system will address important issues that restaurants are currently facing by utilizing technologies including cloud computing, near field contact (NFC) sensors, mobile and online applications, and the Internet of Things (IoT). Due to human constraints, restaurants have numerous inefficiencies. A virtual restaurant, commonly referred to as a ghost chef or black kitchen, is a restaurant that only accepts orders for delivery and pick-up over the phone and online. Smart restaurants can effectively manage speed of service, especially in multi-location quick service restaurants (QSRs) by automating enterprise-wide continuous operations for fast, accurate results. A digital dining experience allows guests to eat with their devices, eyes and more. implementing technology to streamline numerous activities in the hospitality industry is known as restaurant automation. This might entail anything from deploying robotics in the kitchen to automating inventory management or consumer orders using point-of-sale software. Customers can send orders to artificial intelligence using automated order-taking (AOT) technology. Device-to-device (D2D) communication is a term used to describe a method that enables user equipment (UE) to interface with one another with or without the assistance of network infrastructure like access points or base stations. D2D is promising since it makes it possible to communicate with extremely low latency. DEMATEL (Decision Making Trial and Evaluation Laboratory) They are divided into analysis using the Nonmetal mineral product industry, General equipment manufacturing, Mining and washing of coal, Textile industry, Food manufacturing industry It is the interaction between the factors Visualized and assesses dependent relationships Through the structural model Also deals with identifying important. Smart Restaurant, Restaurant Automation, Device-to-Device Communication, Near Field Communications based, Smart Cities and Cloud Computing. Smart Restaurant Management in Smart Restaurant is got the first rank whereas is the Restaurant Automation is having the Lowest rank.

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