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Sales Increasing Strategies Based on Menu Item Performance: Case of a Luxury Restaurant

Özkan ERDEM [1]
Damla KILIÇ [2]
Adem ARMAN[3]
Çiğdem MUTLU[4]

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Abstract

As one of the food and beverage cost control tools in the restaurant industry, menus can inform service providers about the restaurant's performance and assist them in developing sustainable sales-increasing strategies through appropriate analysis techniques. Since menu item activities have an important role in the profitability of the restaurant, the goal of the current study is to determine these activities through Data Envelopment Analysis (DEA) and to propose sustainable sales enhancing strategies according to menu management stages. Accordingly, data of 166 menu items in 6 food groups (soups, appetizers and salads, hot starters, pan dishes and main courses, rice and pasta, desserts) in the menu of a luxury restaurant for December 2020 operating in Antalya were included in DEA. Performance of the menu items in six different food groups in the menu was analyzed by determining selling price, fixed costs and variable costs as input variables, while popularity and gross profit are used as output ones. Results imply that the most efficient food group was soups, while pan and main dishes were those with the lowest activity levels. Following the study results, the strategies to be considered in increasing the menu performance according to the menu management stages depending on the menu item efficiency were proposed. Paper concludes with some useful recommendations to the service providers and practitioners.

Key words: Menu Analysis, Menu Item Performance, Data Envelopment Analysis, Sustainable Sales Increasing Strategies, Restaurants

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[1] Lect., Akdeniz University, Antalya, ozkanerdem@akdeniz.edu.tr, http://orcid.org/0000-0003-0234-2218
[2] Lect., Siirt University, Siirt, damla.kilic63@gmail.com, http://orcid.org/0000-0002-6564-6385
[3] Assoc. Prof., Akdeniz University, Antalya, ademarman@akdeniz.edu.tr, http://orcid.org/0000-0003-3999-3751
[4] Dr., Dokuz Eylul University, İzmir, cigdem.mutlu@deu.edu.tr, http://orcid.org/0000-0002-0033-4110

1. Introduction

Menu analysis is the process of taking an X-ray of the restaurant by evaluating the performance of each menu item based on predetermined performance indicators. For this reason, menu analysis is important in detecting menu items with lower performance than expected and achieving the business goals through the appropriate improvements. Thus, menu analysis becomes one of the most important stages of menu management (Özdemir and Caliskan 2013), while the menu represents a sustainable strategic tool towards increasing sales and profitability (Özdemir and Nebioğlu, 2018). Measuring the performance of menu items, and providing healthy feedback and correct improvements within the menu management process is a very functional and strategic process in terms of the profitability and sustainability of the business. This is why it is important for businesses to consider the menu as a management process and use it as a strategic tool to increase profitability at each stage in order to gain competitive advantage. Besides being one of the first signs of the dining experience, and a tool that provides information about what is served in the restaurant and guides the food selection, menu can be considered as important evidence that reflects the brand image and personality of the restaurant (Magnini and Kim, 2016). Recently considered as communication, marketing and sales tool, menu is an important key that affects consumer behavior (Kincaid and Corsun, 2003; Reynolds et.al, 2005). Thus, restaurant managers should handle the menu management process in a way that prioritizes restaurant profitability. Sustainability of successful menu management process is possible by considering the harmony between planning, pricing, design and analysis stages of the menu, and by establishing a good connection with restaurant qualities such as service, location and employee. Based on the evaluation results of the menu analysis, menu performance can be increased by improving and making the necessary changes at each menu stage. Therefore, restaurants need to analyze their menus with the right variables and with the techniques suitable for each facility. Many different variables were used in menu analysis literature, such as food cost, popularity, labor force, contribution margin, and similar. This study uses Data Envelopment Analysis (DEA), which is frequently used in productivity studies in recent years, and has the ability to include many factors that affect profitability of menu items, both qualitative and quantitative (Taylor and Brown, 2007). As a result of DEA, efficiency is calculated for each menu item, allowing the items to be compared with each other. Current study aims to measure the effectiveness of the restaurant's menu items by using DEA, and to determine the strategies for the necessary improvements and developments.

2. Literature Review

2.1. DEA Studies in the Hospitality Industry

DEA has a widespread use in hospitality industry, especially in hotel and restaurant sectors. Focus of hotel management related studies is generally on measuring the performance of hotels located in the same destination or those in

different destinations. Later studies show that efficiency of hotel businesses varies according to destinations, hotel types and bed capacities (Hwang and Chang, 2003; Barros, 2005; Liu et.al, 2018). Related literature implies that hotel activities were determined based the number of rooms, total expenses, number of personnel, beverage and food expenses, recreation expenses as input variables, while total number of customers, customer satisfaction, food and beverage revenues, total revenues, occupancy rate and number of overnight stays were used as output variables (Uyar and Alış, 2014; Çelik, 2016; Tsai et.al, 2017).

As for the studies on evaluation of restaurant businesses' efficiency, positive relationship between efficiency and location was determined based on comparison between several restaurants (Reynolds, 2004; Barros, 2005). While in some studies the relationship between restaurant type, size and productivity was examined, in others the relationship between employee satisfaction and profitability was in focus. According to these, fast food and chain restaurants are more efficient. Moreover, there is a positive relationship between employee satisfaction and profitability, with sales affecting productivity rather than the restaurant's size (Reynolds and Thompson, 2007; Hadad et.al, 2007; Assas et.al, 2011; Mhlanga, 2017).

2.2. DEA Studies on the Menu Item Activity

In preliminary studies carried out to measure the performance of menu items through matrix models (Miller, 1980; Kasavana and Smith, 1982; Pavesic, 1985; Le Bruto et al. 1995), it was emphasized that performances of the menu items depend on each other, with some menu items, inevitably, remaining below the determined level. Due to inability to evaluate each item independently and the limited level of knowledge, this is not considered as effective menu analysis. As an alternative to matrix models, methods such as Goal Value Analysis developed by Hayes and Huffman (1985) and Profitability Analysis developed by Bayou and Bennet (1992) require detailed information for each menu item that restaurant businesses will include in the formula. Thus, these are more time-consuming than matrix models. Besides matrix models and formulas, multidimensional models are also in use. In the pentagon model developed by Cohen et.al (2007), different variables, such as food cost percentage, selling price, popularity, contribution margin and total contribution margin, are included in the analysis. Accordingly, business managers can obtain information by making the necessary calculations to evaluate the effectivieness of each menu item. This method can be considered as valuable, but also a time-consuming one. On the other hand, DEA is used quite frequently as it provides the opportunity to include many different variables in the analysis, both qualitative and quantitative ones (Reynolds and Taylor, 2011). Therefore, it allows the comparison of inputs and outputs for each menu item (Reynolds, 2004), providing managers with an idea about each menu item and allowing improvements (Reynolds, 2003). Unlike with previous methods, all flow processes from the production to the presentation of the menu items are included in the analysis, providing more realistic results, as the costs that may directly or indirectly affect the performance of the menu item are included (Taylor and Brown, 2007). Authors conducted a search in Scopus and WOS database based on the

following keywords "Menu", "DEA" and "Restaurant". It was determined that 4 empirical studies were conducted to measure the effectiveness of DEA and menu items in indexed journals.These studies as well as those found in other journals on the related topic are presented in Table 1.

One of the preliminary studies with DEA (Taylor et al., 2009) investigated the efficiency of 65 items in the menu of a chain restaurant in Mississippi. Here it is argued that DEA is a better approach than other traditional menu analysis methods, since it includes more variables, such as labor costs. In a study conducted by Reynolds and Taylor (2011) in 2009, the effectiveness of 65 menu items of restaurant chain serving in the USA was evaluated using DEA. While it was determined that 7 menu items were efficient, difficulty of preparation was the area that needed the most improvement (39.52%). Moreover, negative relationship was found between difficulty in preparation and popularity. Chou and Fang (2013) evaluated the effectiveness of 20 menu items of a Chinese-style fast food restaurant in Taiwan, and concluded that DEA is a good method for evaluating financial performance. While the average efficiency value of 20 menu items was at 83.3%, 7 menu items were 100% efficient. This study's implications were that changes in some practices, such as working with local suppliers and changing the cost method towards increasing the effectiveness of menu items, will have a positive effect on profitability. Additionally, re-planning the cooking time and production stages for inefficient menu items would contribute to the effectiveness. In another study, Fang and Hsu (2014) evaluated the performance of 30 items in the menu of a Japanese restaurant chain with DEA. Results show that six menu items had the desired appeal, while four were labelled as undesirable products. Same study shows that gross profit, number of products sold and total labor costs of dinner are higher than lunches. Therefore, it is necessary to carry out R&D and marketing work towards increasing the effectiveness of the lunch menu items.

In their study at the restaurant serving Teppanyaki style in Taiwan, Fang et al. (2013) used traditional menu engineering approaches and DEA together. They examined 6-month data of 34 menu items in total, including 16 a la carte menu items and 18 combined set menu items. Results showed that the first main reason underlying the inefficiency of menu items was food costs, followed by operating expenses. It was concluded that restaurant profitability is 22.33% higher when DEA and menu engineering are used together, instead of only using menu engineering approaches.

Fang (2020) evaluated twelve-month data on 35 menu items in restaurant chains of two different cultural types, Chinese and Japanese-style restaurants, within the framework of resource savings target rates (RSTR). In this context, through DEA and slack-based measure model (SBM), researcher tried to create a model for evaluating the performance of food and labor costs. Empirical findings have shown that average total factor food cost effectiveness (TFFCE) is better than total factor labor cost effectiveness (TFLCE) in these two restaurant types. In the observed periods, TFFCE (80%) and TFLCE (61%) values of the Chinese style restaurant were found to be better than the Japanese style restaurant TFCE (76%)

and TFLCE (50%). Finally, although Chinese-style restaurants have good resource efficiency, they can improve 20% in terms of food cost efficiency and 39% in terms of labor cost efficiency.

Table 1: DEA studies on restaurant menu item activity

Variables	Taylor et. al (2009)	Reynolds and Taylor (2011)	Peng et. al (2011)	Fang et. al (2012)	Chou and Fang (2013)	Fang et.al (2013)	Fang and Hsu (2014)	Fang (2020)	Yiğitoğlu and Tetik (2020)
Ingredient cost	Input	-	Input	Input	Input	Input	Input	-	Input
Unit Food Cost								Input	
Unit labor cost								Input	
Labor cost	-	-	Input	Input	Input	Input	Input	-	Input
Other operating expenses	-	-	-	Input	-	Input	-	-	
Number of vendors	Input	Input	-	-	Input		Input	-	
Number of transactions	Input	Input	Input	-			-	-	
Unit price	-	-	-	-	Input		-	-	
Number of suppliers								Input	
Preparation process and level	-	Input	-	-	Input	Input	-	-	
Sales volume (Popularity)	Output	Output	Output	-	Output		Output	Output	Output
Net profit	-	-	-	-	Output		-	Output	-
Gross profit	Output	Output	Output	Output		Output	Output	-	Output
Income	-	-	-	Output		Output	-	-	
DEA Model	CCR	BCC	BCC	BCC	CCR-BCC		BCC	SBM-DEA	BCC

2.3. Strategies for Increasing Menu Performance

Menu management process stages are one of the most important variables affecting menu performance (Özdemir, 2012). For this reason, sensitive, comprehensive and accurate evaluation of menus is important for restaurant managers to reach their business goals. Therefore, all stages of the menu management process such as planning, pricing, design, analysis and development should be compatible with each other. From a strategical perspective, in the menu planning process as the first stage of menu management, financial, marketing and promotion variables should be considered besides gastronomic ones (Kivela, 2003). Related literature implies that in this process many different criteria, such as food cost, labor cost, personnel, space, equipment, customer demand, and gastronomic variables like taste, visuality, presentation, management, profitability, and marketing are taken into account (Morrison, 1997; Kwong, 2005; Kivela, 2003; Seyitoğlu, 2017). These variables were examined through both matrix-based menu

analysis methods and multidimensional menu analysis approaches. From this persepctive, a strong relationship between menu planning and menu performance can be observed, with variables used in the menu planning process affecting the popularity, cost, and profitability dimensions (Özdemir, 2012). In order to increase menu or menu item performance, businesses should consider customer expectations, kitchen staff and waiters' views, as well as related menu planning variables, prioritizing business profitability in the menu planning process.

Özdemir (2012) emphasizes that menu design variables can be used to affect menu performance. Kwong (2005) supports this by stating that physical changes to menu design will increase sales by 10%. Previous studies show that different strategies can be used at each menu design stage. For example, menu item labels reflect item selection and customer perceptions (Wansink et al. 2005; Lockyer, 2006), while explanations on the menu card affect customer preferences (McCall & Lynn, 2008). In this respect, the perception and attention of customers can be drawn to the specific products by using descriptive information about menu items or by using different labeling strategies. Similarly, the menu item loction affects the customer's perception, menu item selection and ordering behavior (Bowen ve Morris, 1995; Pavesic, 2005; McCall and Lynn, 2008; Özdemir and Çalışkan, 2014; Özdemir and Çalışkan, 2015; Lo et.al, 2017; Özdemir and Nebioğlu, 2018). Accordingly, businesses can place the products they want to sell the most in the so-called "sweet spots" on the menu card to attract more attention of customers (Kwong, 2005; Choi et.al, 2010). Within the scope of the priority and recency rule, some authors argue that the first and last reads in any text or list are remembered more. Thus, placing the products they want to sell the most at these points will positively affect the sales (Yang, 2012; Bowen and Morris, 1995; Kincaid and Corsun, 2003; Reynolds et.al, 2005). In addition to these, as stated by Kincaid and Corsun (2003), customers can be directed to those menu items by putting the desired products into boxes. Accordignly, restaurant businesses can increase the performance of menu items by placing products that are low in efficiency or for which they want to increase popularity in these places. Besides menu item position, the color, paper, cover, writing style, size and photographs used in the design strengthen the image of the restaurant and have significant effects on the perceived service quality (McCall and Lynn, 2008; Mills and Thomas, 2008; Morrison 1996;

Magnini and Kim, 2016). For example, cover design, font style, size, pictures and physical weight used in the menu design positively affect the quality and value perception of the customers (Gueguen et.al, 2012; Magnini and Kim, 2016). Since menu design variables affect customers' perception, demand and item choices, they can be used as a strategic tool to increase the popularity of specific item.

Besides menu planning and design, menu pricing also affects menu performance and menu item profitability (Özdemir, 2012). Pricing strategies are powerful factor used to attract the attention of customers, and to increase sales by influencing their perceptions and choice behaviors (Shoemaker et.al, 2005; Raab et.al, 2009). For example, in the study conducted by Parsa and Naipaul (2008) on psychological pricing, it was stated that the number 0 used at the end of the price

was used to emphasize the quality in fine dining restaurants, and the number 9 was preferred to draw attention to the price in fast food restaurants. For this reason, businesses that want to bring restaurant quality to the fore can use psychological pricing techniques to affect customers' perceptions of quality or price. Businesses aiming to increase the performance of menu items by emphasizing quality can determine the price sensitivity of customers and make pricing in accordance with the price ranges that customers are willing to pay (Raab et.al, 2009). In addition, the sales of products with high cost but low popularity can be increased by applying the Loss Leader Pricing method proposed by Cohen et.al (2007). Here the selling price of the menu item is used as an important variable in determining the menu performance. Therefore, businesses can reach their goals by increasing both the profitability and the popularity of the menu item with the right pricing strategy.

Menu analysis, on the other hand, is an action that requires collecting and processing information to make menu performance more manageable and understandable (Özdemir, 2012). Systematic evaluation of menu item performance is possible by using appropriate scientific and technical menu analysis methods in the current competitive, information and technology environment (Yiğitoğlu and Tetik, 2017). For example, in the menu analysis methods related to measuring and evaluating restaurant menu performance for the last forty years factors such as food cost percentage, contribution margin, popularity, weighted contribution margin, labor force, selling price, variable costs etc. were used (Miller, 1987; Kasavana and Smith,1982; Pavesic, 1983; Hayes and Huffman, 1985; Bayou and Bennet, 1982, LeBruto et.al, 1995; Cohen et.al, 2007; Horton, 2001). Antun and Gustafson (2005) also state that the menus of restaurants should remain flexible in order to gain competitive advantage, emphasizing that menu analysis should be a continuous process. In their conceptual study, Lai et al., (2020) comparatively examined revenue management and menu analysis approaches that use similar variables to increase menu profitability. It was emphasized that performance measurements obtained from revenue management applications can be applied to other menu analysis methods, especially menu engineering and data envelopment analysis, in order to increase operational efficiency. Accordingly, the performance of the menu items should not be evaluated only based on menu anlaysis results. On the contrary, menu management should be holistically handled together with all processes such as planning, design, pricing, analysis and development.

3. Methodology

Aim of the current study is to measure the effectiveness of menu items of a first class restaurant operating in Antalya by using the DEA method, with a strategy focused on feedback and improvement. Nowadays, both parametric and non-parametric methods can be used to measure the efficiency of businesses or affiliated units. Non-parametric methods are suitable for evaluating efficiency in production environments with many inputs and outputs (Çelik, 2016). The most widely used non-parametric method is the DEA method developed by Charnes, Cooper and Rhodes in 1978 (Charnes et.al, 1978). The beginning of DEA is based on Farrel's (1957) article stating the need for better models to improve efficiency (Cooper,

Seiford and Zhu, 2011). DEA is a non-parametric methodology used to evaluate relative effectiveness (Ruggiero, 2006). DEA measures the effectiveness of co-decision-making units that have multiple inputs and outputs, and have been implemented in a wide range of areas over the past 25 years, such as hospitals, banks, care teams, etc. (Cook and Zhu, 2007). It is one of the methods used to evaluate the relative effectiveness of the multiple inputs obtained (Hadad, Friedman and Hanani, 2007). Although many models have been developed for DEA since 1978, CCR model developed by Charnes, Cooper and Rodes (1978) and BCC models developed by Banker, Charnes and Cooper (1984) are the most used ones. In the CCR model, while the weighted outputs are compared to the weighted inputs, it is assumed that the increase in the inputs will be at the same rate. On the other hand, in BCC method it is assumed that the increase in the inputs will affect the increase in the outputs differently (Uysal, 2016). DEA reveals the level of benefiting from the resources of the company, as well as how these resources should be used more efficiently. The DEA method used for this purpose is an important tool that provides business managers with the opportunity to measure the efficiency of their activities and learn how effectively their resources are used (Yakut et al., 2015). Especially in times of crisis (Covid-19 pandemic, war, long-term social events, etc.), businesses need to control their costs with more detailed parameters. In this context, restaurant businesses can obtain more rational results by using the findings related to the efficiency of the menu items within the inputs in the cost control systems. DEA method was used in this study, as studies on determining the efficacy of menu items gain importance and, unlike other methods, it provides the opportunity to make comparisons between menu items by including both qualitative and quantitative inputs in the analysis.

3.1. Scope and Study Sample

Current study was conducted in Antalya, which is the fifth most populous city in Turkey, the second in terms of the number of accommodation facilities (1835), and the first one in terms of bed capacity (599 838). In 2019, Antalya hosted a total of 15 million 280 thousand tourists, both domestic and foreign, which makes it an important tourism city with an average of over 30 million overnight stays (yigm.ktb.gov.tr, 2020). For this reason, the research scope consisted of the items in the menus of 17 first-class restaurants that offer lunch and dinner with table service method in Antalya. In order to reach the research goal in the fastest and easiest way, purposive sampling, which is frequently used in both quantitative and qualitative case studies, was used. For this purpose, 5 restaurants were determined after conducting the search on TripAdvisor according to the aforementioned criteria. E-mails were sent to the selected restaurants and asked whether they would volunteer to participate in the study. 3 restaurants stated that they could not participate in the study due to the workload intensity. 2 restaurants stated that they would participate in the study voluntarily. As a result of face-to-face interviews, one restaurant stated that the data was confidential and refrained from sharing it. One restaurant, on the other hand, stated that they could participate in the study on a voluntary basis by sharing the data. For this reason, the items on the menu of a

restaurant that volunteered to share the data were taken. The subject of the study was the luxury restaurant, which has been operating in Antalya for 80 years and is now run by a 3rd generation manager. The restaurant, which has a total area of 2400 square meters, can serve a total of 700 people - 200 people indoors and 500 people outdoors. This restaurant was chosen for the study because it is a fine dining, its menus are constantly checked and updated, it is among the best restaurants in the region for its service quality, atmosphere and location, and restaurant managers were willing to meet. The restaurant business serves 2 meals, lunch and dinner, and in the food menu there are 177 items in total: 13 soups, 41 appetizers, 16 salads, 30 hot starters, 25 pan dishes, 25 grilled dishes, 12 seafood, 6 hot olive oil, 4 hot meals, 13 rice and pasta and 12 dessert. 166 menu items currently on sale in the menu were included in the study.

3.2. Data Collection Process

According to the request of the business manager, identifying information about the restaurant and its menu is kept confidential. Restaurant's data for December 2020 were taken through face-to-face interviews with restaurant managers, and analyzed. The basic data needed in the research are named as input and output variables due to DEA structure. The most used input and output variables are listed in the evaluation of the performance of the menu items (Table 1). Then, expert opinion (two lecturers working in this field) was taken regarding the listed input and output variables. Finally, considering the relevant literature and expert opinions, the input and output variables to be used in the study were discussed among researchers. It was decided to perform correlation analysis in order to determine the relationship between the decided variables. As a result of the normality tests, it was determined that the relevant data did not show a normal distribution, so Spearman correlation analysis was performed and it was decided to include the input and output variables that were related to them in the analysis. In the related literature, two different methods are used to determine the number of decision making units (DMU) in DEA. According to Sherman (1984), the number of PI is expressed as > Number of Input + Output, while according to Boussofiane et al. (1991) it is considered as PI = (Input + Output) x 2. In this context, due to the low number of products in menu item groups such as soups, desserts, rice and pasta, the input and output variables were combined and the variables to be used in the analysis were determined in accordance with both formulas. While variable costs (food cost, energy expenses and unforeseen expenses), fixed costs (labor cost, rent, taxes, etc.) and selling price are determined as input variables, output variables are popularity and gross profit. It was decided that at least (Input 3+Output 2) x2 =10 menu items should be included in each food group. Material cost data for menu items were obtained from standard recipes, and sales quantities were obtained from monthly cash reports.

3.3. Data Analysis

In this study, the relative efficiency of the menu items was evaluated by using DEA, EMS (Eficiency Measurement System) program, which is a non-parameter method based on linear programming principles and designed to predict the relative efficiency principles of decision-making units. Since it is difficult to control the output in restaurant businesses, the BCC model is used, which is based on the assumption that the increase in inputs will affect the increase in outputs differently (Uysal, 2016). The decision-making units as the first stage of DEA need to be selected. Therefore, six groups of foods on the menu of a luxury restaurant in Antalya were evaluated. After determining the appropriate input and output variables, the menu items to be analyzed were grouped and coded. Foods in the soups group are coded as A1- A13, appetizers and salads group B1- B50, hot starters group C1- C28, pan dishes and main dishes D1-D50, rice and pastas E1- E13, and desserts group F1- F11. Data on coding is presented in APPENDIX-1.

4. Results

Results of the DEA conducted to evaluate the effectiveness of 166 menu items in the menu of a luxury restaurant in Antalya are given in Table 2. Accordingly, there are 22 (13.25%) of the 166 menu items that are efficient, while 144 (86.75%) are ineffective. 7 menu items with the highest efficiency (big) among 166 menu items are A3, B21, B42, C1, D40, E1 and F1, while the 15 efficient menu items from the highest to the lowest are A12, C19, B5, F8, D21, C8, B12, E11, E5, A5, A6, A7, A8, A9, A11.

When the efficiency rates are evaluated according to the menu groups, it is seen that soups are efficient at the rate of 61.5%, appetizers and salads 8%, hot appetizers 10.7%, pan dishes and main courses 4%, rice and pasta 23.0% and desserts 16%. The food group with the highest efficiency rate among all menu items is soups with 61.5%, while the food groups with the lowest efficiency rate are the menu items in the pan dishes and main courses group with a rate of 4%.

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Table 2. Efficiency scores and reference numbers for active menu items

KB	Efficiency Score (%)	Benchmark**
A3	big*	0
B21	big*	0
B42	big*	25
C1	big*	24
D40	big*	47
E1	big*	4
F1	big*	0
A5	100,00	8
A6	100,00	8
A7	100,00	8
A8	100,00	8
A9	100,00	8
A11	100,00	9
A12	134,88	10
B5	128,57	46
B12	112,33	0
C8	112,88	3
C19	134,86	25
D21	120,00	48
E5	100,16	10
E11	105,75	5
F8	122,82	10

* *KBs with a big efficiency value remain active even when their inputs are randomly increased by large amounts.*
***Indicates the number of references for efficient units, and the units and rates that should be referenced for inefficient units.*

As for ineffective menu items, B2 and B35 are the most distant from efficiency. Ineffective menu items from the Soups group are A1, A2, A4, A10 and A13. Item A10 in the soups group is the closest to the efficiency with 74.07% scores. Items coded A1, A2 and A13 with 62.50% are far from the efficiency. In the appetizers and salads group, 4 out of 50 menu items (B5, B12, B21 and B42) were efficient, while 46 of them were inefficient. In this group, the menu items closest to the efficiency are B16 with a score of 80.08%, and the menu items with the code B20 with 78.16%. The menu items farthest from the efficiency are B2 with 21, 12% and B35 with 21.26%. It is seen that 3 of 28 items (C1, C8, C19) in the middle heat group are efficient, while 25 of them are not. Among the menu items in this group, the ones closest to the efficiency are C10 with 75.43% and C27 with

75.00%, respectively. Within this group, the menu items farthest from efficiency are C13 with 23.01%, C14 with 23.69% and C12 with 24.53%.

Only 2 of the 50 menu items (D21 and D40) in the pan and main dishes group are efficient, while the other 48 are inefficient. Menu items with the least efficiency in this group are D7 with 29.51%, D4 with 33%, 18% and D24 with 33.58%. It was determined that 3 of the 13 menu items (E1, E5 and E11) in the rice and pasta group were efficient, while 10 of them were inefficient. Among the menu items in this group, the ones closest to the efficiency are E13 with a score of 88.58%, and E12 with 85.96%, respectively, while the farthest from it was E2 code with 35.88%. While 2 of 12 products (F1 and F8) in the desserts group were efficient, the other 10 were found not to be. In this group closest items are F4, F5, F6 and F7 with a score of 90.91%, respectively. Finally, items farthest from the efficiency were the products coded as F11 and F12 with 57.14%.

4.1. Strategies to Apply to Inefficient Menu Items

The biggest goal of restaurants is to increase their income by providing their guests with a satisfying dining experience. The menu analysis results are an important indicator in determining whether this goal has been achieved or not. For this reason, restaurant managers should carefully interpret the results of menu analysis and take measures to increase menu item performance. In this context, Atkinson and Jones (1994) define menu analysis as the systematic evaluation of a menu in order to improve menu performance. Moreover, Özdemir (2012), considers it as a tool used to evaluate the menu items' individual performance, to rank the products with low or high performance, and to identify their performance deficiencies. Since data such as the costs and prices of menu items and improvements will emerge as a result of menu analysis, Horton (2001) emphasizes importance of menu analysis for managers to make informed decisions about menu items. Through performing such analysis, restaurant managers can take various actions in order to improve the low-performing menu items and to make the high-performers more efficient with appropriate sales, marketing and promotion techniques.

According to current study's results, and as suggested by Jones and Mifli (2001), restaurant managers can take measures to increase the performance of menu items in three different ways: minimal adjustment, menu development and menu item development strategy. While the author proposes inflation-based price-sales price adjustments in the minimal adjustment strategy, there are five different methods proposed in the context of the menu change based on product performance status, such as product promotion, positioning, holding, screening and modifying. According to the author, the promotion technique should be applied in case of low food sales caused by lack of customer awareness, while in the modification method various changes are made in the presentation, re-pricing and re-costing of the product and changing the recipe. Similarly, Morrison (1997) proposes following common improvements based on menu item performance results: promoting the sale of less popular products, changing their name, and replacing low magrin menu items products with the high ones.

Current study results imply that with minimal adjustments to menu items closest to the efficiency, such as A10, B6, B7, C10, C20, D23, D33, D36, E12, E13, F4 and F5, these can become efficient. These regulation can be applied within the scope of the menu planning and menu development stages towards increasing profit rates by controlling and reducing the costs of the related products or increasing the sales prices. The sales of the products can be increased by organizing campaigns related to the products in question or with the encouragement and advice of the service personnel. Finally, the profit rate can be increased by making minimal increases in the prices of these products. As for menu design, these products can be placed at the "sweet spot" points where customers will focus more, or by placing them at the beginning or end of the page. For example, products such as D33, D36 and D38 can be placed at the relevant focal points to attract the custtomers' attention. Furthermore, these products can be placed into the box to draw attention towards related products.

While the popularity of products such as A13, B4, B14, C5, D14, D24, D25, E3 is high, it has been determined that these items are not efficient. In order for these to become so, it is possible to re-cost the relevant menu items by taking the opinions of the chefs and waiters. Moreover, by adopting the strategy of Loss Leader Pricing by Cohen et al. (2007), the sales volume of these products can be further increased. This can contribute positively to analysis results and menu item performance. A1, A2, B2, B26, C7, C12, D4, D7, D20, E2, E3, F11, F12 products are very low in popularity, very costly and far from being efficient. Kwong (2005)) emphasized that managers may take some of the following actions to increase the performance of menu items: quitting, adjusting the selling price, reducing the cost of food, promoting, renewing the meal, changing the menu item. Studies by Morrison (1997), Jones and Mifli (2001) and Kwong (2005) support the notion that amount of sales can be increased by making promotional activities for menu items that are close to the efficiency or for those that are not at the desired level of effectiveness, and/or apply the loss leader pricing strategy by Cohen et al. (2007).

5. Discussion and Conclusion

The main goals of restaurants are to increase their income and profitability, and to ensure their sustainability, by providing their customers with a satisfying and memorable dining experience. For this purpose, restaurant managers should manage the menu in accordance with factors such as location, atmosphere, staff, price, food, and service quality. This is because each stage of menu management affects popularity and profitability, which are directly related to restaurant performance. Therefore, restaurants should increase the number of efficient items by analyzing their menus through techniques suitable for their own characteristics and making appropriate improvements and developments according to the determined performance criteria. Since menus in luxury restaurants are prepared using special, delicious, and fresh ingredients by professional employees (Walker, 2011), it is expected that menu item efficiency in these facilities will be higher in general. However, results of the current study indicate that menu item effectiveness rate in case restaurant is at 13.25%. Similar studies found in the literature in the last

fifteen years show that the menu item efficiency rates are between 30-40 percent (Taylor et.al, 2009; Fang et.al, 2013; Chou and Fang 2013; Yiğitoğlu and Tetik, 2020). Compared with other studies, some menu item efficiency rates were similar with those in previous literature while others differed. In the study of Yiğitoğlu and Tetik (2020), 16 of the 30 menu items were found to be efficient in terms of performance (53.33%), while 14 of them were not. In the study conducted by Fang and Hsu (2014), it was stated that 6 of the 30 menu items were efficient (20%) and 4 of them were unpopular. In one of the pioneering studies on this subject conducted by Reynolds and Taylor (2011), it was concluded that 7 of the 65 menu items were efficient (10.76%). When the study findings and the literature are examined, even if the input and output variables used are similar, producitivity varies due to variations in costs, customer expectations, and sales of restuarants located at different destinations.

While Kivela (2003) states that the food in the main course group is one of the most basic elements of a restaurant's activities, Yiğitoğlu and Tetik (2020) consider the lowest level of efficiency of main courses in a restaurant as a negative situation for the business. From this point of view and according to the findings obtained, restaurant managers should take measures to increase efficiency by focusing primarily on pan dishes and main courses, and then on the food groups such as appetizers and salads, hot appetizers and desserts. In this context, for each ineffective menu item, various arrangements should be made by referring to the closest menu items in terms of variables such as price, cost and popularity.

As stated by Antun and Gustafson (2005), menu analysis should be considered as a continuous process. The analysis results obtained should also be used in menu development studies, which can be considered as a cycle of all processes such as menu planning, pricing, design and analysis (Jones and Mifli, 2001). As emphasized by Özdemir (2012), menu performance and other variables of menu management such as planning, pricing, design and analysis should be evaluated together. In this regard, restaurant managers should consult the opinions of chefs, waiters and customers when necessary, and in order to increase the effectiveness of menu items they should make improvements by considering all processes such as planning, pricing, design, and analysis. In this context, following recommendations can be derived for restaurant managers:

- It is possible to measure the performance of menu items with scientific methods at appropriate periods, taking into account features such as type, size, volume, location of restaurant businesses etc.
- The effect of changes made in menu items on sales can be observed.
- More realistic solutions about increasing effectiveness can be found as a result of discussions with an expert group consisting of different people such as employees, restaurant managers, chefs and others.
- Intuitions, emotions, financial and gastronomic variables should be included in the restaurant menu evaluation. Especially in the section of intuition and emotions, proactive solutions can be evaluated by brainstorming with a team including chefs and waiters.

- More holistic evaluations can be made by considering menu item performance together with all menu management processes such as menu planning, pricing, design and analysis.

This study is important in terms of using the DEA method to evaluate the effectiveness of menu items, as this method has the ability to include many different variables, both qualitative and quantitative, unlike matrix models and cost analysis methods developed based on matrix models. Although there are studies in the related literature focusing on menu effectiveness, current study differs as it examines the effectiveness of all food groups and each item in the menu separately. It should also be noted that an order combination consisting of starter, main course and dessert can change the status of items, as well as affect menu item performance. Unlike other studies where the effectiveness of the menus was discussed within the scope of menu analysis, in this study it was associated with each stage of menu management (such as planning, pricing, design and analysis). Another important aspect of the current study is that it was conducted in a luxury restaurant and on a large sample of menu items (166). Although DEA method was adopted, current study is limited in terms of measuring the effectiveness of menu items belonging to a restaurant. DEA results used in the study depend on input and output variables. Therefore, these variables that are suitable for one restaurant may not be suitable for another one. For this reason, it is important for the reliability of the studies to include the variables suitable for the characteristics of each case restaurant. In future research, a comparison can be made between restaurant menus with similar qualities, or the effectiveness of the menus of restaurants belonging to the same chain can be evaluated using appropriate input and output variables. In further studies, the authors can compare the effectiveness of menu items and the results of the analyzes by using DEA together with matrix-based approaches or other multidimensional models. Since DEA depends on input and output variables, in this research variable costs (food cost, energy expenses and unforeseen expenses), fixed costs (labor cost, rent, taxes, etc.) and selling price were used as input variables, while popularity and gross profit are used as output ones. In future studies, the effectiveness of menu items can be evaluated by applying DEA with different input and output variables and by applying both CCR and BCC methods. Finally, comparisons can be made between the products that are found efficient according to these methods.

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APPENDIX-1: Meals' Codings used in the Study

Meal group	**Coding and Meal Name**
Soups	Salting Soup (A1), Trotter Soup (A2), Tripe Soup (A3), Fish Soup (A4), Chicken Soup (A5), Plateau Soup (A6), Tomato Soup (A7), Tarhana Soup (A8), Vegetable Soup (A9), Manti Soup (A10), Lentil Soup (A11), Ezogelin Soup (A12) and Meat Soup (A13)
Appetizers and Salads	Yogurt Pussly (B1), Cheese Plate (B2), Tulum Cheese - Walnut (B3), Goat Cheese – Cold Meats with Olives (B4), White Cheese Slice (B5), Oily Black Olives (B6), Russian Salad (B7), Borlotti Beans in Olive Oil (B8), Fresh Beans (B9), Shakshuka (B10), Eggplant Salad (B11), Hibeş (B12), Circassian Chicken (B13), Caramelized Onion Fava (B14), Cabbage Wrap (B15), Leaf Wrap (B16), Eggplant Paste with Yoghurt and Hot Pepper (B17), Eggplant Paste with Yogurt in Tomato Sauce (B18), Eggplant Paste with Yogurt (B19), Strained Yoghurt (B20), Herbal Fruit Cucumber-Yogurt (B21), Hot Haydari (B22), White Cheese and Olive Cold Cuts (B23), Cheese Cold Cuts (B24), Old Cheddar (B25), Pastrami (B26), Pickled Cucumbers (B27), Pickled Beetroot (B28), Roasted Red Peppers (B29), Imam Bayıldı (B30), Avocado Mash (B31), Avocado Cold Cut (B32), Noer Smoked Meat (B33), Fish Salad with Avocado (B34), Calamari Salad (B35), Fava (B36), Stuffed Peppers (B37), Spinach Paste with Yogurt (B38), Cucumber-Yogurt (B39), Herbed Cucumber-Yogurt (B40), Walnut Hot Haydari B41), Avocado Cracked Salad (B42), Avocado Fruit Salad (B43), Avocado Grated Salad (B44), Gavurdağ Salad (B45), Tomato Cheese Rucola Salad (B46), Mixed Salad (B47), Cold Cuts (B48), Roasted Capia Pepper Salad (B49) and Piyaz (B50).
Warm starter	Potatoes with Butter and Yoghurt (C1), Roasted Herbs with Yogurt (C2), Hunter Pastry (C3), Hunter Pastry with Yogurt (C4), Paçanga Pastry (C5), Şakşuka (C6), Albanian Liver (C7), Mücver Pan (C8), Grilled Mushrooms (C9), Pan Potatoes (C10), Pan Fresh Potatoes (C11), Pastrami in Foil (C12), Grilled Pastrami (C13), Pastrami in Butter (C14), Grilled Vegetables (C15), Boiled Vegetables (C16), Tarator Zucchini (C17), Potato with Tarator (C18), Cheese Penne (C19), Grilled Halloumi Cheese (C20), Potato with Yoghurt, Butter and Hot Pepper (D21), Spinach with Yogurt and Butter (C22), Frying with Yogurt and Tomato Sauce (C23), Meat Pie (C24), Fresh Beans with Yogurt (C25), Mushrooms with Yogurt and Butter (C26), Bundle Pastry (C27), Tripe with Butter (C28)
Pan Dishes and Main Courses	Sauteed Meat (D1), Chicken Schnitzel (D2), Kurban Roast (D3), Begendile Kurban Roast (D4), Shepherd Roast (D5), Hunter Style Roast (D6), Thick Meat Schnitzel (D7), Meat Schnitzel (D8) , Lamb Chops Schnitzel (D9), Pan Meatballs (D10), Chicken Shepherd Roast (D11), Chicken Roast with Soy Sauce (D12), Chicken Sauteed (D13), Chicken Schnitzel (D14), Chicken Schnitzel with Mustard and Cheddar (D15), Chickpea Tripe Stew (D16), Fried Sausage (D17), Egg with Sausage (D18), Egg with Meat (D19), Fried Egg (D20), Pastrami Egg (D21), Menemen (D22), Omelette (D23), Fillet Steak (D24) , Cross Cut Tenderloin (D25), Stuffed Rice Thick Veal Chops (D26),

	Steak (D27), Mixed Grill (D28), Lamb Skewers (D29), Lamb Chops (D30), Grilled Meat Pieces on Skewers(D31), Lamb Liver Grill (D32), Grilled Meatballs (D33), Meatballs with Cheese (D34), Shish Meatballs (D35), Meatballs with Yogurt (D36), Grilled Chicken (D37), Chicken Skewers (D38), Chicken Wings (D39), Thin Veal Chops with Stuffed Rice (D40), Steak with Cheddar & Mushroom (D41), Skewer of Beef Steak (D42), Stuffed Veal Chops (D43), Veal Chops with Tomato Sauce (D44), Meatballs with Onion (D45), Meatballs with Tomato Sauce on Bread (D46), Chicken with Tomato Sauce on Bread (D47), Grilled Sausage (D48), Fried Calamari (D49), Fried Kalamarı Chops (D50)
Rice and Pastas	Tandoori Lamb Stuffed Rice (E1), Lamb Stuffed Rice (C2), Lamb Shank Stuffed Rice (E3), Stuffed Rice (C4), Rice Rice (E5), Fig Walnut Rice (E6), Bulgur Rice (E7), Pasta (E8), Walnut and Cheese Noodles (E9), Noodles (E10), Sezen Rice (E11), Yogurt Ravioli (E12) and Bergamot Pineapple Rice (E13)
Desserts	Pumpkin Dessert (F1), Creamy Bread Kadayif (F2), Almond Keşkul (F3), Oven Rice Pudding (F4), Cream Chocola (F5), Cream Caramel (F6), Ice Cream (F7), Seasonal Fruits (F8), Creamy Quince Dessert (F9), Semolina Halva (F10), Güllaç (F11), Arabian Kadayif (F12)