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DISCRETE EVENT MODELING FOR OPERATIONAL MANAGEMENT OF RESTAURANTS

Tesis para optar el Título Profesional de Ingeniero Industrial

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<p>Propuesta Carrera Ingeniería Industrial</p>
<p>Título DISCRETE EVENT MODELING FOR OPERATIONAL MANAGEMENT OF RESTAURANTS</p>
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<p>Resumen: Los sistemas de gestión en restaurantes incorporan los conceptos de RevPash y de Menu Analysis para soportar las difíciles decisiones en precios, promociones y administración de recursos. El presente trabajo diseña un modelo de eventos discretos que incorpora los conceptos anteriores y simula las operaciones de un restaurante. Con ayuda del software Arena (versión 14.0) se demostró el beneficio de la propuesta utilizando de los indicadores de contribución marginal y duración del servicio. A partir del modelo propuesto se diseñaron experimentos que prueban la facilidad de uso y las ventajas económicas que pueden obtenerse con estos sistemas. El valor de la propuesta radica en las mejoras en la gestión de restaurantes que deben difundirse para beneficio de propietarios y clientes.</p> <p>Palabras Clave: Simulación, gestión de restaurantes, RevPash, análisis del menú, gestión de operaciones</p> <p>Abstract: Models are a tool that allow us to simulate real life systems in a virtual environment to generate scenarios and observe how the system reacts. Restaurant management systems incorporate the concepts of RevPash and Menu Analysis to support difficult decisions in pricing, promotions and resource management. In this paper, using Arena 14.0 software, a discrete event model was designed that incorporates the above concepts and simulates the operations of a restaurant. Based on the proposed model, measures were proposed to improve the restaurant's profitability and scenarios were designed with the possible effects. The value of this proposal lies in the economic advantage that can be obtained with the application of models and Menu Analysis in restaurant management.</p> <p>Keywords: Simulation, Restaurant Management, RevPash, Menu Analysis and Operations Management.</p>
<p>Línea de investigación IDIC – ULIMA</p>
<p>Área y Sub-áreas de Investigación: Operations Research Analysis – Simulation</p>
<p>Objetivo (s) de Desarrollo Sostenible (ODS) relacionado (s) al tema de investigación.</p> <p>The main objective of this study was to develop a discrete event model that allows the simulation of post-pandemic operational management of Latin American restaurants. It was explained how the context affects the factors of the operations of this type of business, identifying the most important to guarantee the maximization of profitability in the framework of the new normality. Finally, the model was validated with data from a Latin American restaurant.</p>

PLANTEAMIENTO DEL PROBLEMA

Over the last decades, the restaurant industry has experienced significant growth, mainly in Latin America, where local gastronomy plays an important role in tourism development. According to Kim et al. (2020), the restaurant sector comprises 10% of the workforce in the Americas: in the United States alone, jobs increased from 11.9 to 14.7 million between 2004 and 2017, likewise, industry revenues increased by 81.55%. This boom was expressed in multiple ways in countries such as Peru, for example, where a gastronomic boom was generated that led more than 80,000 young people to choose to study in culinary schools (Matta, 2021).

Despite this formidable growth, restaurant business came to a complete standstill for months due to the global health pandemic generated by COVID-19. This health crisis led to a global economic crisis, impeding tourism and forcing the closure of businesses with physical locations. The economic impact was most severe on low-income households, family businesses and tourism-related companies, where restaurants are located (Gkoumas, 2021). The new situation forced thousands of gastronomic businesses to cease operations and led many others to adapt their operational management to the restrictions and new consumption habits. The most important challenge for the sector is to offer the same value proposition and satisfy diners with a quality level of service despite the mandatory prevention measures, since visiting a restaurant has always been more than just satisfying the basic need for food (Madeira et al., 2021).

Faced with this challenge, businesses are looking to maintain their service standards, while at the same time seeking to reduce costs. According to Vieira et al. (2018), declining revenue is a problem that becomes much more acute if there is also low operating profitability. For that reason, many restaurants reduce the budget of fundamental resources without having the opportunity to analyze the real impact it generates on the business. Considering the current market context, the analysis of operational factors is much more critical to financial viability and is vital in building strategies. It is important to know the business in its entirety; however, according to Heo (2017), traditional operational management indicators do not show the true performance of the company and do not allow performance to be evaluated correctly. Therefore, appropriate KPI's must be used, which allow multiple variables and efficiency ranges to be related, in addition to being reliable in the face of market uncertainty and compliance with sanitary measures imposed by the authorities.

These needs can be addressed from multiple perspectives: for years, corporations have been creating operational assessment systems and have concluded that not all businesses respond in the same way. As mentioned by Vergara et al. (2019), the complexity of building such systems lies in the randomness of the variables and in identifying how they are related. As a result, modeling from discrete events fits as an adequate methodology to generate an integral system that relates all these variables.

OBJETIVOS

The main objective of this study was to develop a discrete event model that allows the simulation of post-pandemic operational management of Latin American restaurants. It was explained how the context affects the factors of the operations of this type of business, identifying the most important to guarantee the maximization of profitability in the framework of the new normality. Finally, the model was validated with data from a Latin American restaurant.

JUSTIFICACIÓN

As for all companies, the fundamental objective of restaurants is to optimize their operations to maximize profits. In this regard, Legg et al. (2019) mention that it is not possible to think about improving a process without having an adequate way to measure its performance. They also state that, currently, the most popular indicators to evaluate the management of a restaurant are the average turnover per customer, the occupancy rate and the level of customer satisfaction. However, the operation of a restaurant can be synthesized into two factors: the profit obtained from the sale of each dish and the occupancy time of its capacity, which leads to inconsistency, since none of the indicators mentioned combine both factors.

It is for this reason, that Yoonjoung (2017) suggests that restaurant management starts to be evaluated by a better indicator, called RevPash (Revenue per Available Seat Hour), which allows measuring the marginal revenue per unit of time-capacity. To measure and improve the RevPash of restaurants, a discrete event model was developed in the simulation software Arena, since, as mentioned by Vergara et al. (2019), the simulation of discrete events allows understanding the operations of a system and optimizing its management. The validity of the model was demonstrated by statistical analyses of confidence levels and performance indicators obtained from several simulations under different circumstances and parameters.

This performance evaluation in operational management is not oblivious to market trends. The context is very important to define variables, especially in times of uncertainty such as the current one. The restaurant sector is precisely one of the most economically harmed by COVID-19. The study by Yang et al. (2020) shows that, in the United States, a 1% increase in daily diagnosed cases of COVID-19 represents a 0.06% reduction in restaurant demand. Given the difficult situation being experienced in Latin America due to this virus, restaurants need to improve their operational efficiency to avoid bankruptcy and contribute to economic recovery.

The food sector and restaurants are included in the tourism sector, being essential in the development of hospitality and cultural experience of cities in Latin America. The study conducted by Alonso-Almeida et al. (2015) shows that there is an experiential perspective on the part of consumers, and this perspective varies according to the tourism trend of a locality: in the absence of tourism due to COVID-19, there is no experiential perspective. Erkmen (2019) contributes to this conclusion by noting that, due to the importance of the growth of local gastronomy as a tourism destination attribute, it is crucial to understand what factors contribute to the culinary experience and how this influence traveler satisfaction.

However, these authors focused on an analysis of the most superficial factors of restaurants, considering their value proposition and customer-facing strategy without evaluating the operational implications that this entail. As mentioned by Heo (2017), comprehensive operational indicators are the foundation of the service organizational structure. Not only do they represent how healthy the business is, but they are also the basis for offering differentiation to the target audience.

Operational management starts from understanding the information and resource needs in each step of the service process and in each physical space of a restaurant (Padilla-Solís & Cossa-Cabanillas, 2011). There is a coincidence with Vieira et al. (2018) when it comes to dividing these operations and generating a flow, given that both break down operational management into three aspects. The first is the planning of operations, where a forward projection is made of the demand of the business and, therefore, of the resources that will be needed to meet that demand. The second is the execution of operations, where the performance of the customer service processes is evaluated, from the moment the customer arrives at the restaurant until he/she leaves. Finally, the third aspect is profitability optimization techniques and variable integration systems. Vergara et al. (2019) propose in their discrete event simulation study that the relationship between these processes and the effectiveness in the use of resources impact the efficiency of a model, and that the objective of the model is to achieve the desired level of service.

The purpose of a discrete event model is to simulate the management of a restaurant, not only with operational indicators, but also considering market variables and analyzing competitiveness (Parsa et al., 2019). The objective of considering these variables is that restaurants must have the ability to respond to external crises, in which entrepreneurs cannot control the changes in their environment. Something very much in line with that is what is currently experienced with COVID-19, where restaurants cannot control the health provisions imposed by the government and the growth of new consumption trends by the

population (Madeira et al., 2021). Although there have already been many global health crises like the current one, including some with a greater impact on the tourism industry, the current pandemic has different patterns, achieving a social immobilization as never seen before in history (Muller, 2020).

HIPÓTESIS (Si aplica)

NO APLICA

DISEÑO METODOLÓGICO

To develop a discrete event model for the simulation of post-pandemic operational management of Latin American restaurants, a three-phase methodology was used. First, the variables were determined, defining the input and output data, as well as the key indicators for the model. Subsequently, in the second stage, a first study of the data obtained from operational management was carried out, taking as a reference a restaurant that adapts to the characteristics studied for its validation through menu analysis. Finally, in the third phase of the methodology, we proceeded with the creation of the simulation model using Arena Simulation Software 14.0; this stage being the most important for the research.

Phase	Scope	Tool
1. Variables definition	Definition of key inputs, outputs and indicators for the creation of the model.	Check List
2. <i>Menu Analysis</i> application	Initial study of data from a Latin American restaurant through <i>Menu Analysis</i> and <i>RevPash</i> indicator.	<i>Menu Analysis, RevPash</i>
3. Modeling	Creation of the Discrete Event Model in simulation software.	<i>Arena Simulation Software 14.0</i>
4. Final analysis	The results were discussed to propose improvements.	Graphic material

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ANEXOS.

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