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RESIDENTS' PREFERENCE FOR A PROPOSED PARKING FACILITY IN DAVAO CITY: A CONJOINT ANALYSIS

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Abstract:
The study explored the clients' preferences for a proposed parking facility in the central business district of Davao City by using the conjoint analysis method to determine the relative performance and the best combination of the parking attributes as preferred by clients, namely: parking structure, accessibility, safety and security, amenities, and parking fees. A quantitative market research design was applied. The analysis of data utilized the IBM SPSS software to identify the order of relative importance of the chosen attributes and the additive model to measure the total utility of a parking facility by calculating the sum of the constant and the utility estimate of each attribute level with the highest value. The results revealed that the respondents in Davao City prefer a parking facility that is automated multi-level parking, equipped with internet-connected intelligent parking and CCTV surveillance systems, a parking facility near to car washing areas and coffee shops, and a parking fee priced at P30.00 for the 1st 3 hours. The findings of the study served as a reference to prospective investors and businessmen who would be interested to know how the market behaves in relation to the attributes necessary in a proposed parking facility to address the parking problems in Davao City, and to achieve a better transportation management system to improve the quality of life of people, the economy, and the environment.

Keywords: preference, parking facility, conjoint analysis, Davao City, Philippines

1. Introduction

Parking is a fundamental factor in the transportation system. Car owners depend on parking availability at home and at their destination. Cars basically require a parking

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space at every destination. Parking is a main component of the transportation system. The advantages of having a private car depend on being able to safely keep the car between travels. (Manville & Pinski, 2019). The constant growth in population has significantly increased the number of motor vehicles running on the streets. It is important that every city must prioritize the provision of sufficient parking facilities to improve public services and to help mitigate traffic congestion, traffic violations, and accidents (Parmar *et al*, 2020).

However, commuters are frequently forced to suffer in the absence of parking regulations; the stress, frustration, and air pollution are the effects of the nonexistent parking spaces (Weinberger *et al.*, 2020). The production and consumption of goods are also affected by the lack of parking. People who distribute goods and services find it difficult to keep their business flowing smoothly because of the traffic jams caused by the lack of parking rules (Hammami, 2020). Not only that, but it also destroys the image of the city by clogging up the streets with cars scattered in every corner (Stepanov & Skrininkova, 2021).

A shortage of parking facilities is one of the continuing problems encountered by major cities in foreign countries, including New Delhi, where the number of cars has significantly increased. With that being the case, parking spaces have remained stagnant and underdeveloped due to ancient narrow roads. Poor parking management and policy have caused India to struggle because of overcrowded footpaths and illegal parking (Gautam, 2019). In downtown New Cairo, Egypt, parking problems were caused by a high rate of cars entering its central business district (CBD) with limited parking facilities (Elwany & Elsemary, 2023). Consequently, an imbalance between the availability of parking and parking demand is due to the lack of anticipation of future planning of land use for automobile parking facilities (Amer *et al.*, 2021).

In Beijing, China, a fast-growing city considering its high density but with limited land resources, it is improbable that parking areas can match the expansion of motorization (Wen *et al.*, 2019). However, there are some parts of Beijing that have unutilized high-rise parking buildings because of a lack of internet and communication technology that limits information or access to motorists to identify idle parking areas (Zhao *et al.*, 2021). Hence, with the idea of Al-Turjman and Malekloo (2019) suggested that smart parking linked to the Internet is an essential smart application for densely populated cities that provides real-time parking navigation facilities minimizing parking search and traffic congestion.

In the Philippines, the basic road network of Downtown Cebu City, Visayas, is still the same as the narrow roads since the First World War, and that became a major challenge in how to improve its transport system of a fast-developing city (Bouquet, 2019). The city will find it difficult to progress and improve if the roads created during the world war are constantly blocked by more and more vehicles. Times are changing, and the parking regulations must change with it. Residents and establishment owners park their cars along roadsides. Others resort to illegal parking due to inadequate parking spaces, which causes traffic congestion (Zoika *et al.*, 2020). However, in Mandaue City,

Cebu, the city administration constructed a three-story parking facility building adjacent to the city hall to accommodate city hall employees and clients as a solution to address the scarcity of the city's roadside parking areas (Sunstar, 2020).

Parking problems are also evident in the central business district of Makati City, the financial center of the country, where the head offices of multinational corporations are based (Makati Central Estate Association, Inc., 2019). Because of insufficient parking spaces, motorists are forced to park along the street side of the main roads of Makati which are restricted by local traffic management (Gatarin, 2023). As a result of the growing demand for parking, private firms and land developers of Makati central business district have constructed and managed parking facilities like multi-story parking buildings and parking lots to accommodate Makati City workers (Blancaflor *et al.*, 2019).

Accordingly, the Senate of the Philippines (2019) highlighted the Senate Bill No. 368, known as the Proof-Of-Parking Space Act, filed by Senator Sherwin Gatchalian in July 2019, an act regulating car dealers in Metro Manila by requiring individuals and businesses who would want to purchase a motor vehicle to secure first a notarized affidavit attesting that they have available parking spaces or facilities to provide for their proposed motor vehicles. This affidavit is also a pre-requisite of the Land Transportation Office for the registration of newly purchased motor vehicles (Department of Trade and Industry, 2019). The proof-of-parking space act would help reduce traffic as car buyers would be initially required to provide their own parking spaces before purchasing their dream car (Inquirer.Net, 2019). Furthermore, during the first regular session of the Nineteenth Congress of the Republic of the Philippines in November 2022, Senator Ramon Bong Revilla, Jr. introduced Senate Bill No. 1463, known as the Parking Fee Regulation Act. Section 4 of this act states that a building permit shall only be issued to commercial establishments with a sworn undertaking indicating that sufficient parking spaces are made available to their customers (Senate of the Philippines, 2022). In line with Senate Bill No. 1463, the City Ordinance No. 0417-18 of Davao City provides property owners and investors with government revenue incentives to encourage them to convert their idle properties within the city's commercial zone into parking spaces or convert them into parking buildings to help mitigate the parking and traffic problems in the city's central business district (Philippine Information Agency, 2024).

Unfortunately for Davao City, most of the parking areas available in the city's central business district are on-street or roadside parking only (Co *et al.*, 2022). It is rare to be able to park in the city proper unless you are headed to a private building with private parking spaces. Due to the continuous growth of private vehicle ownership over the last few decades, parking has become a major problem in the central business district of Davao City. There are a total of 135,481 registered vehicles, and 3.8% of the total registered vehicles or 5,000 households have private cars. Also, based on trip information, 80% of road users are private cars (Official Website of the City Government of Davao, 2019). In Bolton Street, heavy traffic occurs due to narrow streets parked with cars on both sides of the road leading to the offices of the Register of Deeds (ROD), the

PhilHealth, and the Bureau of Internal Revenue (BIR). Also, a large portion of San Pedro Street in front of the City Hall and the Sangguniang building is being occupied as on-street parking areas for employees and clients of these government establishments. Other business establishments in San Pedro Street going to Quirino Avenue and Claro M. Recto Avenue going to R. Magsaysay Street are being fully occupied by parked cars. (Sunstar Davao, 2019).

Likewise, it can be said that regulated parking facilities are crucial to the transportation system. It has a positive influence on traffic management in the central business district of Davao City. It is important to have effective traffic management to assess traffic congestion as suggested by Afrin & Yodo (2020), deal with traffic more effectively and address the effects of traffic congestion on society, the economy, and the environment (Lindsey & Santos, 2020).

Every day, the first thing motorists anticipate is the delay of their trip to their destination caused by congested roads. This causes stress to people because delays caused by road traffic can cause them to barely make it to work (Bitkina *et al.*, 2019). Some cannot even make it to work because of the difficulty of commuting. Moreover, stress and frustration can trigger road rage that may lead to accidents (Bjureberg & Gross, 2021). There are many adverse effects of the lack of parking areas, and these are just some examples to show that it is a serious issue in society. Traffic congestion affects working hours, labor costs and limits the wealth and resources in terms of the production and consumption of goods and services (Rahman *et al.*, 2021).

Last but not least, the effect on the environment is also important. In many places, motor vehicle emissions have become the major cause of air pollutants. Exposure to high levels of emissions such as carbon dioxide, carbon monoxide, and nitrogen oxides causes a significant risk to human health (Farda & Balijepalli, 2021). Traffic congestion damages the quality of air and endangers public health, particularly for people living and working near main thoroughfares (Muthoka, 2019). With the growing population of the city and country, it is vital that air pollution is controlled to avoid any health issues in the future (Schraufnagel *et al.*, 2019).

A typical parking facility for a densely populated central business district like Davao City can be modelled with other countries having sufficient parking facilities built in their respective business districts, like in the case of Singapore. In the early 1960s, Singapore's urban infrastructure was poor, while the general population and vehicular traffic were growing significantly faster than the development of its land transportation system (Giron, 2019). To address the city's traffic congestion, the government of Singapore built its first multi-storey Market Street Carpark, an eight-storey building consisting of 900 parking bays for cars and motorcycles being the largest parking facility in Southeast Asia at that time (National Library Board Singapore, 2021). Today, Singapore has become one of the technologically advanced countries with smart car parking facilities that provide drivers with real-time information on parking availability through information and communications technology (Wolniak & Grebski, 2023).

Likewise, Japan, a small yet technologically advanced country, came up with a solution to their narrow roads and limited parking areas using parking systems that allow multiple cars to be parked in small spaces (Pojani *et al.*, 2019). These are automated multilevel parking facilities equipped with machines to carry and stack cars securely in a multilayered parking structure above and below ground (Funase, 2023). Another parking technology developed by Japan is the multilevel Rotary Parking System (RPS), a space-saving mechanical parking facility built near commercial buildings and marketplaces (Ranjan & Tangar, 2020).

This study is based on the Random Utility Theory recommended by Aguiar *et al.* (2023), who suggested that this theory has been the essential instrument to describe the behaviour of decision makers by assuming that decision makers behave as though they capitalize on their preferences on top of their choice sets. Another theory on Rational Choice, as suggested by Herfeld (2020), was that people make rational choices by assessing their preferences based on their beliefs. A customer is perceived to choose rationally if he chooses the option that best satisfies his preferences. The conceptual composition of this study is illustrated in Figure 1. The research explored the five preferred attributes of a parking facility and considered these attributes as variables.

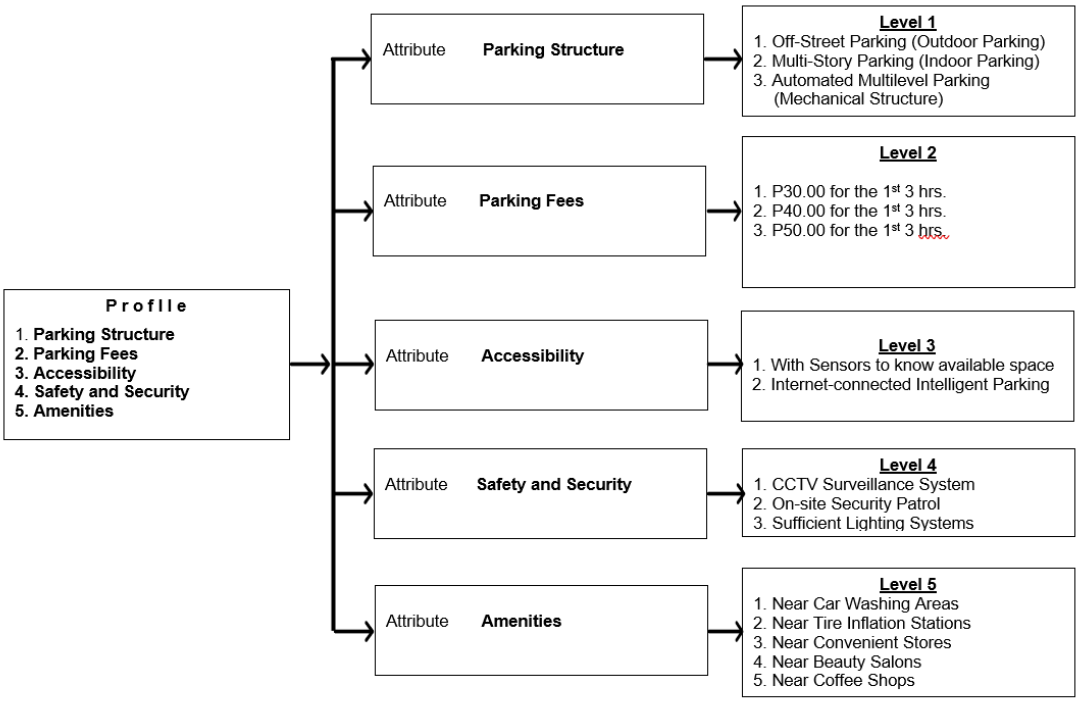

Figure 1. Conceptual Framework of the Study

2. Literature Review

The attributes of parking structure, parking accessibility, safety and security, amenities, and parking fees have been identified as important factors in the evaluation process. Parking structure is one of the important factors in determining the residents' preference for parking facilities. Parking structures are considered as the fundamental elements of

the transportation system. These structures come in many forms that provide security and efficient passageways for the car and driver (Rosenblum *et al.*, 2020). For the parking structure, three (3) levels were considered: off-street outdoor parking, multi-story indoor parking, and automated multilevel parking structure. Off-street outdoor parking structures refer to parking areas for cars within a confined parking lot or garage usually owned by a private organization or government-owned (Bray, 2020). However, parking lots occupy space and require a considerable portion of land (Stepanov & Skrininkova, 2021). Multi-story indoor parking structures refer to multi-storey car park buildings which are designed where expansion of land for a parking facility is not possible, but capable of increasing the capacity for vehicle parking spaces above-ground and underground (Hanzl, 2019).

Multilevel parking systems are a practical solution to congested cities with parking space issues (Amer *et al.*, 2021). Automated multilevel parking systems refer to multilayered mechanical parking garages (Elhenawy *et al.*, 2020) and work as a lift move traverse type three-dimensional garage that can be built quickly and cheaper to construct on a small portion of land (Serpen & Debnath, 2019).

Previous research indicates that the cost of parking fees is also an essential attribute that affects the resident's preference on how much money they are willing to pay for parking services. The implementation of market-priced parking is necessary to gain revenue for a city and for the maintenance of parking facilities (Savignano, 2023). Moreover, parking pricing schemes can also attract private investors to invest in parking facilities (Truong & Ngoc, 2020). For the parking fees, three parking prices were considered: Thirty Pesos (P30.00) for open or street parking for the 1st 3 hours then Twenty Pesos (P20.00) for the succeeding hour, Forty Pesos (P40.00) for Multi-Level parking facilities for the 1st 3 hours and Twenty Pesos (P20.00) for the succeeding hour, and Fifty Pesos (P 50.00) for other open parking facilities per hour and One Hundred Fifty Pesos (P150.00) for overnight parking per vehicle. These prices were regulated under the approved House Bill no. 7725, which is the "Parking Operations and Fees Regulation Act" that promotes public safety and protects consumers from paying parking fees to business operators imposing unreasonable parking rates. This law covers all parking facilities, whether sheltered or non-sheltered, government or privately-owned establishments (Inquirer.Net, 2021).

Apart from the parking structure and parking fee attributes, the accessibility attribute is another important factor identified as a parking information system (Barriga *et al.*, 2019). A parking information system is a fundamental component of a parking facility that provides real-time information on parking availability and is an effective way to reduce the amount of parking search time (Al-Turjman & Malekloo, 2019). On the other hand, the Parking Guidance and Information System (PGIS) delivers information that guides the driver to a location with a vacant parking area within a parking facility, as well as vehicle detection sensors mounted on parking entries and exits to monitor vehicle occupancy (Martino *et al.*, 2019).

Intelligent Parking Services (IPS) is a personalized internet-based service application for drivers that can be accessed with the use of smartphones (Mouhcine *et al.*, 2019). In real-time, the IPS has the capability to monitor the location of the vehicle, search a parking area (Mohammadi *et al.*, 2019), make a reservation for parking, and provide a route advisory on how to reach the desired parking facility and later bills the driver the corresponding service charges (Liu *et al.*, 2020).

Personal safety and vehicle security are also essential factors that cannot be ignored when choosing a parking facility (Park & Garcia, 2019). However, parking areas are places where criminal acts occur, like robbery and car theft (Krohn *et al.*, 2019). Hence, the use of CCTV surveillance systems, sufficient lighting, and on-site security patrols in parking facilities (Ezepue *et al.*, 2023).

Furthermore, amenities are one of the factors that affect the client's preference. This important attribute provides people with a positive parking experience with value-added services from which they can benefit (Bunten & Rolheiser, 2020). Companies compete with others by offering additional services that provide comfort and convenience to their customers (Kim *et al.*, 2021). Likewise, favourable amenities increased customer satisfaction and customer's willingness to reconsider coming back, and, in turn, increased the profits of the company (Verma and Thakur, 2022). For the amenities attribute, five levels were considered: car washing areas, tyre inflation stations, convenience stores, beauty salons, and coffee shops.

To further explain the conjoint analysis concept in Figure 1, conjoint analysis is a technique commonly termed as a survey-based statistical method requiring respondents to make a series of judgments based on their preferred profiles and then break down or decompose into attributes (Eggers *et al.*, 2022). A profile is basically a mixture of all the attributes, and each attribute is defined by its level (Lu & Zhang, 2020). The purpose of the conjoint analysis method is to quantify customer preferences to determine utility functions and to estimate how much each customer in a sample values each level of each attribute, commonly called as partworths since they capture how much each part of the product is worth to the customer (Worapishet, 2022).

There were earlier studies associated with parking facility preferences using the conjoint analysis method. A study was made by Waerden and Agarad (2019) to understand the car drivers' willingness to pay for design-related attributes of parking garages in the business district of the Netherlands, based on the principles of Hierarchical Information Integration (HII) approach as supported by Kantelaar *et al.* (2022), stating that the HII approach deals with numerous attributes causing information overload and helps reduce respondent burden. The respondents' choices were then evaluated using a multinomial logit model, with results showing three basic attributes: Parking capacity, Tariff, walking distance, and 25 other design-related attributes considerably contributed to the total utility of parking garages (Macioszek & Kurek, 2020).

A study was conducted by Aroloye (2021) about the visitor's preference for parking places in the central area of Belgium, the Netherlands, using a logit chance model or logistic regression as supported by Fernandes *et al.* (2020). Aroloye utilized four

attributes to define the choice of parking facilities: walk time & and distance, parking time limit, parking fees, and parking availability (supply). His results showed that parking fees, parking time limit, and parking availability (supply) have a significant impact on parking choice, showing a pattern that consumers prefer sufficient parking facilities to lessen parking search time and effort, as well as parking spots with a considerable fee and parking time limit. In the central business district of the City of Dhaka, Bangladesh, there were several underutilized parking facilities that can be upgraded into smart parking systems or facilities based on the Internet of Things or IoT technology. This innovative parking management system could significantly reduce the time and effort of a driver looking for a place to park and even guide the driver to a better route with real-time information simply by using an application through his laptop or cellphone. The result of this study showed that it could significantly lessen traffic congestion and improve the city's traffic management (Alam *et al.*, 2023).

However, regardless of existing studies about parking facilities, there is no research yet intended to establish the residents' preferences for a parking facility in Davao City using a Conjoint Analysis Approach. This study would like to bridge the gap of knowledge by reaching out to private investors, businessmen, and even the city government of Davao and letting them understand the urgency of providing parking facilities in the central business district of Davao City. Since this research will establish the residents' preference in terms of the parking infrastructure, accessibility, parking fees, safety and security, and amenities for a parking facility, this information will be useful to prospective investors and businessmen who might be interested to know how the market behaves in relation to the attributes necessary in a parking facility.

The objective of this study is to identify the best sets of parking facility attributes that clients prefer. Specifically, this study aims to determine the relative performance and the best combination of the following attributes as preferred by clients, namely parking fees, accessibility, amenities, parking structures, and safety and security using the Conjoint Analysis approach (Eggers *et al.*, 2022). This study is also tasked to identify the individual and aggregate models of the respondents' preference for a parking facility. Hypothetically, there is no relative importance nor best combination of the above-mentioned attributes as preferred by clients. The study conforms to the United Nation's Sustainable Development Goals (SDG) number 9: Industry, Innovations and Infrastructure.

The findings of this study will benefit private investors and businessmen of Davao City who would want to invest in providing parking facilities in the city's central business district. Likewise, the results of this research may be useful references to the different parking literature of other countries.

3. Material and Methods

This study utilized primary data using a survey questionnaire distributed to target respondents who own and drive light and middle-size sedan cars who frequently drive

to work or do business within the central business district of Davao City and have been using parking facilities. Furthermore, part of the primary data was the profiling of the respondents based on their demographic attributes, namely: age, gender, income, occupation, and number of years as an experienced driver. Excluded in this survey are those people who own and drive large-size heavy-duty trucks and buses. However, respondents may withdraw during the course of the study if they feel the need to do so at any time and for any reason.

A total of 360 respondents participated in the survey process. These are clients who own light and middle-size cars and frequently drive to work or do business within the central business district of Davao City, specifically within District 1, who were contacted personally or reached through online surveys (Parson & Yan, 2021). The use of internet-based technology for data collection is highly recommended by Nayak *et al.* (2019). The sample size of 360 respondents is acceptable given that the conjoint analysis sample sizes ranging from 300-500 are adequately considerable, as suggested by Allenby *et al.* (2019), therefore, considered sufficient to obtain a reliable conjoint-estimating tool to address the concerns of the study.

The researcher utilized a non-probability sampling technique to identify the respondents. Non-probability sampling techniques are commonly used to obtain valid and reliable information about a target population. When formulating a population estimate, it is important that the population is well-defined demographically before conducting data collection and identifying the respondents to ensure the reliability of the results in the actual evaluation process (Bacher *et al.*, 2019).

Davao City is a highly urbanized city with a land area of 2,444 square kilometers having a total population of 1,776,949 (National *et al.*, 2020), with 41,000 business establishments (Philippine Daily Inquirer, 2019). This study focuses on Davao's downtown areas, particularly in District 1, Poblacion District involving selected four barangays, namely: (1) Barangay 2-A covering City Hall Drive, A. Pichon, Bolton, and San Pedro Streets (Near City Hall and Sangguniang Building), (2) Barangay 12-B covering C. Bangoy (formerly Ponciano Reyes Street) and J.P. Rizal Streets, (3) Barangay 13-B covering A. Bonifacio Street, and (4) Barangay 15-B covering C.M. Recto Street (Streets of Philippines, 2022). These identified locations were known to have designated street parking areas fully occupied by parked cars, as verified through an ocular observation conducted by the researcher during weekdays between 8 a.m. and 5 p.m.

The survey questionnaire was produced from the 20 plan cards generated through the IBM SPSS Statistics Data Editor Software version 16.0 using a 5-point Likert scale ranging from 1 as "very least preferred" to 5 as "very most preferred" to measure the respondents' preferences towards the five attributes and its respective levels derived from the literature review, and from the results obtained from key informant interviews (KII) conducted to few respondents. Next is the profiling of the respondents based on their demographic attributes, namely: age, gender, income, occupation, and number of years as an experienced driver.

This study utilized the commonly used full profile conjoint analysis method in designing residents' preferences for a parking facility by formulating combinations of attribute levels so that client preferences to the five attributes can be adapted to qualify for the statistical criteria such as efficiency, and orthogonally among the levels and succeeding part-worth estimates. Moreover, an orthogonal array design was applied to generate 20 placards containing hypothetical combinations that were used in the survey questionnaire.

In the process of data analysis and interpretation, the IBM SPSS Statistics Data Editor Software is used to establish the sequence of relative importance of the five identified attributes. Furthermore, this research runs the software's SCORE subcommand to rate the five parking facility profiles. Accordingly, the ratings on the profiles were deconstructed, resulting in part-worth estimates of each attribute level.

4. Results and Discussion

A profiling was conducted for the 360 respondents who participated in the survey process based on their distinct characteristics for the purpose of analysis as shown in Table 1: Representation of the Clients' Characteristics.

Table 1: Representation of the Clients' Characteristics

Characteristics	**Levels**	**Frequency**	**Percent**
Gender	Male	176	48.90
	Female	184	51.10
Age group	18 to 30 years	120	33.30
	31 to 40 years	89	24.70
	41 to 50 years	73	20.30
	51 to 65 years	71	19.70
	No Comment	7	2.00
Monthly income	Less than P25,000	126	35.00
	P25,000 - P49,999	104	28.90
	P50,000 - P74,999	62	17.20
	P75,000 - P100,000	20	5.60
	No Comment	48	13.30
Occupation	Government Employee	140	38.90
	Bank & Insurance Employee	55	15.30
	Medical & Health Care, Fast Food Employees	55	15.30
	Service & Academe Employee	45	12.50
	Self-Employed	65	18.00
No. of years as experienced driver	5 years and below	123	34.20
	5 - 10 years	58	16.10
	10 - 20 years	72	20.00
	20 - 70 years	84	23.30
	No comment	23	6.40
Total		**360**	**100.00**

The findings from the Demographics in Table 1 show that *males* and *females* have almost equal proportions, while young drivers ages *18 to 30 years* old have the highest percentage among the age group. The majority of the *monthly income* of car owners/drivers earn *less than P25,000* monthly and *P25,000 to P50,000* monthly, and most of them are seasoned drivers from the *government* and *business sectors*. This aligns with the viewpoint of Smiley and Rudin-Brown (2020), which suggests that experienced and educated drivers are more responsive in terms of behavioral adaptation, which refers to changes in road user behavior in response to new and unpredictable road conditions. This behavior can also be applied to good driving habits, such as defensive driving and adherence to traffic laws as well. Since these respondents are income earners, it can be related to the statement of Shoup (2021), which suggests that motorists can afford and are willing to pay parking fees provided they have a secure and suitable place to park with cost-effective parking management.

The findings from the conjoint analysis in Table 2 demonstrate that respondents in Davao City possess nuanced preferences with regard to the attributes of car parking facilities. It is worth mentioning that the attribute *"Amenities"* has emerged as the most significant factor, with a calculated importance value of *35.900%*. Respondents prefer a parking facility with amenities since it provides comfort, convenience, and value-added services to drivers (Mahmud *et al.*, 2020). Preference for a parking facility can also be expressed using marginal utility evaluated in each attribute level. Under *"Amenities"*, the utility estimate for *proximity to car washing areas* is significantly positive at *(.271)*, indicating that it is a highly desirable amenity, while the values for *proximity to coffee shops (-.030), convenient stores (-.040), and beauty salons (-.201)* were found to be less preferred as evidenced by a negative utility estimate, indicating that respondents do not perceive these amenities as valuable or desirable.

Furthermore, *"Fees"* is the attribute with the second-highest importance value of *25.293%*, indicating that cost plays a critical role in the decision-making process. The initial charge of *P30.00 for a duration of 3 hours* was associated with a negative utility estimate of *(-.381)*. The negative utility estimate experienced a substantial increase when the fee for the *first 3 hours was set at P40.00*, resulting in a negative value of *(-.762)*. Moreover, the negative utility estimate exhibited an even greater increase when the fee for the *first 3 hours was raised to P50.00*, yielding a value of *(-1.142)*. The findings suggest that the respondents have a significant aversion to increased fees. Parking fees significantly affect a person's travel choices, such as change of parking destination or cancellation of trip activities (Yan *et al.*, 2019). However, motorists are willing to pay parking fees as long as parking areas provide a suitable place to park with safety and security for the car and driver as well (Shoup, 2021).

The third most important attribute, labeled *"Infrastructure"*, is deemed to possess a substantial level of significance, accounting for *20.088%* of the decision-making process as reported by the respondents. Among the various infrastructure attribute levels, *multi-story parking (.083)*, and *off-street parking (-.213)*, the utility estimate for *automated multilevel parking systems* was rated the highest with an estimated value of *(.131)*. This suggests that

respondents expressed a stronger preference for this particular type of parking infrastructure. The utility estimate for *automated multilevel parking systems* conforms to the suggestions of Serpen and Debnath (2019) that in these modern times, automated multi-story parking structures are the practical solution to meet the demands of parking within highly-densed cities, considering that this structure requires less real estate and can be built in a short period of time.

The attribute *"Safety and Security"* holds a moderate level of significance, as indicated by its importance value of *12.425%*. Under *"Safety and Security"*, the *CCTV Surveillance System* demonstrates a positive utility estimate of *(0.018)*, suggesting a slight inclination towards the adoption of this safety feature, followed by *sufficient lighting* with a positive utility estimate of *(.014)* and *onsite security patrol* which is regarded less favorably, as indicated by a negative utility estimate of *(-.032)*. Regardless of being considered as less preferred amenities, *CCTV surveillance systems, lighting systems, and onsite security patrol* remain a significant factor in the decision-making process since these attribute levels are significantly effective crime prevention measures (Piza *et al.*, 2019).

The attribute *"Accessibility"* exhibits the lowest importance value of *6.294%*, suggesting that it may not hold significant weight in the decision-making process. Parking facilities equipped *with sensors that can detect the availability of parking spaces* have been found to have a minimal negative utility estimate of *(-.001)*. This finding indicates a nearly neutral preference towards such parking facilities. *Intelligent parking facilities that are connected to the internet* exhibit a correspondingly minimal optimistic utility estimate of *(.001)*.

Table 2: Relative importance of Attributes and utility estimates of attribute levels for a proposed car parking facility

Attribute	Importance Value	Attribute Level	Utility Estimate	S.E.
Infrastructure	20.088%	Off-street parking	-.213	.008
		Multi-story parking	.083	.009
		Automated multilevel parking systems	.131	.009
Accessibility	6.294%	With sensors to know available space	-.001	.006
		Internet-connected intelligent parking	.001	.006
Safety and Security	12.425%	Cctv surveillance system	.018	.008
		Onsite security patrol	-.032	.009
		Sufficient lightings	.014	.009
Amenities	35.900%	Near car washing areas	.271	.010
		Near convenient stores	-.040	.010
		Near beauty salons	-.201	.010
		Near coffeeshops	-.030	.010
Fees	25.293%	P30.00 for the 1st 3 hours	-.381	.007
		P40.00 for the 1st 3 hours	-.762	.014
		P50.00 for the 1st 3 hours	-1.142	.021
		(Constant)	4.038	.014

Table 3 exhibits the preferences of individual respondents and the overall sample for a proposed parking facility. Correspondingly, it shows that the *aggregate model of respondents* preferred *Infrastructure* having an *automated multilevel parking system (.131), with access to the internet-connected intelligent parking (.001), equipped with a CCTV surveillance system for safety and security (.018), a parking facility that is near to car washing areas (.271), and having a parking fee of P30.00 for the 1st 3 hours (-0.381).*

Based on the individual analysis, for *Profile 2*, it shows that the respondent considers the attribute *"Infrastructure"* as the most significant factor having an importance value of *40.909%* while the respondent's least preferred attribute is *"Safety and Security"* with an importance value of *13.636%*. Accordingly, *Profile 2* prefers a parking facility with *automated multilevel parking systems, that has access to internet-connected intelligent parking, with CCTV surveillance system, and a parking facility near to convenient stores or beauty salons*. The overall score for *Profile 2* through the additive model is expressed as the sum of the utility estimates and the constant, therefore, 0.625 + 0.375 + 0.167 + 0.250 + 3.833 = **5.250**. For *Profile 85, "Safety and Security"* is the attribute having the highest importance value of *42.636%* while the respondent's least preferred attribute is *"Fees"* with an importance value of *6.202%*. However, *Profile 85* prefers an *off-street parking facility with sensors to know available spaces, and equipped with a CCTV surveillance system, a parking facility near to convenient stores or coffee shops, with a parking fee priced at P30.00 for the 1st 3 hours*. The overall score for *Profile 85* is computed as: 0.167 + 0.125 + -0.136 + 0.125 + -0.045 + 4.746 = **4.9776**. Lastly, *Profile 214* considers *"Fees"* as the most preferred attribute having the highest importance value of *33.735%* while the least preferred attribute is *"Safety and Security"* with an importance value of *8.835%*. *Profile 214 prefers an automated multilevel parking system, that has access to internet-connected intelligent parking, with CCTV surveillance system, a parking facility near coffee shops, with a parking fee priced at P30.00 for the 1st 3 hours.* The overall score for Profile 214 is computed as: + 0.250 + 0.187 + 0.083 + 0.313 + -0.477 + 5.064 = **5.420**.

After conducting a comparative analysis of individual profiles *(Profile 2, Profile 85, and Profile 214)* in relation to the aggregate model, several significant differences and similarities can be observed in their preference structures as shown in Table 3. According to the data presented in Table 3, the *aggregate model* demonstrates a significance of *20.088% for infrastructure*. *Profile 2* exhibits a strong inclination towards *automated multilevel parking systems*, as indicated by a preference score of *(0.625)*. This preference stands in contrast to the overall aggregate preference, which has a lower utility score of *(0.131). Profile 85* exhibits diverse responses, displaying a notable inclination towards *off-street parking*. Conversely, *Profile 214* demonstrates a moderate inclination towards automated systems. This phenomenon highlights the various preferences as shown by individuals, despite the tendency for aggregated data to lessen these variations.

In relation to the concept of *Accessibility*, it is noteworthy that the aggregate model assigns the least significance to this attribute, with a weight of *6.294%*. However, *Profile 2* demonstrates a higher preference towards *Accessibility*, with a weight of *27.273%*, while *Profile 214* also shows a notable preference towards this attribute, with a weight of

13.253%. *Profile 2* exhibits a preference for *internet-connected intelligent parking*, which stands in contrast to the aggregate model's relatively neutral position on this particular characteristic.

It is worth mentioning that *Profile 85* exhibits a significantly elevated emphasis on *safety and security 42.636%*, which deviates from the overall model *12.425%*. The negative utility of *Profile 85* towards both *CCTV surveillance and onsite security patrol* raises potential concerns regarding the effectiveness of these measures. The same negative results can be seen from the utility estimate values in Table 2, indicating that these utilities are considered as less preferred tools. Likewise, *Profiles 2* and *214* have also ranked *safety and security* as their least preferred attributes, as shown in the individual analysis in Table 3. It can be assumed that the respondents do not consider *safety and security* as a significant factor since they know for a fact that the central business district of Davao City is already a highly secured city fully equipped with resolution CCTV Surveillance Systems in every block of the City (Ramos *et al*., 2021), and consistently patrolled by the PNP and Task Force Davao uniformed personnel twenty-four hours a day, and seven days a week (Tamayo *et al*., 2022). Due to the city's well-managed security protocols, Davao City is considered the safest city in the country (Philippine News Agency, 2022).

In terms of *amenities*, the aggregate model places significant emphasis on their importance, attributing a weight of *35.900%*. Notably, there is a notable preference for parking facilities in *close proximity to car washing areas*. Nevertheless, individual profiles demonstrate a greater range of preferences. As an example, *Profile 214* shows a noticeable inclination towards parking *in close proximity to coffee shops and convenience stores*, whereas the aggregate model demonstrates a slight inclination against these attributes.

Regarding the attribute of *fees*, the various fee preferences present a compelling aspect. The aggregate model reveals a significant reluctance towards increasing fees. However, *Profile 214* exhibits an even stronger reluctance, particularly when the fee is set at *P50.00 for the initial 3 hours*, resulting in a coefficient of *-1.432. Profile 2*, on the other hand, remains unaffected by these alterations in fees.

The results of Table 3 illustrate the potential for substantial deviation between individual viewpoints and collective agreement. This corresponds to the research of Herfeld (2020) on Rational Choice Theory, which suggests that people make different individual rational choices by assessing their preferences based on their beliefs. A customer is perceived to choose rationally if he chooses an alternative that will best satisfy his choice of preferences.

Table 3 additionally displays the outcomes of the model fit measures pertaining to conjoint analysis. The measures of fit offer valuable insights into the model's validity, and it also verifies if the market behaves consistently according to the respondents' preferences both in actual and holdout profiles (Paetz *et al*., 2019). The aggregate model exhibits a moderate fit with the observed data, as indicated by *Pearson's correlation coefficient of 0.690* and *Kendall's tau of 0.444*. On the other hand, *Profile 214* demonstrates a significantly high *Pearson's correlation coefficient (r = 0.935)* and *Kendall's tau coefficient (τ = 0.783)*. However, the holdout profiles of (profiles 2, 85, and 214) were rated by the

respondents but were not utilized by the conjoint process for estimating utilities. As an alternative, the conjoint process computed the correlations between the observed and predicted rankings for these profiles to verify the effectiveness and reliability of the utilities (Radas & Prelec, 2021).

Table 3: Individual and aggregate models of clients' preference for a proposed car parking facility

Attribute Levels	Individual Models			Aggregate Model
	Profile 2	Profile 85	Profile 214	
(Constant)	3.833	4.746	5.064	4.038
Off-street parking	-.500	.167	-.250	-.213
Multi-story parking	-.125	-.083	.000	.083
Automated multilevel parking systems	.625	-.083	.250	.131
With sensors to know available space	-.375	.125	-.187	-.001
Internet-connected intelligent parking	.375	-.125	.187	.001
CCTV surveillance system	.167	-0.136	.083	.018
Onsite security patrol	.042	-0.273	-.167	-.032
Sufficient lightings	-.208	-0.409	.083	.014
Near car washing areas	-.250	-.125	-.187	.271
Near convenient stores	.250	.125	.312	-.040
Near beauty salons	.250	-.125	-.438	-.201
Near coffeeshops	-.250	.125	.313	-.030
P30.00 for the 1st 3 hours	.000	-.045	-.477	-.381
P40.00 for the 1st 3 hours	.000	-.091	-.955	-.762
P50.00 for the 1st 3 hours	.000	-.136	-1.432	-1.142
Infrastructure	**40.909**	17.054	17.671	20.088
Accessibility	27.273	17.054	13.253	6.294
Safety and Security	13.636	**42.636**	8.835	12.425
Amenities	18.182	17.054	26.506	**35.900**
Fees	.000	6.202	**33.735**	25.293
Pearson's r	0.882*	0.711*	0.935*	0.690*
Kendall's tau	0.808*	0.629*	0.783*	0.444*
Kendall's tau for holdouts	0.236^{ns}	-0.775^{ns}	0.816^{ns}	0.667^{ns}

5. Recommendations

To address possible questions about articles not included in this study, future researchers may explore other factors and provide more knowledge, such as finding the ideal and most advantageous location for the proposed parking facility.

The findings of this study will serve as a reference to prospective investors and businessmen who would be interested to know how the market behaves in relation to the attributes necessary in a proposed parking facility, as well as with the City Government of Davao to consider the urgency of putting-up parking facilities in the central business district of Davao City and be able to have an opportunity to contribute to the society and achieve a better transportation management system to improve the quality of life of people, the economy, and the environment.

6. Conclusion

Based on the relative importance, the attribute "Amenities" holds the highest significant factor, while "Accessibility" exhibits the lowest importance value. Based on the attribute levels, a parking facility that is near car washing areas is the most desirable amenity, while the attribute level of a fee priced at P50.00 for the 1st 3 hours is the least preferred utility. Based on individual preferences, the most preferred parking facility is the one having the following significant factors: a parking facility that is an automated multilevel parking system, equipped with internet-connected intelligent parking and CCTV surveillance system, a parking facility that is near coffee shops, and has a parking fee priced at P30.00 for the 1st 3 hours. The ranking tells us how clients choose their preferences given the combinations that were generated through an orthogonal array.

Consequently, it can be presumed that the respondents in Davao City prefer a parking facility that is near car washing areas and coffee shops, a parking facility that is an automated multi-level parking system equipped with internet-connected/intelligent parking, CCTV surveillance systems, and a parking fee priced at P30.00 for the 1st 3 hours. Based on the study, this type of parking facility is perceived to be a practical infrastructure project proposal that can address the traffic congestion and parking problems in densely populated cities, particularly in Davao City.

The results of the study support the Random Utility Theory recommended by Aguiar *et al.* (2023), who assumed that every individual customer is a rational decision-maker, maximizing the perceived utility or attribute levels as his/her preferred and discrete alternatives. This theory also suggests that goods and services can be ranked according to their usefulness (Croissant, 2020).

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Conflict of Interest Statement

The authors declared no conflict(s) of interest during the conduct of this study and its publication thereof.

Ethical Statement

This study conforms to the ethical guidelines administered by the University of Mindanao Ethics Committee (UMERC), which issued UMERC certification number UMERC-2023-117. The UMERC is a multidisciplinary and independent body engaged in reviewing research involving human participants to make sure that the participants' dignity, rights and welfare are protected by these key ethical areas: Voluntary Participation, Privacy and Confidentiality, Informed Consent Process, Plagiarism, Fabrication, and Conflict of Interest.

The data collection process began following the approval from the City Transport and Traffic Management Office (CTTMO) to conduct the research. The objective of the data collection was to gather 360 respondents from car owners doing business and attending personal errands within the central business district of Davao City. Online surveys were distributed across social media platforms through a Google Forms link with the assistance of Professional Schools (PS) instructors and coordinators. Printed survey questionnaires were also distributed to people who own cars within the central business district of Davao City. The participants were given instructions to provide accurate responses to the survey questionnaires based on their preferences on the various combinations of the five attributes of a parking facility and its appropriate levels. The data collection process began in March 2023 and was completed in July 2023. The responses of the 360 participants were consolidated and converted into an excel spreadsheet format. The researcher then reviewed the data for any missing values to ensure its quality and integrity. Consequently, the data was then analyzed using the IBM-SPSS software, and the results showed the relative importance and utility estimates of attribute levels of the proposed parking facility.

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