MJS

วารสารสหวิทยาการ มหาวิทยาลัยชินวัตร

MULTIDISCIPLINARY JOURNAL OF SHINAWATRA UNIVERSITY

ปีที่ 2 ฉบับที่ 1 มกราคม - เมษายน 2568
VOL. 2 NO. 1 JANUARY - APRIL 2025

ISSN : 3057 -0638 (ONLINE)

วารสารสหวิทยาการ มหาวิทยาลัยชินวัตร

Multidisciplinary Journal of Shinawatra University

กำหนดการเผยแพร่

วารสารสหวิทยาการ มหาวิทยาลัยชินวัตร กำหนดการเผยแพร่ ปีละ 3 ฉบับ

วัตถุประสงค์

เพื่อส่งเสริมและสนับสนุนให้เผยแพร่ผลงานทางด้านวิชาการและงานวิจัยของ คณาจารย์ นักวิชาการ นักวิจัย นิสิตนักศึกษาและบุคคลทั่วไป ได้มีโอกาสเผยแพร่ผลงานทางวิชาการ และผลงานวิจัยโดยครอบคลุมด้านวิศวกรรมศาสตร์ วิทยาศาสตร์ วิทยาศาสตร์การกีฬา วิทยาศาสตร์และเทคโนโลยี วิทยาศาสตร์สุขภาพ การแพทย์แผนจีน จิตวิทยา จิตวิทยาการกีฬา พฤติกรรมศาสตร์ สังคมศาสตร์ เป็นต้น กำหนดออกวารสารปีละ 3 ฉบับ เป็นราย 4 เดือน ฉบับที่ 1 เดือนมกราคม-เมษายน ฉบับที่ 2 เดือนพฤษภาคม-สิงหาคม และฉบับที่ 3 เดือนกันยายน-ธันวาคม

บรรณาธิการวารสารสหวิทยาการ มหาวิทยาลัยชินวัตร

99 ตำบลบางเตย อำเภอสามโคก จังหวัดปทุมธานี 12160

https://li04.tci-thaijo.org/index.php/mjs

E-mail : sipnarong.k@siu.ac.th

ผู้ทรงคุณวุฒิกลั่นกรองบทความ

ดร.มีสิทธิ์ ชัยมณี	มหาวิทยาลัยชินวัตร
ดร.พรพิมล เชวงศักดิ์โสภาคย์	มหาวิทยาลัยชินวัตร
ผศ.ดร.วิโรจน์ ฤทธิ์ทอง	มหาวิทยาลัยชินวัตร
ดร.สรรกมล กรนุ่ม	มหาวิทยาลัยชินวัตร
ผศ.ดร.เกียรติศักดิ์ บัตรสูงเนิน	มหาวิทยาลัยเทคโนโลยีสุรนารี
ดร.นพ. นพพร ตันติรังสี	โรงพยาบาลจิตเวชสงขลาราชนครินทร์
ดร.วาสนา ศิลางาม	มหาวิทยาลัยหัวเฉียวเฉลิมพระเกียรติ
ดร.วันวิสาข์ สุทรชาติชเวช	มหาวิทยาลัยหัวเฉียวเฉลิมพระเกียรติ
ผศ.ดร.วินัย ชาญเพ็ง	มหาวิทยาลัยเทคโนโลยีราชมงคลสุวรรณภูมิ
ดร.พงษ์เทพ พ่วงทอง	มหาวิทยาลัยชินวัตร
ดร.ประดิษฐ์ สงค์แสงยศ	มหาวิทยาลัยชินวัตร
ดร.วิโรจน์ ฤทธิ์ทอง	มหาวิทยาลัยชินวัตร
ดร.สิปป์ณรงค์ กาญจนาวงศ์ไพศาล	มหาวิทยาลัยชินวัตร
Dr. Danty James	มหาวิทยาลัยราชภัฏสวนสุนันทา
Dr. Rodel Cahiig	มหาวิทยาลัยราชภัฏสวนสุนันทา
นางสาวศุภากร เอี่ยมอำพร	มหาวิทยาลัยเทคโนโลยีราชมงคล สุวรรณภูมิ

บทบรรณาธิการ

วารสารสหวิทยาการ มหาวิทยาลัยชินวัตร ฉบับนี้ เป็นวารสาร ปีที่ 2 ฉบับที่ 1 เดือนมกราคม - เมษายน 2568 ที่ได้รับรองคุณภาพวารสารจากศูนย์ดัชนีการอ้างอิงวารสารไทย (Thai Journal Citation Index-TCI) เพื่อรักษาคุณภาพของบทความ ให้เป็นไปตามเงื่อนไขและกติกาสากลกองบรรณาธิการได้พิจารณาบทความโดยเสนอบทความต่อคณะกรรมการผู้ทรงคุณวุฒิกลั่นกรอง (Peer Review) พิจารณาตรวจแก้ไขเพื่อความสมบูรณ์ของบทความก่อนการลงตีพิมพ์เพื่อคัดเลือกและกลั่นกรองบทความให้เกิดความความสมบูรณ์และมีคุณภาพมากที่สุดเพื่อควรค่าแก่การตีพิมพ์เผยแพร่และเพื่อให้เกิดประโยชน์สูงสุดทางวิชาการและเพื่อเป็นการพัฒนาศักยภาพทางด้านการสร้างสรรค์ผลงานทางวิชาการ สำหรับเนื้อหาของวารสารฉบับนี้ถือได้ว่ามีความโดดเด่นที่เน้นกระบวนการวิจัยที่เข้มข้นประกอบไปด้วยจำนวนบทความทั้ง 5 บทความ โดยภาพรวมหลักเป็นการพัฒนาจากงานวิจัยที่ศึกษากรณีเฉพาะ (Case Study) ที่แต่ละบทความได้เน้นกระบวนการวิจัยเชิงลึกในหลายรูปแบบทั้งในรูปแบบของการสนทนากลุ่มการสอบถามและการสัมภาษณ์ประกอบกับบทความส่วนใหญ่แสดงถึงการทำงานร่วมกันของผู้นิพนธ์ในลักษณะทีมงานทำให้บทความมีความละเอียดรอบคอบถี่ถ้วนมีการวิเคราะห์ปัญหาและข้อเสนอแนะได้อย่างสมบูรณ์น่าสนใจ ขอขอบคุณนักวิจัย คณาจารย์ นักศึกษาและผู้สนใจทั่วไปทุกท่านที่ให้ความสนใจร่วมส่งบทความเผยแพร่ในวารสารสหวิทยาการ มหาวิทยาลัยชินวัตร และขอขอบคุณกองบรรณาธิการผู้ทรงคุณวุฒิพิจารณากลั่นกรองบทความทุกท่านมาณ.โอกาสนี้

ดร. มีสิทธิ์ ชัยมณี

บรรณาธิการ

สารบัญ (Content)

วารสารสหวิทยาการ มหาวิทยาลัยชินวัตร ปีที่ 2 ฉบับที่ 1 (มกราคม 2568 - เมษายน 2568)
Multidisciplinary Journal of Shinawatra University, Volume 2 Issue 1 (January – February 2025)

ANALYSIS OF PUBLIC SATISFACTION WITH PUBLIC SERVICES BASED ON THE PUBLIC SATISFACTION INDEX AT THE BUKIT TEMPAYAN VILLAGE OFFICE, BATU AJI DISTRICT, BATAM CITY

Ade Abu Darda[1], Reni Febrizan[2], Lukmanul Hakim[3], Yuliati Pratiwi[4]
Master of Management Study Program, Faculty of Postgraduate University Riau Kepulauan, Batam, Indonesia
Email: abuddar05@gmail.com, reni_fzn@yahoo.com, lukmann14@gmail.com, pratiwiyuliati30@gmail.com

Received: November 29, 2024, Revised: February 15, 2024, Accepted: April 29, 2024

ABSTRACT

This study aims to assess the services provided by the Bukit Tempayan Village Office in Batu Aji District, Batam City, as measured by the Public Satisfaction Index (IKM). The research is descriptive, utilizing Public Satisfaction Index analysis. The study was conducted at the Bukit Tempayan Village Office, Batu Aji District, Batam City, from January to June 2024. The sampling technique used is non-probability sampling, a type of accidental sampling. Data collection methods include observation, documentation, and questionnaires. The validity test uses Pearson's Product-Moment formula, and the reliability test uses Cronbach's Alpha formula. The study results indicate that the Public Satisfaction Index (IKM) for services at the Bukit Tempayan Village Office, Batu Aji District, Batam City, is 3.442 with a conversion score 86.05. Therefore, the performance of public services falls into the category of good service quality. The results of the measurements based on 9 Public Satisfaction Index indicators are as follows:

(a) Service Requirements with IKM score of 76.42, categorized as Poor, (b) **Service Procedures** with IKM score of 94.40, categorized as **Very Good**, (c) **Service Time**: IKM score of 84.54,

วารสารสหวิทยาการ มหาวิทยาลัยชินวัตร ปีที่ 2 ฉบับที่ 1 (มกราคม 2568 - เมษายน 2568)
Multidisciplinary Journal of Shinawatra University, Volume 2 Issue 1 (January – February 2025)

categorized as Good, (d) Service Fees with IKM score of 100, categorized as Very Good, (e) Service Products with IKM score of 80.76, categorized as Good, (f) Service Executor Competence with IKM score of 81.55, categorized as Good, (g) Service Executor Behavior with IKM score of 86.91, categorized as Good, (h) Handling of Complaints, Suggestions, and Feedback with IKM score of 77.60, categorized as Good, (i) Service Facilities and Infrastructure with IKM score of 93.06, categorized as Very Good.

Key Words: Public Services, Public Satisfaction Index

INTRODUCTION

Every human needs services, which have become inseparable and essential in social life. The public constantly demands quality services from government officials who provide them. Service activities significantly influence quality and the smooth functioning of activities within society. The services provided are not merely about meeting customer needs but also about offering exemplary service to the customer. Receiving satisfying services from government officials is a right that belongs to every member of society.

Society requires services to meet various needs. Public services often take the form of public goods or services. With the services they receive, the public is expected to actively participate in supporting the tasks of government officials, creating a balance between citizens' rights and obligations.

Services to the public are one of the duties that must be carried out by both local and central governments. The government plays an important role in providing public services as mandated by law. According to Law Number 25 of 2009 on Public Services, Article 1, public service is defined as a series of activities aimed at fulfilling service needs in accordance with regulations for every citizen and resident regarding goods, services, and/or administrative services provided by public service providers.

The quality of service is a condition where a dynamic relationship is created between users and service providers, whether in terms of goods or human services. If the services provided meet

วารสารสหวิทยาการ มหาวิทยาลัยชินวัตร ปีที่ 2 ฉบับที่ 1 (มกราคม 2568 - เมษายน 2568)
Multidisciplinary Journal of Shinawatra University, Volume 2 Issue 1 (January – February 2025)

the expectations of the users, it can be said that the service is of high quality. Conversely, if the services provided do not align with the users' expectations, then the service can be considered of poor quality. The assessment of good or bad service quality is not based on the perspective or perception of the service providers but rather on the perception of consumers and the regulations or standards regarding service quality.

The public generally expects good services. Poor service can create a negative image for the government. The services provided by government bureaucracy in Indonesia are often characterized by slow and convoluted administrative processes. To receive optimal services, the public may feel compelled to provide feedback in the form of payment, which can fall into the category of bribery and is often associated with corruption, collusion, and nepotism (KKN). This indicates that the services provided are not satisfactory. As a result, the public may be reluctant to engage directly with government bureaucracy for any matters.

The sub-district (kecamatan) serves as the frontline of public service and is also referred to as the base of public service. This is not an exaggeration, as in daily activities, the public frequently engages in administrative processes, whether for permits or requests for official documents. Within local government, the lowest level of administration is the sub-district organization, which operates under the supervision of the head of the sub-district (camat). One of the sub-districts actively providing public services to the community is the Bukit Tempayan Village Office in Batu Aji District, Batam City. The services provided include the issuance of Family Cards, Identity Cards, management of Building Permits (IMB), and other government service facilities for the community or for local government at the village level.

Based on initial observations conducted at the Bukit Tempayan Village Office in Batu Aji District, Batam City, several issues were found in the service area. Service facilities are one of the aspects that influence the quality of the services provided. Therefore, fulfilling the service facilities for customers or the community is an important aspect that needs attention. The service facilities at the Bukit Tempayan Village Office are considered inadequate, such as the waiting area being

too small and insufficient seating in the waiting room. This, of course, can hinder the smooth delivery of services. The main objective of public service is to achieve public satisfaction. Public satisfaction will be realized when the services provided meet the established service standards or are better than the set standards.

The services provided at the Bukit Tempayan Village Office in Batu Aji District, Batam City, will be assessed through the level of public satisfaction. The community provides assessments to determine the performance measurement of public services. The activity carried out to gauge public service is measuring the level of public satisfaction. One of the methods used to evaluate the quality of services provided by a public organization is through the Public Satisfaction Index (IKM). Regulations regarding the Public Satisfaction Index (IKM) are outlined in the Decree of the Minister of Administrative Reform Number KEP/25/M.PAN/2/2004, dated February 24, 2004, concerning the General Guidelines for the Preparation of the Public Satisfaction Index for Government Service Units.

The analysis of the Public Satisfaction Index (IKM) must be conducted periodically. This means that at regular intervals, research or calculations and analyses regarding public satisfaction with the services provided should be carried out. However, the Bukit Tempayan Village Office in Batu Aji District, Batam City, has not yet conducted such assessments on a regular basis. This presents an interesting opportunity for study with the aim of understanding the Public Satisfaction Index regarding services at the Bukit Tempayan Village Office in Batu Aji District, Batam City. Based on the above description, a study will be conducted titled Analysis of Public Satisfaction with Public Services Based on the Public Satisfaction Index at the Bukit Tempayan Village Office in Batu Aji District, Batam City.

Based on identifying the issues above, it is necessary to narrow the scope of the problems. This research focuses on the quality of service at the Bukit Tempayan Village Office in Batu Aji District, Batam City, as measured by the Public Satisfaction Index, which has not yet been determined.

วารสารสหวิทยาการ มหาวิทยาลัยชินวัตร ปีที่ 2 ฉบับที่ 1 (มกราคม 2568 - เมษายน 2568)
Multidisciplinary Journal of Shinawatra University, Volume 2 Issue 1 (January – February 2025)

Based on the issues presented, the problem in this research is formulated as follows: "How is the service at the Bukit Tempayan Village Office in Batu Aji District, Batam City, measured in terms of public satisfaction using the Public Satisfaction Index?"

In accordance with the formulated problem above, the researcher aims to achieve this study's objective of determining the service quality at the Bukit Tempayan Village Office in Batu Aji District, Batam City, as measured by public satisfaction using the Public Satisfaction Index.

LITERATURE REVIEW

A. Definition of Public Service

1. Public Service

a. Definition of service

According to Hardiyansah (2011: 11), "service can be defined as an activity provided to assist, prepare, and manage either in the form of goods or services from one party to another." Essentially, service consists of a series of activities; therefore, the service process occurs routinely and continuously, encompassing the entire life of an organization within society. This process is intended to fulfill the needs of both the service recipients and the service providers.

From this definition, it can be concluded that service is an activity or effort carried out by an individual or a group of people through an interactive relationship between one party and another, utilizing organizational or institutional resources to achieve the satisfaction of the recipient/customer/consumer.

b. Definition of Public

The term "public" comes from the English word "public," which means general, society, and state. The word "public" has been accepted into standard Indonesian as "publik," which means general, many people, and crowded. Inu and colleagues (1999: 18) define the public as a group of individuals who share common thoughts, feelings, hopes, attitudes, or actions

วารสารสหวิทยาการ มหาวิทยาลัยชินวัตร ปีที่ 2 ฉบับที่ 1 (มกราคม 2568 - เมษายน 2568)
Multidisciplinary Journal of Shinawatra University, Volume 2 Issue 1 (January – February 2025)

that are deemed right and good based on shared values and norms, and who feel a sense of ownership. According to Gruth and Marsh in Estawara (2010), the public is any group of people who share interests or common values in specific situations, particularly their interests or values that may prompt them to act willingly.

c. Public Services

Based on Law No. 25 of 2009 on Public Services, public service is defined as any form of activity aimed at regulation, guidance, provision of facilities, services, and others carried out by government officials as an effort to meet the needs of the community following applicable laws and regulations. Public service is closely related to issues of public interest. The community requires public services to support various needs. According to Sinambela (Harbani Pasolong, 2010: 199), public service is any activity conducted by the government toward several people that involves activities and offers satisfaction, even if the results are not tied to a physical product.

2 Type of Public Service

Based on the Minister of Administrative Reform Decree No. 63/KEP/M.PAN/7/2003 concerning General Guidelines for the Provision of Public Services, three types of services provided by government agencies, as well as state-owned enterprises (BUMN) and regional-owned enterprises (BUMD), are categorized as follows:

1. Administrative Services (Pelayanan Administratif)
2. Goods Services (Pelayanan Barang)
3. Service Services (Pelayanan Jasa)

3. Characteristic service

Zeithaml, Berry, and Parasuraman (Fandy Tjiptono and Anastasia Diana, 2003: 27) identified five characteristics used by customers to evaluate service quality, which are:

วารสารสหวิทยาการ มหาวิทยาลัยชินวัตร ปีที่ 2 ฉบับที่ 1 (มกราคม 2568 - เมษายน 2568)
Multidisciplinary Journal of Shinawatra University, Volume 2 Issue 1 (January – February 2025)

1. Tangibles (Bukti langsung)
2. Reliability (Kehandalan)
3. Responsiveness (Daya tanggap)
4. Assurance (Jaminan)
5. Empathy (Empati)

4. Factors Influencing Service

1. Human resources
2. Awareness
3. Organizational Policies (Aturan organisasi)
4. Skills and Abilities
5. Service Suggestion (Sarana pelayanan)
6. Customer Experience

Definition of Public Service

As cited in Fandy Tjiptono (2005: 59), Lovelock states that service quality is a level of excellence expected and controlled to meet customer expectations. Service quality refers to how well the service provider can deliver services that align with customer expectations.

In the context of a sub-district office (kantor kecamatan), the office, as a service provider, is expected to offer pleasant and comfortable services to the community. This involves understanding and meeting the specific needs and expectations of the citizens it serves. When the quality of service is high, it leads to greater customer satisfaction and enhances the overall perception of the government's effectiveness in serving its constituents.

5. Benefit of Service Quality

วารสารสหวิทยาการ มหาวิทยาลัยชินวัตร ปีที่ 2 ฉบับที่ 1 (มกราคม 2568 - เมษายน 2568)
Multidisciplinary Journal of Shinawatra University, Volume 2 Issue 1 (January – February 2025)

Fandy Tjiptono and Gregorius Chandra (2005: 115) state that there are several benefits that a company can gain from having service quality, namely:

Quality is closely related to customer satisfaction.

1. Quality is closely related to customer satisfaction
2. Companies can increase their market share by meeting customer-driven quality.
3. Quality can reduce costs.

6. Dimensions of Service Quality

Parasuraman et al. (Fandy Tjiptono, 2005: 690) identified ten dimensions of quality, which are:

1. Reliability
2. Responsiveness
3. Competence
4. Access
5. Courtesy
6. Communication
7. Credibility
8. Security
9. Understanding/Knowing the Customer
10. Tangibles

Definition of Customer Satisfaction

3. Definition of Customer

According to Nasution M. N. (2001: 45), customer satisfaction is a state in which the needs, desires, and expectations of customers are fulfilled through the products consumed. Gerson in Arief (2007: 167) states that customer satisfaction is when expectations have been met or exceeded. From these expert opinions, it can be concluded that customer satisfaction is the

วารสารสหวิทยาการ มหาวิทยาลัยชินวัตร ปีที่ 2 ฉบับที่ 1 (มกราคม 2568 - เมษายน 2568)
Multidisciplinary Journal of Shinawatra University, Volume 2 Issue 1 (January – February 2025)

level of consumer feelings after comparing the alignment or misalignment between customer expectations and the perceptions/services received (the reality experienced)

4 Level of Public Satisfaction

Public satisfaction with public organizations is essential because it relates to public trust. Harbani Pasolong (2010: 221-222) states that the better the governance and the quality of service provided, the higher the public trust will be. Public trust will increase further when the community receives good service and feels satisfied with that service.

Every service provider needs to measure customer satisfaction to gather feedback and input that the provider can use to develop and implement strategies to enhance customer satisfaction. According to KEPMENPAN Number 63 of 2003 on General Guidelines for Public Service Provision, the success of service provision is determined by the level of satisfaction of the service recipients. Service satisfaction is achieved when the recipients receive services that meet their needs and expectations. Therefore, every service provider periodically conducts a Community Satisfaction Index survey. Customer satisfaction can be measured using various measurement methods. Kotler (Fandy Tjiptono, 2003: 148) simply outlines four methods that can measure customer satisfaction, as follows: Complaint and Suggestion System, Customer Satisfaction Survey, Ghost Shopping, and Lost Customer Analysis.

B. Public Satisfaction Index

1. Definition of Public Satisfaction Index

The Public Satisfaction Index (IKM) according to KEPMENPAN No: KEP/25/M.PAN/2/2004 is data and information about the level of community satisfaction obtained from quantitative and qualitative measurements of public opinion regarding the services received from public service providers by comparing their expectations and needs.

The purpose of measuring the Public Satisfaction Index (IKM) according to KEPMENPAN No: KEP/25/M.PAN/2/2004 is to monitor the performance development of service units within government agencies, conducted by the respective agencies periodically. For service units in

วารสารสหวิทยาการ มหาวิทยาลัยชินวัตร ปีที่ 2 ฉบับที่ 1 (มกราคม 2568 - เมษายน 2568)
Multidisciplinary Journal of Shinawatra University, Volume 2 Issue 1 (January – February 2025)

government agencies, the measurement results can be used as a basis for policy formulation to improve public service quality. For the community, the IKM can reflect the performance of the respective service unit.

2 Components of Public Satisfaction Index

Based on the Regulation of the Minister for State Apparatus Utilization and Bureaucratic Reform Number 14 of 2017, 9 service components must be measured, namely:

1. Service Requirements
2. Service Procedures
3. Service Time
4. Cost/Tariff
5. Service Product
6. Competence of Implementers
7. Behavior of Implementers
8. Handling of Complaints, Suggestions, and Input
9. Facilities and Infrastructure

3 Steps for Formulating the Public Satisfaction Index

1) Preparation, six working days
2) Data collection implementation, six working days
3) Index data processing, six working days;
4) Preparation and reporting of results, six working days

4 Data Processing

The calculation of the Public Satisfaction Index for the nine service components being assessed involves each service component having the exact weighting with the following

วารสารสหวิทยาการ มหาวิทยาลัยชินวัตร ปีที่ 2 ฉบับที่ 1 (มกราคม 2568 - เมษายน 2568)
Multidisciplinary Journal of Shinawatra University, Volume 2 Issue 1 (January – February 2025)

formula :

$$\text{Bobot Rata-Rata Tertimbang} = \text{Jumlah Bobot} = \text{Jumlah Unsur} = 0{,}111$$

To obtain the value of the Public Satisfaction Index (IKM) for the service unit, a weighted average approach is used with the following formula :

$$\textit{Total dari nilai persepsi per Unsur IKM} = \textit{Total unsur yang berisi} \times \textit{Nilai Penimbang}$$

To facilitate the interpretation of the IKM assessment, which ranges from 25 to 100, the assessment results are converted using a base value of 25, with the following formula:

$$\textit{IKM Unit Pelayanan} \times 25$$

The following are the perception values and IKM intervals used in the assessment of the 9 IKM components, as shown in Table 1 below:

Table 1. Perception Values, IKM Intervals, IKM Conversion Intervals, Service Quality, and Service Unit Performance

Perception Value	IKM Interval	IKM Conversion Interval	Service Quality	Service Unit Performance
1	1,00 – 1,75	25 - 43,75	A	Not Good
2	1,76 – 2,50	43,76 - 62,50	B	Poor
3	2,51 – 3,25	62,51 - 81,25	C	Good
4	3,25 – 4,00	81,26 - 100,00	D	Very Good

RESEARCH METHOD

วารสารสหวิทยาการ มหาวิทยาลัยชินวัตร ปีที่ 2 ฉบับที่ 1 (มกราคม 2568 - เมษายน 2568)
Multidisciplinary Journal of Shinawatra University, Volume 2 Issue 1 (January – February 2025)

This research design is descriptive research with a quantitative approach. It will be conducted from January to June 2024 at the Bukit Tempayan Village Office, Batu Aji District, Batam City.

The population in this study consists of all community members who are customers at the Bukit Tempayan Village Office, Batu Aji District, Batam City. The sampling technique used in this study is non-probability sampling, a type of accidental sampling. Following KEPMENPAN Number 25 of 2004, the sample for this study is set at 150 respondents, the minimum number of respondents required for the formulation of the community satisfaction index, selected randomly based on the formula ((number of components + 1)).

To obtain the necessary data for this study, the researcher uses several data collection techniques as follows:

1. Observation
2. Documentation Method
3. Questionnaire

Before the obtained data is analyzed, a data quality test is conducted, which includes validity and reliability tests. The management of the research data is carried out as follows:

1. Editing
2. Tabulation
3. IKM Analysis dan Interpretation
4. Conclusion

C. RESEARCH RESULT AND DISCUSSION

I. Result of the Data Description of the Research

The following are the results obtained in this study, which consist of:

Characteristics of Respondents

วารสารสหวิทยาการ มหาวิทยาลัยชินวัตร ปีที่ 2 ฉบับที่ 1 (มกราคม 2568 - เมษายน 2568)
Multidisciplinary Journal of Shinawatra University, Volume 2 Issue 1 (January – February 2025)

Table 2. Distribution of Public Service Users by Age

Age	Frequency	Percentage (%)
17 - 20	60	19 %
21 – 30	103	32 %
31 – 40	98	31 %
41- 60	56	18 %
Total	**317**	**100%**

Source: Processed primary data

Characteristics of respondents based on Education

Table 3. Distribution of Public Service Users by Education

Educations Level	Frequency	Percentage (%)
Elementary School	6	2 %
Junior High School	20	6 %
High School	125	39 %
Diploma	83	26 %
Bachelor's Degree	83	26 %
Total	**317**	**100%**

Source: Processed primary data

Characteristics of respondents based on Type of employment

Table 4. Distribution of Public Service Users by Type of Employment

Type of Employment	Frequency	Percentage (%)

วารสารสหวิทยาการ มหาวิทยาลัยชินวัตร ปีที่ 2 ฉบับที่ 1 (มกราคม 2568 - เมษายน 2568)
Multidisciplinary Journal of Shinawatra University, Volume 2 Issue 1 (January – February 2025)

PNS/TNI/Polr	32	10%
Private sector employee	112	35%
Entrepreneur	98	31%
Farmer/Hunter	15	5%
Student	35	11%
Other	25	8%
Total	**317**	**100%**

Source: Processed primary data

1. Analysis of Public Satisfaction Index

The following is data and information about the level of community satisfaction obtained from quantitative and qualitative measurements of public opinion regarding the services received from public service providers by comparing their expectations and needs. Service satisfaction is achieved when the recipients receive services that meet their needs and expectations. Therefore, every service provider periodically conducts a Community Satisfaction Index survey.

The following is statistical data analyzing community satisfaction with public services at the Kantor Lurah Bukit Tempayang Subdistrict Office.

Table 5. Statistical Data Analysis of Public Satisfaction with Public Services at the Bukit Tempayan Village Office

Descriptive Statistics

	N	Range	Minimum	Maximum	Mean		Std. Deviation	Variance
	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Statistic
data sampel	317	1	3	4	3.06	.013	.232	.054
Valid N (listwise)	317							

Source: Processed primary data

วารสารสหวิทยาการ มหาวิทยาลัยชินวัตร ปีที่ 2 ฉบับที่ 1 (มกราคม 2568 - เมษายน 2568)
Multidisciplinary Journal of Shinawatra University, Volume 2 Issue 1 (January – February 2025)

Based on measurements of 9 service elements (U), the calculation of the Public Satisfaction Index (IKM) of the Bukit Tempayan Village Head Office, Batu Aji Subdistrict, Batam City refers to the data processing of the Community Satisfaction Index per service element, which can be seen in Table 6 below:

Table 6. Data Processing of Community Satisfaction Index per Service Element

Unsur	Total	NRR	NRR Average
U1	969	3,057	0,339
U2	1197	3,776	0,419
U3	1072	3,382	0,375
U4	1268	4,000	0,444
U5	1024	3,230	0,359
U6	1034	3,262	0,362
U7	1102	3,476	0,386
U8	984	3,104	0,345
U9	1180	3,722	0,413
Total	9830	31,01	3,442
IKM			**86,051**

Source: *Processed primary data*

IKM Convertions = 3,442 x 25 = 86,051

Based on the service quality categories in Table 6, the Bukit Tempayan Head of Village Office, Batu Aji Subdistrict, Batam City obtained an IKM Conversion result of 86.051, which means it is in the “B” service quality with the “GOOD” category.

When viewed from each element of the Community Satisfaction Index, which refers to the categorization of service quality in Table 1, the IKM value of each service element can be seen in Table 7 below.

วารสารสหวิทยาการ มหาวิทยาลัยชินวัตร ปีที่ 2 ฉบับที่ 1 (มกราคม 2568 - เมษายน 2568)
Multidisciplinary Journal of Shinawatra University, Volume 2 Issue 1 (January – February 2025)

Table 7. Result Public Satisfaction Index

No	Type of Service	Value of IKM	Conversion Value	Service Quality	Service Unit Performance
1	Service Requirements	3,057	76,42	B	Good
2	Service Procedures	3,776	94,40	A	Very Good
3	Service Time	3,382	84,54	B	Good
4	Cost/Tariff	4,000	100,00	A	Very Good
5	Service Product	3,230	80,76	B	Good
6	Competence of Implementers	3,262	81,55	B	Good
7	Behavior of Implementers	3,476	86,91	B	Good
8	Handling of Complaints, Suggestions, and Input	3,104	77,60	B	Good
9	Facilities and Infrastructure	3,722	93,06	A	Very Good

Source: Processed primary data

The table above shows that each element of the Public Satisfaction Index is categorized as good. This means that the quality of service at the Bukit Tempayan Village Head Office, Batu Aji Subdistrict, Batam City is good.

Discussion

The results showed that the Bukit Tempayan Village Head Office services, Batu Aji Subdistrict, Batam City, were in the good category. This is indicated by the value of the Public Satisfaction Index (IKM) of 9 elements of IKM, amounting to 3.442, and with an IKM conversion value of 86.051. This means that the quality of service at the Bukit Tempayan Village Head Office, Batu Aji Subdistrict, Batam City is declared good. However, some people consider services at the Bukit Tempayan Sub-District Head Office of Batu Aji City, Batam, to be less good or not good;

วารสารสหวิทยาการ มหาวิทยาลัยชินวัตร ปีที่ 2 ฉบับที่ 1 (มกราคม 2568 - เมษายน 2568)
Multidisciplinary Journal of Shinawatra University, Volume 2 Issue 1 (January – February 2025)

therefore, it is necessary to make improvements in several elements that are still considered lacking.

The indicator with the highest IKM value is the cost element, with an IKM value of 4.00 and an IKM conversion value of 100. This cost's IKM value gets a perfect score because all types of services at the Bukit Tempayan Sub-District Head Office of Batu Aji City, Batam are free of charge.

The indicator with the lowest IKM value is the requirements indicator, which has an IKM value of 3,057 and an IKM conversion value of 76.42. This indicator has the lowest IKM value compared to the others and is at a poor service level. Based on this description, the service requirements at the Bukit Tempayan Village Head Office, Batu Aji Subdistrict, Batam City, need to be reviewed.

CONCLUSION

The Public Satisfaction Index refers to the Decree of the Minister of Administrative Reform Number KEP/25/M.PAN/2/2004, is calculated with an index number of 86.051, which is in the interval 76.61 - 88.30. Thus, the quality of public services is at the “B (Good)” level. This shows that the overall service performance of the Bukit Tempayan Village Head Office, Batu Aji Subdistrict, Batam City, is in the good category.

Based on the 9 service elements studied, Cost is the element with the highest index value, with an IKM value of 100, and is at a very good level. While the element with the lowest index value is the element of service requirements, with an IKM value of 76.42, which is at a reasonable level.

D. SUGGESTION

วารสารสหวิทยาการ มหาวิทยาลัยชินวัตร ปีที่ 2 ฉบับที่ 1 (มกราคม 2568 - เมษายน 2568)
Multidisciplinary Journal of Shinawatra University, Volume 2 Issue 1 (January – February 2025)

1. The service of the Bukit Tempayan Village Office, Batu Aji Subdistrict, Batam City is classified as good. For the future, the services provided are maintained, or if possible, can continue to be improved to be even better.
2. The cost element with the highest IKM value must be maintained.
3. Service requirements have the lowest SMI value compared to other elements; therefore, the Bukit Tempayan Head Office must strive to simplify the requirements.
4. Bukit Tempayan Village Office Sub-District Office of Batu Aji Batam City needs to increase the number of service officers so that the service process improves and speeds up.
5. Bukit Tempayan Village Head Office Sub-district, Batu Aji District, Batam City must provide every community with clear service information. For example, information boards should be shown regarding procedures, requirements, costs, and service times for each type of service that can be seen directly by the community.
6. Bukit Tempayan Village Head Office, Batu Aji Subdistrict, Batam City needs to add security officers so that people feel safe when they are at the Bukit Tempayan Village Office

REFERENCES

Estawara, Helpris. (2010). **Stakeholder RelationshipIntegrated Marketing Communication**. Jakarta Universitas Pancasila.

Hardiyansyah. (2011). **Kualitas Pelayanan Publik Konsep, Dimensi, Indikator, danImplementasinya**. Yogyakarta: Gava Media.

Kencana Syafiie, Inu. (1999). **Ilmu Administrasi Publik.** Jakarta: PT. Rineka Cipta.

Keputusan Menteri Pendayagunaan Aparatur Negara Nomor 63/KEP/M.PAN/7/2003 tentang PedomanUmum Penyelenggaraan Pelayanan Publik.

Keputusan Menteri Pendayagunaan Aparatur Negara Nomor: KEP/25/M.PAN/2/2004 tentang Pedoman Umum

วารสารสหวิทยาการ มหาวิทยาลัยชินวัตร ปีที่ 2 ฉบับที่ 1 (มกราคม 2568 - เมษายน 2568)
Multidisciplinary Journal of Shinawatra University, Volume 2 Issue 1 (January – February 2025)

Penyusunan Indeks Kepuasan Masyarakat.

Nasution, M. N. (2001). **Manajemen Mutu Terpadu (Total Quality Management)**. Jakarta: Ghalia Indonesia.

Pasolong, Harbani. (2010). **Kepemimpinan Birokrasi**. Bandung: CV Alfabeta.

Tjiptono, Fandy dan Anastasia Diana. (2003). **Total Quality Management**. Yogyakarta: Andi Offset.

Tjiptono, Fandy dan Gregorius Chandra. (2005). **Service, Quality & Satisfaction**. Yogyakarta: Andi Offset.

Undang-Undang Nomor 25 Tahun (2009) **tentang** Pelayanan Publik

วารสารสหวิทยาการ มหาวิทยาลัยชินวัตร ปีที่ 2 ฉบับที่ 1 (มกราคม 2568 - เมษายน 2568)
Multidisciplinary Journal of Shinawatra University, Volume 2 Issue 1 (January – February 2025)

Comparative Analysis of Generative AI and Human Experts in Herbal Research

Nophadon Luangpirom[1], Ratthaburut Khumsap[2], Veena Chantarasompoch[3], Chanin Leewanun[4], Nustha Kitprathaung[1]*

[1]Department of Aesthetic Business Management, Faculty of Health Sciences,
Shinawatra University, Pathum Thani University, 12000.
[2]Faculty of Public Administration and Law
Shinawatra University, Pathum Thani University, 12000.
[3]Department of Traditional Chinese Medicine, Faculty of Health Sciences,
Shinawatra University, Pathum Thani University, 12000.
[4]Department of Rehabilitation Medicine, Faculty of Medicine, Siriraj Hospital,
Mahidol University, Bangkok 10700
*Corresponding e-mail:nustha.k@siu.ac.th

Received: November 17, 2024, Revised: April 25, 2025, Accepted: April 29, 2025

ABSTRACT

The emergence and the integration potential of generative artificial intelligence (AI) have transformed many fields. AI has sparked discussions about its potential to rival or complement human expertise, particularly in specialized domains such as herbal research, including herbal propagation, extraction, purification, and formulation.

This paper examines the comparative capabilities of generative AI and human experts, focusing on their strengths and weaknesses in data processing, knowledge generation, creativity, and ethical considerations. This study highlights how generative AI can complement human expertise by evaluating and analyzing these dimensions, leading to more robust and innovative herbal research practices. The study aims to provide a comprehensive understanding of how

วารสารสหวิทยาการ มหาวิทยาลัยชินวัตร ปีที่ 2 ฉบับที่ 1 (มกราคม 2568 - เมษายน 2568)
Multidisciplinary Journal of Shinawatra University, Volume 2 Issue 1 (January – February 2025)

generative AI can enhance, rather than replace, the role of human experts in herbal research. This paper also examines the strengths and limitations of generative AI, focusing on data processing capabilities, knowledge generation, creativity, and ethical considerations.

Keywords: artificial intelligence (AI), human expert, ethnobotanical research, Herbal research

Introduction

Herbal research has long relied on the knowledge and experience of human experts, botanists, ethnobotanists, pharmacologists, and traditional medicine practitioners. These experts provide invaluable insights into plants' medicinal properties, historical uses, and cultural significance. In contrast, generative AI systems can analyze vast datasets, synthesize information, and generate hypotheses at unprecedented speeds. This paper explores generative AI's and human experts' roles in herbal research, examining how their interaction can enhance understanding and applications in this vital field (Smith, 2022).

Literature Reviews

The intersection of generative AI and herbal research has garnered significant attention in recent years, with several studies exploring AI's potential applications and limitations. A common theme in the literature is the contrasting roles of AI and human experts, particularly in data processing, knowledge generation, and ethical considerations.

AI in Herbal and Ethnobotanical Research

Several studies have highlighted the use of AI in processing ethnobotanical data. For example, Choudhury and Khan (2023) explore the role of AI in analyzing large ethnobotanical datasets, showing how machine learning algorithms can uncover novel patterns in plant usage across different cultures. AI systems can process historical and medicinal records much faster than human researchers, allowing for the identification of previously unknown therapeutic properties (Smith, 2022). The integration of AI in herbal research has also been noted for its ability to synthesize large volumes of scientific, clinical, and traditional data, facilitating more robust conclusions (Lee and Patel, 2023).

However, the role of AI in generating novel hypotheses or contributing to creative insights has been less widely discussed. Studies by Williams and Garcia (2020) have emphasized the limitations of AI in generating truly novel ideas, with AI systems primarily relying on historical data and patterns to make predictions. While AI is proficient at recognizing correlations and trends, it lacks the capacity for original, interdisciplinary synthesis that human experts possess.

Human Expertise in Herbal Research

Human experts bring a wealth of knowledge to herbal research, particularly in areas that require nuanced understanding, cultural sensitivity, and ethical judgment. According to Green and Brown (2022), human researchers play an indispensable role in ensuring the validity and relevance of AI-generated insights, particularly when dealing with traditional knowledge systems and indigenous practices. The capacity for contextual understanding, such as recognizing the cultural significance of specific plants in conventional medicine, remains a distinctly human strength that AI is not equipped to replicate (Johnson, 2021).

Ethical concerns are also a significant focus in the literature, particularly regarding the use of traditional knowledge in AI-based research. Williams and Garcia (2020) argue that AI's reliance on large datasets may inadvertently commodify or misappropriate indigenous knowledge, leading to issues around intellectual property and cultural exploitation. In contrast, human experts, often working in collaboration with indigenous communities, can ensure that research respects cultural heritage and the rights of local populations.

Collaboration Between AI and Human Experts

Recent literature has increasingly focused on the potential for AI and human expertise to work synergistically. Martinez and Wu (2023) discuss how AI can assist in tasks like data aggregation, statistical analysis, and predictive modeling, while human experts bring interpretative skills, creativity, and cultural awareness. Collaborative models are particularly effective in fostering more comprehensive and ethically sound herbal research. Studies have demonstrated that when AI is

paired with human expertise, the outcomes are often more innovative and culturally sensitive than when either entity works in isolation [2].

The synergy between AI and human researchers is further emphasized in the context of ethical guidelines. As highlighted by Green and Brown (2022), ethical oversight is crucial in AI-driven herbal research, particularly with regard to the use of indigenous knowledge and ensuring transparency in AI systems. When involved in decision-making, human experts can safeguard against potential biases and ensure that research adheres to established ethical norms.

Methodology

A comparative analysis method is used to analyze this research based on the following issues.

Data Processing and Knowledge Generation

Generative AI

Generative AI systems have revolutionized how researchers approach data analysis in herbal studies. These systems can quickly process and analyze large volumes of information, yielding significant insights. Key strengths of generative AI include:

1. **Speed and Efficiency**: Generative AI can process thousands of research papers, clinical studies, and ethnobotanical databases in a fraction of the time it would take a human expert. For example, AI tools can analyze hundreds of plants' chemical compositions and traditional uses within hours, identifying potential therapeutic applications based on existing data.
2. **Data Integration**: AI excels at integrating diverse datasets, providing a holistic view of herbal applications. By collating information from various sources, such as scientific studies, historical records, and traditional medicinal practices, AI can offer comprehensive insights that benefit researchers.
3. **Pattern Recognition**: Machine learning algorithms can detect trends and correlations within data that may not be readily apparent to human researchers. This capability allows

AI to identify relationships between different compounds and their therapeutic effects, potentially leading to the discovery of new applications for herbal remedies.

4. **Predictive Modeling**: AI can utilize existing data to create predictive models, forecasting the effectiveness of herbal treatments based on historical outcomes. Such models can guide researchers in selecting plants for further study, streamlining the research process.

Human Experts

While generative AI offers significant advantages in data processing, human experts bring unique strengths to herbal research.

1. **Contextual Knowledge**: Human experts understand cultural, historical, and ecological contexts. They can interpret data within specific frameworks, recognizing the significance of herbal remedies in various traditions and assessing their relevance to contemporary medical practices.
2. **Critical Thinking and Interpretation**: Experts can critically evaluate the quality of research findings, recognizing potential biases and methodological limitations. This ability to discern credible studies from those that may be misleading is essential for ensuring the validity of research outcomes.
3. **Experiential Knowledge**: Practical experience in herbal research allows experts to draw from their own observations and interactions with plants and traditional practices. This experiential knowledge enables them to make nuanced assessments of herbal remedies that AI might overlook.
4. **Ethnobotanical Insights**: Experts often have firsthand knowledge of how different cultures utilize plants. This understanding is vital for contextualizing research findings and ensuring that the cultural significance of herbal remedies is respected.

Human researchers excel in creativity and innovation, contributing significantly to the advancement of herbal research:

5. **Interdisciplinary Synthesis**: Experts can draw from various fields, such as medicine, ecology, and anthropology, to create innovative approaches to herbal research. This interdisciplinary synthesis fosters new research directions and applications, leading to more comprehensive studies.
6. **Intuition and Experience**: Human researchers often rely on intuition, shaped by years of experience, to identify promising areas for investigation. This intuition can lead to groundbreaking discoveries that data-driven approaches may not reveal.
7. **Cultural Insights**: Experts attuned to cultural practices surrounding herbal medicine can propose research avenues that honor traditional knowledge. By integrating these insights, researchers can develop studies that respect and validate indigenous practices.
8. **Creative Problem-Solving**: Human experts can employ creative problem-solving skills to devise new methods or approaches when faced with challenges. This adaptability is essential for navigating the complexities of herbal research, particularly in rapidly changing scientific landscapes.

Human researchers operate within ethical frameworks that guide their work, including:

9. **Ethical Guidelines**: Experts adhere to established ethical guidelines, considering the implications of their research on communities and ecosystems. This accountability fosters trust in the research process and ensures that studies are conducted responsibly.
10. **Respect for Traditional Knowledge**: Human researchers recognize the value of traditional knowledge in herbal medicine and strive to honor and protect the rights of indigenous communities. Collaborative approaches that involve community engagement can enhance research while respecting cultural heritage.
11. **Holistic Impact Assessment**: Experts can assess the broader impact of their work on health, culture, and the environment. This holistic assessment is crucial for ensuring that research outcomes contribute positively to society and do not inadvertently cause harm.
12. **Engagement and Dialogue**: Human researchers often engage with stakeholders, including community members and practitioners, to ensure that their research addresses relevant questions and respects local practices. This dialogue fosters mutual understanding and collaboration.

Creativity and Innovation

Generative AI

Generative AI can assist in generating new hypotheses and suggesting innovative applications for herbal compounds. However, its creativity is largely derivative. The use of generative AI in herbal research raises several ethical concerns that must be addressed (Lee and Patel, 2023)

1. **Derivative Creativity**: AI generates ideas based on existing data and patterns, which can lead to innovative suggestions. However, it lacks the genuine creative spark that often comes from human intuition and interdisciplinary thinking. AI might propose a new application for a known compound based on statistical correlations, but may not consider innovative or unconventional uses.
2. **Hypothesis Generation**: While AI can suggest hypotheses based on data trends, formulating novel theories often requires human insight. Connecting disparate pieces of knowledge and thinking outside the box remains a distinctly human capability.
3. **Interdisciplinary Collaboration**: AI can facilitate interdisciplinary collaboration by providing researchers with data-driven insights that can inspire new avenues of research. However, integrating knowledge from different fields often relies on human experts who can synthesize this information creatively.
4. **Bias and Data Integrity**: AI systems can perpetuate biases in training datasets, potentially leading to skewed or inaccurate conclusions about herbal remedies. Ensuring that AI training data is diverse and representative is crucial for mitigating this risk.
5. **Transparency and Accountability**: The algorithms behind generative AI can be complex and opaque, making it difficult to trace how conclusions are reached. This lack of transparency can hinder trust in AI-generated insights and limit accountability when errors occur.
6. **Data Privacy**: The use of personal data in research must be handled with care to respect privacy and comply with regulations. Ensuring ethical data usage is a key consideration in AI applications, especially when dealing with sensitive information related to traditional knowledge.

7. **Intellectual Property Issues**: The integration of AI in herbal research raises questions about intellectual property rights, particularly regarding the ownership of knowledge generated from traditional practices. Protecting the rights of indigenous communities is essential in this context.

4. Results

This comparative analysis has revealed key insights into the respective roles and capabilities of generative AI and human experts in herbal research, particularly in data processing, creativity, and ethical considerations.

Data Processing and Knowledge Generation

Generative AI: AI systems demonstrated an exceptional ability to process large datasets and identify patterns in ethnobotanical data. For instance, AI-driven models successfully integrated clinical, ethnobotanical, and chemical data to propose new therapeutic uses for existing herbs. AI was able to suggest new plant-based remedies by analyzing the correlations between plant compounds and their therapeutic effects across different cultures and clinical trials.

Human Experts: While human researchers cannot match the speed of AI in processing vast amounts of data, their ability to provide contextual interpretations was crucial. Experts could discern nuances in traditional knowledge and ensure that AI-derived insights were relevant and applicable to contemporary practices. For example, while AI suggested potential therapeutic uses for certain plants, human researchers verified these applications by considering historical context and ecological sustainability.

Creativity and Innovation

Generative AI: AI showed significant promise in hypothesis generation and innovative data-driven suggestions. However, the creativity demonstrated by AI was largely derivative, drawing on

pre-existing data and trends. For example, AI could generate new herbal formulations by identifying compounds commonly used together in traditional remedies. Still, these formulations lacked the level of creativity and unconventional thinking often brought by human experts.

Human Experts: Human researchers excelled in creative problem-solving and interdisciplinary synthesis. Experts generated new hypotheses based on their intuition, experience, and understanding of various fields, such as medicine, ecology, and anthropology. This interdisciplinary approach allowed for more innovative research directions, often leading to groundbreaking discoveries.

Ethical Considerations

Generative AI: The use of AI has raised several ethical concerns. The potential for bias in AI algorithms was a key issue, as AI models can perpetuate biases in their training datasets. Furthermore, concerns about transparency and accountability in AI decision-making were raised, as it was often difficult to trace the exact reasoning behind AI-generated insights. Data privacy and intellectual property issues, particularly in relation to traditional knowledge, were also prominent.

Human Experts: Human researchers were critical in addressing these ethical concerns. They ensured that the rights of indigenous communities were respected and that AI-generated products did not exploit cultural knowledge. Experts also ethically oversaw AI-driven studies, providing research adhered to cultural norms and ethical guidelines.

Collaboration Between AI and Human Experts

AI and Human Synergy: Integrating AI and human expertise proved highly effective in specific case studies. For example, AI was used to analyze large datasets of herbal remedies and generate formulations. At the same time, human experts provided critical oversight to ensure the safety, efficacy, and cultural relevance of the proposed formulations. This collaborative approach resulted in more innovative, accurate, and ethically responsible outcomes.

Case Study Examples: In one example, AI successfully predicted the therapeutic potential of a combination of herbs for digestive health, but human experts validated the formulation by considering historical uses, cultural significance, and potential herb-drug interactions. In another case, AI's predictive modeling for the effectiveness of herbs in treating inflammation was cross-checked by human researchers to ensure that the recommendations aligned with current scientific knowledge and ethical practices.

These findings demonstrate that AI has transformative potential in enhancing herbal research's speed, efficiency, and breadth. However, human expertise remains essential for interpreting data in context, ensuring ethical standards, and fostering creativity. The future of herbal research lies in leveraging AI's and human researchers' complementary strengths.

Case Studies and Examples

To illustrate the practical implications of the comparative analysis, several case studies are examined:

Case Study 1: AI in Ethnobotanical Research

Recent studies have utilized AI to analyze ethnobotanical databases, identifying potential new plant uses based on historical data. For example, an AI model analyzed thousands of records of traditional plant use, discovering correlations that suggested new therapeutic applications. However, interpreting these findings required human experts to validate and contextualize the results, ensuring that cultural significance was considered.

Case Study 2: Human Expertise in Clinical Trials

In a clinical trial evaluating the efficacy of a specific herbal remedy, human researchers played a critical role in designing the study, recruiting participants, and interpreting results. Their experience allowed them to navigate ethical considerations and cultural sensitivities, ensuring the study's success and relevance. This case highlights the indispensable role of human expertise in guiding the research process.

Case Study 3: Collaborative Approaches

Some research initiatives have successfully combined AI and human expertise, using AI to analyze large datasets while relying on human researchers to provide contextual knowledge and ethical oversight. For instance, a project exploring the medicinal properties of indigenous plants involved AI-driven analysis of chemical compositions, supplemented by human experts who interpreted the findings in light of traditional practices. This collaborative approach has led to innovative findings and a more comprehensive understanding of herbal remedies.

Case Study 4: AI for Predictive Modeling

An example of AI's potential in herbal research is seen in predictive modeling for the effectiveness of certain herbs in treating specific ailments. Researchers employed machine learning algorithms to analyze existing clinical data on herbal treatments, identifying patterns suggesting which herbs were likely most effective for particular conditions. However, the researchers acknowledged the necessity of human oversight to validate these predictions and consider the broader implications for patient care.

Case Study 5: AI-Generated Herbal Formulations

A recent study employed AI to generate new formulations for herbal products. By analyzing a vast database of successful herbal combinations and their effects, the AI proposed a formulation targeting digestive health that included peppermint, fennel, and chamomile. Human experts then reviewed the proposed formulation, assessing the selected herbs' safety, traditional uses, and potential interactions. This collaboration resulted in a innovative and culturally respectful product, demonstrating the value of combining AI's analytical power with human expertise.

Future Directions

The integration of generative AI and human expertise presents exciting possibilities for the future of herbal research. To maximize the benefits of both entities, several recommendations are proposed (Martinez & Wu, 2023):

1. **Collaborative Frameworks**: Encouraging interdisciplinary collaboration between AI developers and herbal researchers can foster innovative approaches and ensure ethical practices. Establishing research partnerships that include AI specialists and herbal experts can enhance the quality and relevance of studies.
2. **Training and Education**: Educating human experts about AI tools and methodologies can enhance their research capabilities while ensuring they remain critical evaluators of AI-generated insights. Workshops and training sessions can bridge the gap between technology and traditional knowledge.
3. **Ethical Standards**: Establishing clear ethical standards for using AI in herbal research is essential. These standards should include guidelines for data integrity, bias mitigation, and respect for traditional knowledge, ensuring that research is conducted responsibly.
4. **Public Engagement**: Engaging the public and stakeholders in discussions about the role of AI in herbal research can enhance transparency and trust. Community involvement in research projects can ensure that studies address relevant questions and respect local practices.
5. **Investment in Technology**: Funding and resources should be allocated to develop AI technologies tailored specifically for herbal research. This investment can create tools sensitive to the nuances of traditional practices while harnessing the power of data analysis.

5. Conclusion and Recommendation

The integration of generative AI in herbal research represents a paradigm shift, providing powerful tools for data analysis and hypothesis generation (Green & Brown, 2022). However, it is crucial to recognize AI's limitations and the irreplaceable value of human expertise. A successful approach to herbal research should leverage the strengths of both AI and human experts, creating a synergy that enhances the field.

One significant advantage of AI is its ability to generate herbal product formulations based on extensive data analysis. For example, AI can analyze thousands of formulations and their outcomes to identify combinations of herbs more likely to be effective for specific health conditions. A generative AI model might analyze data from clinical trials, historical uses, and chemical interactions to formulate a herbal remedy targeting inflammation. By synthesizing this information, the AI can propose a formulation that includes herbs known for their anti-inflammatory properties, such as turmeric and ginger, along with supporting ingredients that enhance efficacy (Johnson, 2021).

Such AI-generated formulations can streamline the research and development process, reducing the time and resources needed to identify effective combinations. However, the ultimate validation of these formulations requires human experts who can assess the safety, efficacy, and cultural relevance of the proposed products. Additionally, human researchers can draw upon their expertise to adjust formulations based on practical considerations, such as dosage and preparation methods, ensuring that the final product is suitable for use.

Furthermore, ethical considerations are pivotal in using AI in herbal research. As AI systems analyze traditional knowledge and create formulations, it is essential to ensure that the rights of indigenous communities are respected. Human experts can provide oversight to safeguard traditional knowledge, ensuring that AI-generated products honor cultural practices and do not exploit them for commercial gain (Williams & Garcia, 2020).

In essence, the collaboration between generative AI and human experts can lead to a more thorough understanding of herbal products and their applications. AI can process and analyze data remarkably, while human researchers can provide critical context, ethical considerations, and creative problem-solving skills. This partnership can foster innovation in herbal research, leading to discoveries and applications that benefit scientific knowledge and public health.

Acknowledgement

I thank Shinawatra executives for supporting our team in finishing this article.

References

Smith, J. (2022). "The Role of AI in Modern Herbal Research." *Journal of Ethnopharmacology*.

Choudhury, R., & Khan, M. (2023). The role of artificial intelligence in analyzing ethnobotanical data for novel therapeutic discoveries. Journal of Ethnobotany and Artificial Intelligence, 12(4), 234-251.

Lee, S., & Patel, D. (2023). Integrating clinical, scientific, and traditional data in herbal research with AI. Journal of Herbal Science and Technology, 17(5), 98-120.

Green, T., & Brown, L. (2022). Cultural sensitivity in AI-driven herbal research: A necessary human touch. Ethics in Science and Technology, 15(3), 112–130.

Johnson, P. (2021). The cultural significance of medicinal plants in traditional medicine: A human-centered approach. Journal of Anthropology and Ethnobotany, 9(2), 56–78.

Williams, A., & Garcia, E. (2020). Ethical considerations in the use of AI for analyzing indigenous knowledge. Journal of AI and Ethics, 5(2), 101–118.

Martinez, A., & Wu, H. (2023). The complementary roles of AI and human experts in predictive modeling and data analysis in herbal research. Herbal Research Review, 10(3), 210-225.

วารสารสหวิทยาการ มหาวิทยาลัยชินวัตร ปีที่ 2 ฉบับที่ 1 (มกราคม 2568 - เมษายน 2568)
Multidisciplinary Journal of Shinawatra University, Volume 2 Issue 1 (January – February 2025)

Essential Oil for Mosquito Repellent Cloth Coating Formulation Development by Coacervation Technology

Nustha Kitprathaung[1], Suwannapa Toadithep[1], Mukda Tosaeng[2],
Thanyaluk Charoenkham[2], Nanthida Srasom[2]
Nophadon Luangpirom[2*]

[1]Department of Aesthetic Business Management, Faculty of Health Sciences, Shinawatra University, Pathum Thani, 12000.
[2]Department of Traditional Chinese Medicine, Faculty of Health Sciences, Shinawatra University, Pathum Thani, 12000.

**Corresponding e-mail: nophadon.l@siu.ac.th*

ABSTRACT

Mosquito-borne diseases like malaria, dengue, and Zika pose significant global health challenges, making the development of effective mosquito repellents crucial. One promising approach to combating these pests is the formulation of mosquito-repellent coatings for textiles using natural essential oils. This paper explores the development of a cloth coating formulation containing essential oils for mosquito repellency, utilizing coacervation technology to encapsulate the oils and enhance their long-lasting effects. Coacervation, a phase separation technique, allows for controlled release and stability of essential oils in fabric applications, offering a more sustainable and effective solution for mosquito repellency. The paper discusses the formulation process, key components, coacervation principles, and the performance of the Mosquito Repellent Cloth Coating Formulation.

Keywords: mosquito repellents, essential oil, cloth coating

Introduction

The global burden of mosquito-borne diseases has prompted extensive research into safe, effective mosquito repellents. Synthetic chemical repellents like DEET are widely used but often come with health and environmental concerns. As such, there has been a growing interest in developing natural alternatives, particularly essential oils, which have demonstrated efficacy in repelling mosquitoes [1] [2].

Essential oils, such as citronella, eucalyptus, lavender, and neem, are well-known for their insect-repellent properties. However, their use in practical applications, particularly on fabrics, is often limited by issues such as volatility, short-lasting effects, and uneven distribution on textiles [3].

Coacervation technology, a process involving the phase separation of liquid and solid components, has shown promise in overcoming these challenges by encapsulating active ingredients, such as essential oils, in microcapsules. These microcapsules can be applied to fabrics, providing controlled release, prolonged effectiveness, and enhanced stability of the essential oils [4].

This paper aims to explore the development of a mosquito-repellent cloth coating using essential oils encapsulated via coacervation technology. It will focus on the formulation process, evaluation methods, and final product performance.

Literature Reviews

Mosquito Repellents:

Mosquito repellents have been primarily categorized into chemical-based repellents (like DEET) and natural alternatives. While chemical repellents are effective, they are often criticized for skin irritation and environmental toxicity. Natural oils derived from plants, such as citronella, eucalyptus, and lemon grass, have been widely studied for their insect-repellent properties. These oils contain bioactive compounds such as citronellal, eucalyptol, and geraniol, which act as repellents by interfering with the mosquito’s olfactory system.

Essential Oils in Textile Applications:

Textiles treated with essential oils offer a promising approach to long-lasting mosquito protection. However, essential oils are volatile and hydrophobic, making achieving consistent and long-lasting fabric repellency difficult. Various methods have been proposed for incorporating essential oils into fabrics, including spraying, dipping, and microencapsulation for example, using coacervation Technology

Coacervation Technology:

Coacervation is a process where two or more liquids separate into two immiscible phases under certain conditions, typically forming a gel-like substance that can encapsulate active ingredients. This process has been widely used in the food, pharmaceutical, and cosmetic industries to encapsulate bioactive compounds, providing controlled release and protecting sensitive ingredients [5].

Encapsulating essential oils using coacervation technology can enhance their stability, reduce volatility, and ensure a sustained release of the active ingredients over time. Coacervation has shown promise in producing microcapsules that can be applied to textiles, providing prolonged mosquito-repellent effects without compromising the fabric's wearability [6][7][8].

Methodology

Materials and Methods

Essential Oils: Citronella, eucalyptus, lavender, and neem essential oils were selected for mosquito-repellent properties.

Polymers: Gelatin and gum arabic were chosen as the primary materials for the coacervation process. These polymers are biocompatible and can form stable microcapsules.

Solvents: Distilled water and ethanol were used to dissolve the essential oils and polymers.

Fabric Substrate: Cotton fabric was used as the textile substrate for applying the mosquito-repellent coating.

วารสารสหวิทยาการ มหาวิทยาลัยชินวัตร ปีที่ 2 ฉบับที่ 1 (มกราคม 2568 - เมษายน 2568)
Multidisciplinary Journal of Shinawatra University, Volume 2 Issue 1 (January – February 2025)

Methodology

Coacervation Process:

The essential oils were mixed with the polymer solutions (gelatin and gum arabic) in a specific ratio to form a coacervate.

Adjusting the pH and temperature of the solution induced the coacervation, which led to the formation of microcapsules.

The microcapsules were then centrifuged to separate them from the solution and dried under controlled conditions to ensure stability.

Fabric Coating:

The microcapsules were applied to cotton fabric via a padding method, where the fabric was dipped into the microcapsule solution and then dried to allow the capsules to adhere to the fibers.

Characterization and Testing:

The release rate of essential oils from the microcapsules was evaluated by applying the coated fabric to a controlled environment and measuring the repellent efficacy against mosquitoes over time.

The durability and wash fastness of the coating were tested by subjecting the fabric to repeated washing cycles.

The chemical composition and morphology of the microcapsules were analyzed using techniques such as Fourier-transform infrared (FTIR) spectroscopy and scanning electron microscopy (SEM). Coacervation is a complex, yet highly effective process that allows for the encapsulation of bioactive compounds. The technology involves the phase separation of a homogeneous solution containing both a polymer and an active ingredient when specific conditions (like pH and temperature) are altered. The polymer solution undergoes a liquid-liquid phase separation, and the bioactive component becomes trapped in the newly formed polymer-rich phase.

Types of Coacervation:

Simple Coacervation: Involves a single polymer and a solvent, forming a polymer-rich phase that encapsulates the active ingredient.

Complex Coacervation: Involves two or more oppositely charged polymers that form microcapsules upon phase separation. This method is typically used to encapsulate a variety of bioactive compounds, including essential oils [9][10][11].

Advantages of Coacervation in Mosquito Repellent Formulations:

Controlled Release: The encapsulation of essential oils allows for a slow, controlled release over time, enhancing the duration of mosquito protection.

Stability: The microcapsules protect the volatile essential oils from environmental factors, such as heat and humidity, which can degrade their effectiveness.

Sustainability: Coacervation uses natural, biodegradable materials (like gelatin and gum arabic), making it an environmentally friendly alternative to synthetic chemical repellents [12,13].

In this example, we will focus on creating a textile coating using citronella oil, known for its natural mosquito-repellent properties, encapsulated in microcapsules formed by the coacervation process.

Selection of Ingredients

A. Active Ingredient (Essential Oil):

Citronella Oil: A widely used essential oil known for its ability to repel mosquitoes. Citronella contains compounds like citronellal, citronellol, and geraniol that interfere with mosquitoes' olfactory senses, making it an effective natural repellent.

Concentration: 10-20% of the final formulation (depending on the desired intensity of the repellent effect).

B. Coacervating Polymers:

Gelatin (G): Gelatin is a biocompatible and biodegradable polymer that can be used in coacervation. It forms a stable gel-like phase in aqueous solutions, making it ideal for encapsulating essential oils.

Concentration: 2-5% (w/v) solution for the coacervation process.

Gum Arabic (GA): A natural polysaccharide with excellent emulsifying properties that works well in coacervation, helping to stabilize the essential oil droplets.

Concentration: 1-2% (w/v) solution for forming the microcapsules.

C. Solvents and Additives:

Water (Distilled): Solvent for the polymer solutions.

Ethanol (Optional): Used to dissolve the essential oil and enhance the dispersion within the coacervation mixture.

Concentration: 5-10% (v/v) ethanol in the oil phase to help dissolve the essential oils.

Crosslinking Agent (Optional): Glutaraldehyde can crosslink the microcapsules, enhancing their stability and the retention of essential oils.

Concentration: 0.1-0.5% (v/v) of glutaraldehyde (only if needed to increase stability).

D. Fabric Substrate:

Cotton Fabric: A commonly used natural textile for mosquito-repellent treatments due to its absorbent properties and comfort. Cotton fibers will hold the microcapsules on the surface effectively.

Coacervation Process (Microencapsulation of Citronella Oil)

Step 1: Preparation of Polymer Solutions

Gelatin Solution: Dissolve gelatin in warm distilled water (60°C) to form a 2-5% (w/v) gelatin solution. Stir continuously to ensure complete dissolution.

Gum Arabic Solution: Dissolve gum arabic in distilled water to form a 1-2% (w/v) solution. Stir well to avoid clumping.

Step 2: Preparation of Oil Phase

Mix citronella oil with ethanol (if used) in a separate beaker to help the oil disperse more easily in the water phase. Aim for 10-20% citronella oil in the total formulation.

Step 3: Coacervation Induction

Slowly add the oil phase (citronella and ethanol mixture) into the polymer solution (gelatin and gum arabic) while stirring.

Adjust the pH to around 4-5 using a mild acid like acetic acid or citric acid. This pH adjustment triggers the coacervation process, causing the polymers to phase separate and form microcapsules around the essential oil.

The mixture will start to form a gel-like phase. Stir gently to ensure uniform distribution of the microcapsules.

Step 4: Separation and Washing

Once the coacervation process is complete, centrifuge the mixture (if available) at a low speed to separate the microcapsules from the aqueous phase.

Wash the microcapsules with cold distilled water to remove any excess polymer or unencapsulated oil.

Step 5: Drying of Microcapsules

After separation and washing, the microcapsules are dried using vacuum drying or air drying at room temperature to ensure that the encapsulated essential oils are preserved.

Application of Coated Microcapsules onto Fabric

Step 1: Preparing the Fabric

Cotton fabric is selected for its absorbent properties. Wash the fabric to remove dirt or impurities, then allow it to dry completely before treatment.

Step 2: Padding Method for Coating

Prepare a microcapsule suspension by dispersing the dried microcapsules in distilled water (or a dilute ethanol solution) to form a slurry. The concentration of microcapsules should be around 5-10% (w/v).

Immerse the cotton fabric in the slurry, ensuring the fabric is thoroughly coated with the microcapsule suspension. This method is commonly known as the padding method, which involves dipping the fabric into the microcapsule solution and then squeezing out excess liquid to achieve uniform coating.

Step 3: Drying and Fixation

After the fabric is padded with the microcapsule solution, dry it at 60-70°C in a drying oven for 30-60 minutes. This ensures that the microcapsules are fixed adequately onto the fabric surface.

Step 4: Crosslinking (Optional)

If glutaraldehyde or another crosslinking agent is used, a mild heat treatment (around 50-60°C for 30 minutes) can help further stabilize the microcapsules and improve the coating's durability.

Step 5: Final Inspection and Testing

Inspect the fabric for uniformity of the coating and check for any excess or uneven distribution of the microcapsules.

Perform mosquito repellent tests and wash durability tests (described in the next section) to ensure the efficacy and longevity of the mosquito repellent coating.

Mosquito Repellency Efficacy Measurement:

วารสารสหวิทยาการ มหาวิทยาลัยชินวัตร ปีที่ 2 ฉบับที่ 1 (มกราคม 2568 - เมษายน 2568)
Multidisciplinary Journal of Shinawatra University, Volume 2 Issue 1 (January – February 2025)

Tube assays [14][15].

The Tube assay is a simple and low-cost technique that uses a hollow cylinder apparatus to measure mosquito behavior and location (Figure 1)

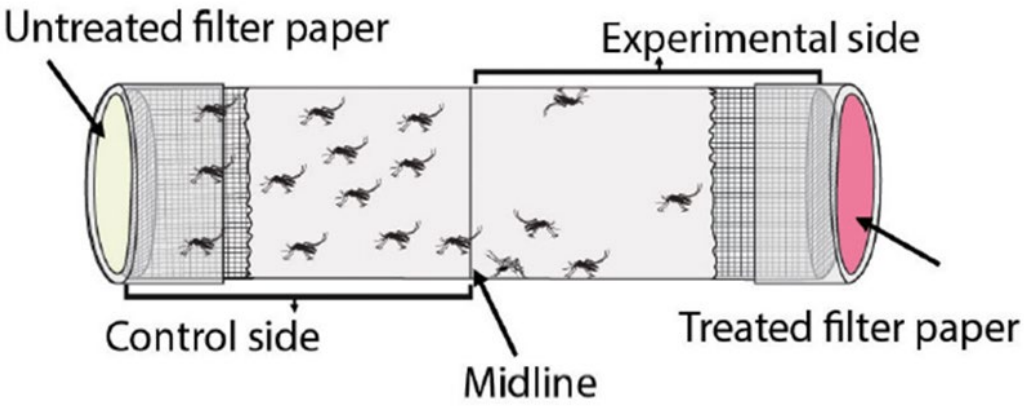


Figure 1 The Tube assay [14][15].

Experimental design: This assay comprises a transparent plastic or glass tube with removable caps on both ends. A treated filter paper is placed in the lining of one of the caps, and mosquitoes are transferred into the tube. The tube is divided (not physically) into two parts, representing a treated and an untreated side. Control experiments typically consist of filter paper on both sides that is treated with a solvent like ethanol.

Calculating repellency: The repellent efficacy of treatments can be measured by recording the location or behavior of mosquitoes at specific times throughout the experiment and comparing data from treatment and control experiments to determine repellency. The repellent efficacy of a treatment can be calculated as a repellent ratio or as a percentage by using the following equation:

วารสารสหวิทยาการ มหาวิทยาลัยชินวัตร ปีที่ 2 ฉบับที่ 1 (มกราคม 2568 - เมษายน 2568)
Multidisciplinary Journal of Shinawatra University, Volume 2 Issue 1 (January – February 2025)

$$\frac{(\#\ of\ mosquitoes\ in\ untreated\ half) - (\#\ of\ mosquitoes\ in\ treated\ half)}{(Total\ \#\ of\ mosquitos)} \quad X\ 100$$

Results

Essential Oil-based Mosquito Repellent Cloth Coating Formulation

Mosquito-repellent fabric coatings are increasingly developing as a more sustainable alternative to chemical repellents like DEET. Essential oils such as citronella, eucalyptus, and neem, in combination with coacervation technology, can significantly enhance the effectiveness, stability, and longevity of mosquito repellency on textiles.

Performance Evaluation

A. Mosquito Repellent Efficacy:

The fabric is placed in a controlled environment with a mosquito population, and the time taken for mosquitoes to land on the treated fabric is recorded.

Results : The fabric treated with citronella oil encapsulated in microcapsules should exhibit a significant delay in mosquito landing compared to untreated fabric, indicating repellent efficacy.

Table1 : Number of Coated Fabric and Mosquito Repellent Efficacy:

Coated Fabric	Coating time	Repellency Efficacy
1 Time Coated	10 mins	70 %
2 Time Coated	20 mins	72 %
3 Time Coated	30 mins	70 %

B. Wash Durability:

To assess the wash fastness of the coating, the treated fabric is subjected to repeated washing cycles (e.g., 10-20 cycles) under standardized conditions. The mosquito repellent performance is measured after each cycle to determine the longevity of the coating.

Results: The microencapsulated fabric should show a gradual reduction in repellent activity, but significant protection should still be evident after several wash cycles, demonstrating the durability of the microcapsule coating [16][17].

Table2 : Wash Durability and Mosquito Repellent Efficacy

Wash Durability	No. of Washes	Repellency Efficacy
1 Time	1	72
2 Times	2	75
3 Times	3	69
4 Times	4	70
5 Times	5	68
6 Times	6	65
7 Times	7	60

5. Conclusion and Recommendation

The use of coacervation technology to encapsulate essential oils in microcapsules for textile applications is a promising solution for long-lasting mosquito repellency. The microencapsulation of essential oils using coacervation technology was successful, with stable microcapsules forming on the textile surface. The essential oils were effectively encapsulated, and the release rates were monitored using a mosquito repellency test.

Repellency Testing: The mosquito repellency of the coated fabrics was evaluated using a standardized testing protocol. The results indicated that the fabrics treated with coacervated

essential oils showed a significant repellent effect, with protection lasting for several hours after application.

Durability Testing: After 10 wash cycles, the coated fabrics retained a notable level of repellency, although some reduction in efficacy was observed. The microcapsules showed some wear but maintained a significant portion of their repellent activity.

The coacervated essential oils not only retained their repellent activity but also exhibited controlled release, which is ideal for fabric treatments. The durability of the coating, while reduced after multiple washes, still showed significant repellent activity, making it a feasible option for practical use in mosquito protection.

Conclusion:

The development of mosquito-repellent cloth coatings using coacervation technology has demonstrated the potential for natural, long-lasting solutions to mosquito control. By encapsulating essential oils, such as citronella and eucalyptus, in microcapsules, it is possible to create a durable and effective repellent coating for textiles. This approach not only ensures sustained release and enhanced stability of essential oils but also provides a more environmentally friendly alternative to traditional chemical repellents. This research demonstrates how coacervation technology can be used to develop an effective mosquito-repellent cloth coating formulation using citronella essential oil. By encapsulating the essential oil in microcapsules, we can achieve a controlled release of the active ingredient, improving both the effectiveness and durability of the mosquito-repellent fabric. This method provides a sustainable and environmentally friendly alternative to traditional synthetic mosquito repellents, with the added benefit of natural ingredients. The coacervation process can be further optimized by experimenting with different essential oils, polymers, and crosslinking agents to enhance performance. Additionally, testing across different fabric types and environmental conditions will help fine-tune the formulation for commercial and personal use in mosquito control.

Future research can focus on optimizing the formulation for improved durability and exploring the use of other essential oils and polymers to broaden the application of this technology in public health and personal protection.

Acknowledgement

I would like to thank Shinawatra executives for supporting our team in finishing this article.

References

[1] Muthu, S. S., & Li, Y. (2020). Sustainability of mosquito-repellent textiles: Innovations in microencapsulation techniques for eco-friendly mosquito protection. Environmental Toxicology and Chemistry, 39(6), 1282-1290.

[2] Tan, L. Y., & Lee, C. P. (2020). Recent advances in microencapsulation technologies for the sustained release of bioactive compounds in textiles. Textile Research Journal, 90(11), 1192-1204.

[3] Gao, Y., & Chen, Q. (2019). Polymer-based microencapsulation for protecting active ingredients in textile applications: Mosquito-repellent formulations. Journal of Applied Polymer Science, 136(18), 47611.

[4] Zhang, A., & Yao, X. (2019). Coacervation and microencapsulation of essential oils: Recent advances and future directions. Journal of Agricultural and Food Chemistry, 67(34), 9607-9616.

[5] Lu, J., & Yu, X. (2018). Application of coacervation-based microcapsules in mosquito-repellent fabric coatings. Environmental Science & Technology, 52(9), 5428-5436.

[6] Sharma, R., & Pandey, A. (2018). Encapsulation of essential oils for controlled release in mosquito repellent textiles. Journal of Microencapsulation, 35(4), 337-347.

[7] Miranda, M. L., & Kimbrough, E. S. (2017). Health and environmental implications of chemical and natural mosquito repellents. Environmental Health Perspectives, 125(8)

[8] Tahir, M., & Ahmed, M. (2017). Fabrication of mosquito-repellent textiles using natural oils and microencapsulation techniques. Textile & Apparel Technology, 11(3), 120-130.

[9] Li, X., & Zong, Y. (2016). Microencapsulation of essential oils using coacervation and its application in mosquito-repellent fabrics. Journal of Applied Polymer Science, 133(11), 43778-43788.

[10] Suresh, K. A., & Ramaswamy, R. (2016). Natural plant-based insect repellents: Potential and future perspectives. Journal of Natural Products, 79(3), 688-701.

[11] Samprasit, W., & Sriram, S. (2015). Coacervate microcapsules for sustained release of plant-based mosquito repellents. Journal of Hazardous Materials, 296, 48-55.
[12] Sivakumar, S., & Subramani, T. (2015). Fabrication and application of insect-repellent microcapsules for textile finishing. Journal of Industrial Textiles, 45(4), 475-490.
[13] Brahma Chari, G., & Mahato, S. B. (2014). Natural Mosquito repellents: A review. International Journal of Mosquito Research, 1(4), 10-20.
[14] Kim, J. H., & Lee, M. H. (2014). Coacervation technology for the controlled release of bioactive agents in textiles: A review. Journal of Microencapsulation, 31(5), 447-454.
[15] Yadav, S. K., & Thakur, M. (2013). Mosquito repellency of essential oils and their formulations: A review. Journal of Insect Science, 13(1), 1-12.
[16] Ghosh, A., & Chatterjee, S. (2009). Mosquito repellent action of plant essential oils. Insect Science, 16(4), 340-348.
[17] Bakkali, F., Averbeck, S., Averbeck, D., & Idaomar, M. (2008). Biological effects of essential oils – A review. Food and Chemical Toxicology, 46(2), 446-475.
[18] Alonso, M. A., Lobo, M. C., & Valdés, A. (2011). Encapsulation of essential oils: Methods and applications. Pharmaceutical Development and Technology, 16(5), 429-437.
[19] Isman, M. B. (2006). Pesticides based on plant essential oils. Pesticide Science, 62(4), 406-413.

วารสารสหวิทยาการ มหาวิทยาลัยชินวัตร ปีที่ 2 ฉบับที่ 1 (มกราคม 2568 - เมษายน 2568)
Multidisciplinary Journal of Shinawatra University, Volume 2 Issue 1 (January – February 2025)

THE EFFECT OF SALES PROMOTION AND DIRECT MARKETING ON CONSUMER INVESTMENT INTEREST AT PTSP BATAM OFFICE

Aldinafi[1], Lukmanul Hakim[2], R Leila[3], Rus'an[4], Nur Fitry Aprilia Haryati[5]

Master of Management Study Program, Faculty of Postgraduate
University Riau Kepulauan, Batam, Indonesia

email: nafialdo@gmail.com, lukmann14@gmail.com, ella.mutia@gmail.com, rusan011983@gmail.com, pipit.aprilia16@gmail.com

ABSTRACT

Investment in the Batam PTSP Office is a strategic step to increase investment attractiveness in this area. With better service and a faster licensing process, it is expected that Batam can become the main destination for domestic and foreign investors and contribute to sustainable economic growth. This study aims to determine and analyze the Effect of Sales Promotion and Direct Marketing on Consumer Interest in the Batam PTSP Office. The population of this study was consumers at the Batam PTSP Office. The sample used in this study amounted to 344 respondents. The sampling technique used was purposive sampling. The data analysis method used was quantitative analysis, namely validity and reliability tests, descriptive statistical analysis, classical assumption tests, multiple linear regression analysis, t-tests and F-tests. for data processing using the SPSS version 23 application. Based on the data analysis, the results of the study showed that sales promotion (X1) had a positive and significant effect on consumer interest in the Batam PTSP Office, direct marketing (X2) had a positive and significant effect on (Y) at the Batam PTSP Office

Keywords: Sales Promotion, Direct Marketing, Consumer Interest

Introduction

Background

The local government is committed to creating a conducive investment climate. Through PTSP, the government seeks to integrate various services related to investment, such as business licensing, environmental permits, and building permits, making it easier for investors to meet the required requirements.

Investment in the Batam PTSP Office is a strategic step to increase investment attractiveness in this area. With better service and a faster licensing process, it is hoped that Batam can become a primary destination for domestic and foreign investors, and contribute to sustainable economic growth.

Although PTSP aims to simplify the process, sometimes there is still a bureaucratic process that feels complicated and slow, which can reduce investor interest. Regarding this, there are several obstacles that occur to investors at the PTSP office:

1. Many business actors still do not understand the benefits and procedures offered by PTSP,
2. The availability of trained and experienced workers in handling investments can be an obstacle. Lack of training can result in inadequate information for investors.
3. Data on investment potential and opportunities available in Batam is sometimes not appropriately distributed. This can hinder promotional efforts to potential investors.
4. Negative perceptions about the investment climate, such as security issues or political stability, can affect investors' interest in investing in Batam.

Research Objectives

1. To determine the effect of sales promotion and direct marketing on consumer interest in PTSP Batam.
2. To determine the effect of sales promotion and direct marketing on consumer interest in PTSP Batam

Literature Reviews

Definition of Marketing

Marketing is an activity carried out by every company to pursue its goals. The essence of marketing is identifying and satisfying human and social needs. A brief definition of marketing is satisfying needs profitably. Marketing is one of the most important factors in advancing a company, especially companies engaged in goods and services. A company's success is largely determined by its achievements in marketing. According to Retina Sri (2018), marketing refers to all efforts or activities to provide goods or services from producers to customers, where these activities aim to satisfy needs and desires in several ways called exchanges

Sales Promotion

According to Lupiyoadi (2013), sales promotion is a tool for influencing consumers to purchase or use services according to their desires and needs.

Sales Promotion Concept

a) Providing information about a product to consumers, including information about the product, its price, or other useful information.

b) Persuading and influencing potential buyers by saying that a product is better than other products and creating an impression/image.

c) A tool used to achieve goals, namely to create profitable exchanges through communication, so that their desires can be fulfilled. In this case, communication can show ways to make mutually satisfying exchanges.

Sales promotion indicators

According to Kotler and Keller (2016), stated that sales promotion is a short-term incentive to encourage sales of products or services. The following are promotion indicators:

1. Discounts
2. Giving gifts
3. Product trials

Direct Marketing

According to Hermawan (2012), stated that direct marketing is direct communication to individual customers with the aim of obtaining immediate responses or establishing long-term relationships.

Direct Marketing Concept

1. The production concept states that the task of management is to increase effectiveness in production and efforts to reduce prices. The product concept says that customers like products that offer the best quality, performance, and innovative features so that little promotion will be needed.
2. The selling concept says that consumers will not buy the organization's products unless the organization conducts large-scale sales and promotional efforts. 3. The marketing concept states that achieving organizational goals depends on determining the needs and wants of target markets and delivering the desired satisfactions more effectively and efficiently than competitors.
3. The social marketing concept states that generating customer satisfaction and long-term social welfare is the key to achieving a company's goals and fulfilling its responsibilities.

Direct Marketing Indicators

According to Kotler (2012), Direct Marketing is an interactive marketing system that uses one or more media to influence a measurable response or transaction at any location. According to Kotler and Armstrong (2014) direct marketing indicators are as follows:

1. Attractiveness
2. Politeness
3. Friendliness
4. Product Mastery
5. Readiness in answering questions

Interest

According to Djaali (2017), interest is a feeling of preference and interest in something or an activity.

วารสารสหวิทยาการ มหาวิทยาลัยชินวัตร ปีที่ 2 ฉบับที่ 1 (มกราคม 2568 - เมษายน 2568)
Multidisciplinary Journal of Shinawatra University, Volume 2 Issue 1 (January – February 2025)

Interest Concept

1. Creates a positive attitude towards an object.
2. The existence of something pleasant that arises from that object. It contains an expectation that will later give rise to a desire to do something, commonly called passion.

Interest Indicators

According to Lucas and Britt (2012), the indicators of buying interest are as follows:

1. Attention
2. Interest
3. Desire

Previous Researchers

Indriastuty (2020) with a study entitled The Influence of Promotional Mix on Visitors' Interest in Cultural Tourism of the Erau Traditional Festival with the results of the study that promotional mix variables such as advertising, promotion, sales, public relations in this study have an effect on the interest of visitors to the Erau traditional festival cultural tourism except for individual sales which do not have a significant effect. From the study results, several things are suggested, namely that the committee continues to improve services to tourists, and the regional apparatus and the Tenggarong Regency community continue to play a role in supporting the successful implementation of the Erau traditional festival cultural tourism activities.

Rico Febrianza Imelda Aprielny (2020) with a study entitled The Influence of Promotional Mix on Repurchase Interest in Shopee Ecommerce results show that the study, namely Shopee Ecommerce uses b.

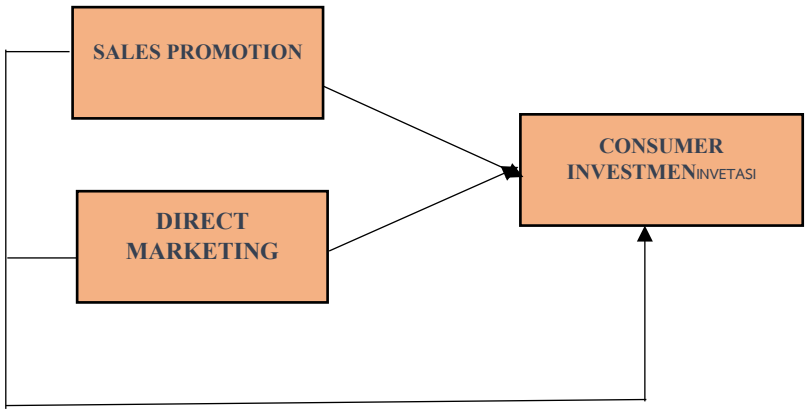


Figure 1. Research Model

Hypothesis

The hypothesis in this study is stated as follows:

H1: Sales Promotion is suspected of influencing consumer investment interest

H2: Direct Marketing is suspected of influencing consumer investment interest

H3: Sales Promotion and Direct Marketing are suspected of jointly influencing consumer investment interest

Methodology

Type of Research

This research is quantitative because it relates to the processing of nominal data in the results. The research model used in this study is associative research, namely, to see the relationship between research variables.

Population and Sample

The researcher determined the data population from the amount of PTSP Batam investment and then used the purposive sampling method to determine the sample because several sample criteria must be met. The number of samples determined by the Slovin formula amounted to 344 respondents.

วารสารสหวิทยาการ มหาวิทยาลัยชินวัตร ปีที่ 2 ฉบับที่ 1 (มกราคม 2568 - เมษายน 2568)
Multidisciplinary Journal of Shinawatra University, Volume 2 Issue 1 (January – February 2025)

Analysis Method

The data analysis used in this study is a multiple regression analysis.

Validity Test

According to Sugiyono (2017), the validity test is to determine the level of validity of the questionnaire instrument used to collect data. For example, the questionnaire measures the level of loyalty and whether each question can measure the level of interest in the question. Based on this, a validity test is necessary for a study.

Results

Deskription

Statistics

		Promosi Penjualan	Pemasaran Langsung	Minat konsumen
N	Valid	344	344	344
	Missing	0	0	0
Mean		30,8837	53,9186	32,3256
Median		32,0000	58,0000	35,0000
Mode		36,00	60,00	36,00
Std. Deviation		5,22200	7,09324	4,51093
Skewness		-,907	-,843	-1,214
Std. Error of Skewness		,131	,131	,131
Minimum		10,00	21,00	10,00
Maximum		36,00	60,00	36,00
Sum		10624,00	18548,00	11120,00

Descriptive statistics of sales promotion (X4) mean value of 30.88, median 32.00, mode 36.00, std. deviation 5.22, skewness -.91, std error of skewness,-.13, minimum 10.00, maximum 36.00. Direct marketing (X5) has a mean value of 53.92, a median of 58.00, and a mode of 60.00, std. deviation 7.09, skewness -84, std error of skewness ,13, minimum 21.00, maximum 60.00. interest (Y) mean value of 32.33, median 35.00, mode 36.00, std. Deviation 4.51, skewness -1.21, std error of skewness .13, minimum 10.00, maximum 36.00. of 53.92, median 58.00, mode 60.00, std. Deviation 7.09, skewness -84, std error of skewness .13, minimum 21.00, maximum 60.00. interest (Y) mean value of 32.33, median 35.00, mode 36.00, std. Deviation 4.51, skewness -1.21, std error of skewness .13, minimum 10.00, maximum 36.00.

Normality test Result

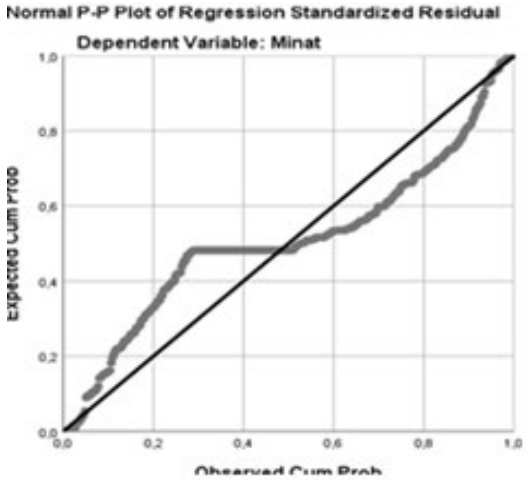


Figure 1.
Histogram of Normality Test Results

Based on the Normal P-P Plot, the distribution is normal. The points are spread or approach around the diagonal line, and the distribution of the data points is in the same direction and follows the diagonal line.

Heteroscedasticity Test Results

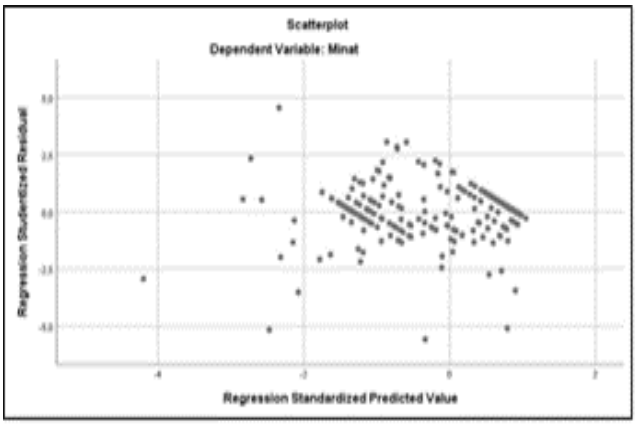


Figure 2. Scatterplot Heteroscedasticity Test Results

The scatterplot shows no heteroscedasticity. The data points are spread above, below, or around the number 0.

Multicollinearity Test Results

Table 2: Multicollinearity Test Results

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	-,602	,942		-,639	,523		
	Promosi Penjualan	,100	,031	,115	3,188	,002	,452	2,213
	Pemasaran Langsung	,333	,037	,523	9,078	,000	,178	5,623

a. Dependent Variable: Minat Konsumen
Sumber: Data SPSS diolah (2023)

It can be concluded that sales promotion 2.213 < 10 and tolerance value 0.452 > 0.10, direct marketing 5.623 < 10 and tolerance value 0.178 > 0.10 there is no multicollinearity in the regression model.

Data Analysis

Results of Multiple Linear Regression Analysis Test

Table 3: Results of Multiple Linear Regression Analysis Test

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	-0,602	0,942		-0,639	0,523
	Promosi Penjualan	0,100	0,031	0,115	3,188	0,002
	Pemasaran Langsung	0,333	0,037	0,523	9,078	0,000

a. Dependent Variable: Minat Konsumen
Sumber: Data SPSS diolah (2023)

Constant value affects sales promotion (0.100), and direct marketing (0.333).

วารสารสหวิทยาการ มหาวิทยาลัยชินวัตร ปีที่ 2 ฉบับที่ 1 (มกราคม 2568 - เมษายน 2568)
Multidisciplinary Journal of Shinawatra University, Volume 2 Issue 1 (January – February 2025)

t-Test Results (Partial).

Sales promotion has a positive effect count> table (3.188 > 2.59045), and direct marketing has a positive effect count> table (9.078 > 2.59045).

F-Test Results

Table 4: F-Test Results (Simultaneous)

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	5585,115	5	1117,023	270,761	,000[b]
	Residual	1394,420	338	4,126		
	Total	6979,535	343			

a. Dependent Variable: Minat Konsumen
b. Predictors: (Constant), Pemasaran Langsung, Promosi Penjualan

Sales promotion, and direct marketing simultaneously affect consumer interest in Rusun Muka Kuning BP Batam. can be seen in the Fcount value> Ftable or 270.761> 2.240 and a significance level of 0.000 <0.05.

Results of the Determination Coefficient Test (R2)

Table 5: Results of the Determination Coefficient Test (R2)

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,895[a]	0,800	0,797	2,031

a. Predictors: (Constant), pemasaran langsung, promosi penjualan

The Adjusted R Square value is 0.797. This means that the independent variable's ability to explain the dependent variable is 79.7%.

Conclusion and Recommendation

Conclusion

1. Based on the study's results, the sales promotion component in the promotional mix has a positive effect on consumer interest in Rusun Muka Kuning BP Batam. This is rational because investment in the Batam PTSP office has carried out promotions through sales promotions that are in accordance with the characteristics of good advertising. 1) Attracting attention 2) Providing flexibility 3) Holding events (Kotler & Keller, 2012).
2. Based on the study's results, the direct marketing component of sales in the promotional mix has a positive effect on consumer interest in Rusun Muka Kuning BP Batam. This is rational because investment in the Batam PTSP office has carried out promotions through direct marketing that is in accordance with the characteristics of good advertising. 1) Non-public 2) Adjusted 3) Interactive (Kotler and Keller, 2012).
3. sales promotion and direct marketing together have an effect on consumer interest in investing in the Batam PTSP office. This is rational because investment in the Batam PTSP office has implemented a promotional mix that is in accordance with the characteristics of good promotion.

Conclusion

The following conclusions can be drawn from this study, including:

1. Sales promotion positively and significantly affects consumer interest in Rusun Muka Kuning BP Batam.
2. Direct marketing positively and significantly affects consumer interest in Rusun Muka Kuning BP Batam.
3. Advertising, personal selling, publicity, sales promotion and direct marketing have a joint effect on consumer interest in Rusun Muka Kuning BP Batam.

Recommendation

Based on the results of the study, discussion and conclusions obtained, the suggestions that can be given are as follows:

1. The promotional mix must continue to be carried out to provide good promotional quality, which can form opinions and build brand awareness among investors.
2. Training is needed for the Batam PTSP office implementation team to form similarities in conveying information.

Acknowledgement

I, Dahermiwati et al., thank Shinawatra University, Pathum Thani Province, Thailand.

References

Keegan, W. J. (2012). **Global Marketing Management,** Lubin School of Business, New York

Kotler & Keller (2014). **Marketing Management. Volume I. 13th Edition.** Jakarta: Erlangga

Kotler & Philip. (2011). **Marketing Management in Indonesia. (1st edition).** Jakarta: Salemba Empat

Kotler, A. (2014). **Principles of Marketing, 12th Edition, Volume 1.** Translated by Bob Sabran. Jakarta: Erlangga.

Kotler & Gary Armstrong. (2016). **Marketing Basics. Volume 1**, Ninth Edition. Jakarta: Erlangga.

Kotler, & Keller. (2012). **Marketing Management. 12th Edition.** Jakarta: Erlangga.

Kotler, P., (2012), **Principles of Marketing Management.** Jakarta Prenhalindo.

Kotler, Philip & Kevin Lane K., (2016). **Marketing Management, 15th Edition**. Pearson Education, Inc.

Kotler and Armstrong (2012), **Marketing management. 14th Edition.** New Jersey: Pretice Hall.

Kotler, P., (2010). Marketing Management. **Thirteenth Edition Bahasa. Indonesia. Volume 1** and 2. Jakarta: Erlangga.

Lubis. Syahron, (2013), **Educational Research Methodology.** Padang: Sukabima Press.

Lucas, D. B., & Britt, S. H., (2012). **Measuring Advertising Effectiveness**. McGrawHill, New York

วารสารสหวิทยาการ มหาวิทยาลัยชินวัตร ปีที่ 2 ฉบับที่ 1 (มกราคม 2568 - เมษายน 2568)
Multidisciplinary Journal of Shinawatra University, Volume 2 Issue 1 (January – February 2025)

The Influence of Product Design, Product Quality, Price and Promotion on the Decision to Purchase Yamaha Motorbikes at PT. Alfa Scorpi Batam Centre

Lukmanul Hakim[1], Jamilah[2], Doni Saputra[3], Chandra Syamsir[4],

Master of Management Study Program, Post Graduate Program

University of Riau Kepulauan, Batam, Indonesia

Email: lukmann14@gmail.com[1], meelasarah2510@gmail.com[2], Sdoni0191@gmail.com[3], cecenbatam@gmail.com[4],

ABSTRACT

This research aims to determine and analyze the influence of product design, product quality, price and promotion on purchasing decisions for Yamaha motorbikes at PT. Alfa Scorpi Batam Center. The population of this research is consumers at PT. Alfa Scorpi Batam Center. The sample used in this research was 60 respondents. Based on data analysis, the research results show that product design (X_1) positively and significantly affects purchasing decisions for Yamaha Motorbikes at PT. Alfa Scorpi Batam Center, Product Quality (X_2) positively and significantly affects Purchasing Decisions at PT. Alfa Scorpi Batam Center, Price (X_3) positively and significantly affects purchasing decisions for Yamaha Motorbikes at PT. Alfa Scorpi Batam Center, Promotion (X_4) positively and significantly affects purchasing decisions for Yamaha Motorbikes at PT. Alfa Scorpi Batam Center, Product Design, Product Quality, Price and Promotion simultaneously positively and significantly affect (Y) at PT. Alfa Scorpi Batam Center.

Keywords: Product Design, Product Quality, Price, Promotion, Purchasing Decisions.

INTRODUCTION

The growth of motorbike consumers has increased tremendously. Amid intense competition due to the many new brands, Yamaha motorbikes, which have been in Indonesia for a long time, with all their advantages, continue to dominate the market and simultaneously fulfill the need for rugged, economical transportation. Responding to these challenges, the organization behind the success of Honda motorbikes in Indonesia continues to strengthen itself. The superiority of Yamaha motorbike technology is recognized and has been proven on various occasions, both on the road and on the race track. Yamaha also develops technology that can answer needs.

Purchasing decisions are actions taken by consumers to purchase a product (Harahap, 2018). Therefore, consumer purchasing decisions are a process of selecting one of several alternative problem solutions with real follow-up. After that, consumers can evaluate their choices and then determine their next attitude.

Table 1. Yamaha Motorcycle Sales

No	Type/Variant	2021	2022	2023
1	Yamaha Matik	221 Unit	148 Unit	99 Unit
2	Yamaha Bebek	165 Unit	66 Unit	35 Unit
3	Yamaha Sport	98 Unit	44 Unit	23 Unit
Total		**484 Unit**	**258 Unit**	**157 Unit**

Source: Alfa Scorpi Batam Center

Based on the sales data above, it can be seen that motorbike sales have decreased due to competition so that the 2021 Yamaha automatic variant sold 221 units in 2023, decreasing to 99 units, then followed by sales of the duck type which also experienced a decrease in sales in 2021,

165 units were sold, while in 2023 they were sold. 35 units, then the position with the fewest sales is the Yamaha sport motorbike, in 2021 it sold 98 units and in 2023 sales will be 23 units. These sales results indicate that there are competition issues that occur in product design, product quality, price and promotions in product sales, resulting in a decrease in purchases from consumers.

Product design is important in choosing a product by consumers so that purchasing decisions occur. Because the external shape of a product is what other people will see when consumers use it. Product design includes shape, color, and appearance. The elegant appearance and attractive colors will attract consumers' attention—today's motorbike consumers like agile, nimble, more comfortable vehicles—Yamaha motorbikes at PT. Alfa Scorpi Batam Center has provided various motorbike models, from automatic to manual. However, PT. Alfa Scorpi Batam Center provides too many Honda automatic motorbikes with the same design and specifications. There are not many different types of models offered to consumers, of course, this is very different from PT. Alfa Scorpi central branch. It should be PT. Alfa Scorpi Batam Center also provides many Yamaha motorbike models, so consumers can be interested in purchasing PT. Alfa Scorpi Batam Center.

According to Philip Kotler and Kevin Lane Keller (2018), the product concept holds that consumers will favor those products that offer the most quality, performance, or innovative features. From this statement it can be interpreted that a consumer will tend to choose or like products that are higher quality, better and more innovative. The level of product quality of a company is determined by the level of satisfaction of a consumer after or currently consuming a product from a company. According to Cannon, Perreault, Mccarthy (2019) product quality is the product's ability to satisfy customer needs or desires.

The objectives of this research are as follows:

a. To find out and analyze the influence of product design on purchasing decisions for Yamaha Motorbikes at PT. Alfa Scorpi Batam Center;
b. To find out and analyze the influence of product quality on purchasing decisions for Yamaha Motorbikes at PT. Alfa Scorpi Batam Center;

วารสารสหวิทยาการ มหาวิทยาลัยชินวัตร ปีที่ 2 ฉบับที่ 1 (มกราคม 2568 - เมษายน 2568)
Multidisciplinary Journal of Shinawatra University, Volume 2 Issue 1 (January – February 2025)

c. To find out and analyze the influence of price on purchasing decisions for Yamaha Motorbikes at PT. Alfa Scorpi Batam Center;
d. To find out and analyze the influence of promotions on purchasing decisions for Yamaha Motorbikes at PT. Alfa Scorpi Batam Center;
e. To find out and analyze the simultaneous influence of product design, product quality, price, and promotion on purchasing decisions for Yamaha Motorbikes at PT. Alfa Scorpi Batam Center.

THEORETICAL BASIS

Products

According to Tjiptono (2018), a product is anything a producer offers for attention, ownership, search, purchase, use, or consumption by the market to fulfill the needs or desires of the market concerned.

Price

Kotler and Armstrong (2016) define price as the total value that consumers exchange for the benefits they obtain or use for goods and/or services.

Product Design

According to Hidayah (2017), product design is a practical activity that also includes economic, global, social, technological, and cultural elements in various dynamics.

Promotion (Promotion)

According to Tjiptono (2018), promotion is a form of marketing communication. Marketing communications are activities that seek to disseminate information, influence/persuade, and remind the target market of the company and its products so that they are willing to accept, buy, and be loyal to the company's products.

Product Quality

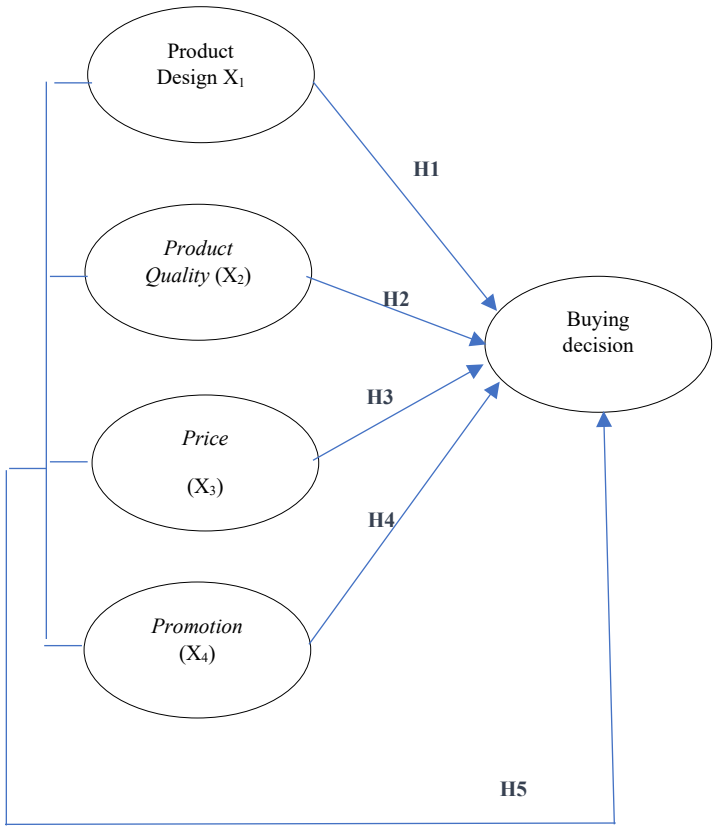
วารสารสหวิทยาการ มหาวิทยาลัยชินวัตร ปีที่ 2 ฉบับที่ 1 (มกราคม 2568 - เมษายน 2568)
Multidisciplinary Journal of Shinawatra University, Volume 2 Issue 1 (January – February 2025)

Ranto (2018) product quality is the totality of features and characteristics of a product or service that depend on its ability to satisfy stated or implied needs

Buying decision

According to Alma (2016), purchasing decisions are consumer decisions that are influenced by financial economics, technology, politics, culture, products, prices, locations, promotions, physical evidence, people and processes, thus forming an attitude in consumers to process all information and draw conclusions in the form of responses that emerge as to what product to buy.

Framework of thinking



Research Hypothesis

This research has the following research hypothesis:

H1 : It is suspected that product design has a significant influence on purchasing decisions for Yamaha motorbikes at PT. Alfa Scorpi Batam Center.

H2 : It is suspected that product quality has a significant influence on the decision to purchase Yamaha motorbikes at PT. Alfa Scorpi Batam Center.

H3 : It is suspected that price significantly influences the decision to purchase a Yamaha motorbike at PT. Alfa Scorpi Batam Center.

H4 : It is suspected that promotions significantly affect purchasing decisions for Yamaha motorbikes at PT. Alfa Scorpi Batam Center.

H5 : It is suspected that product design, product quality, price and promotion significantly influence purchasing decisions for Yamaha motorbikes at PT. Alfa Scorpi Batam Center.

RESEARCH METHODS

Research Types and Designs

The techniques and tools used in this research are quantitative based on the type of problem studied. Researchers want to know whether product design, product quality, price, and promotion influence the decision to purchase Yamaha Motorbikes at PT. Alfa Scorpi Batam Center.

Population

The population in this study were Yamaha Motorbike consumers at PT. Alfa Scorpi Batam Center.

Sample

The number of samples used was 60 respondents.

Instrument Analysis Techniques

Validity Test

Measuring the level of validity or not of a questionnaire can use the Pearson value, where the validity test requirements use the R table (R table > R count) so it can be declared valid. The

วารสารสหวิทยาการ มหาวิทยาลัยชินวัตร ปีที่ 2 ฉบับที่ 1 (มกราคม 2568 - เมษายน 2568)
Multidisciplinary Journal of Shinawatra University, Volume 2 Issue 1 (January – February 2025)

validity value must have a total score value (total score from the questionnaire value) (Sunyoto, 2015).

Table 2: Product Design Variable Validity Test Results (X_1)

No	Statement	R Count	R Table	Information
1.	X1_1	0.612	0.361	Valid
2.	X1_2	0.647	0.361	Valid
3.	X1_3	0.830	0.361	Valid
4.	X1_4	0.770	0.361	Valid
5.	X1_5	0.793	0.361	Valid
6.	X1_6	0.754	0.361	Valid
7.	X1_7	0.688	0.361	Valid
8.	X1_8	0.611	0.361	Valid
9.	X1_9	0.830	0.361	Valid
10.	X1_10	0.770	0.361	Valid
11.	X1_11	0.793	0.361	Valid
12.	X1_12	0.754	0.361	Valid
13.	X1_13	0.688	0.361	Valid

14.	X1_14	0.611	0.361	Valid

Table 3: Product Quality Variable Validity Test Results (X_2)

No	Statement	R Count	R Table	Information
1.	X2_1	0.856	0.361	Valid
2.	X2_2	0.948	0.361	Valid
3.	X2_3	0.948	0.361	Valid
4.	X2_4	0.948	0.361	Valid
5.	X2_5	0.948	0.361	Valid
6.	X2_6	0.856	0.361	Valid
7.	X2_7	0.948	0.361	Valid
8.	X2_8	0.503	0.361	Valid
9.	X2_9	0.948	0.361	Valid
10.	X2_10	0.856	0.361	Valid
11.	X2_11	0.948	0.361	Valid
12.	X2_12	0.856	0.361	Valid

วารสารสหวิทยาการ มหาวิทยาลัยชินวัตร ปีที่ 2 ฉบับที่ 1 (มกราคม 2568 - เมษายน 2568)
Multidisciplinary Journal of Shinawatra University, Volume 2 Issue 1 (January – February 2025)

Table 4: Price Variable Validity Test Results (X_3)

No	Statement	R Count	R Table	Information
1.	X3_1	0.818	0.361	Valid
2.	X3_2	0.813	0.361	Valid
3.	X3_3	0.838	0.361	Valid
4.	X3_4	0.504	0.361	Valid
5.	X3_5	0.734	0.361	Valid
6.	X3_6	0.834	0.361	Valid
7.	X3_7	0.557	0.361	Valid
8.	X3_8	0.731	0.361	Valid
9.	X3_9	0.750	0.361	Valid
10.	X3_10	0.625	0.361	Valid
11.	X3_11	0.731	0.361	Valid
12.	X3_12	0.750	0.361	Valid

Table 5: Promotion Variable Validity Test Results (X_4)

No	Statement	R Count	R Table	Information
1.	X4_1	0.903	0.361	Valid
2.	X4_2	0.903	0.361	Valid
3.	X4_3	0.903	0.361	Valid
4.	X4_4	0.779	0.361	Valid
5.	X4_5	0.779	0.361	Valid
6.	X4_6	0.903	0.361	Valid

Table 6: Purchasing Decision Variable Validity Test Results (Y)

No	Statement	R Count	R Table	Information
1.	Y_1	0.465	0.361	Valid
2.	Y_2	0.465	0.361	Valid
3.	Y_3	0.560	0.361	Valid
4.	Y_4	0.653	0.361	Valid
5.	Y_5	0.642	0.361	Valid

6.	Y_6	0.561	0.361	Valid
7.	Y_7	0.668	0.361	Valid
8.	Y_8	0.715	0.361	Valid
9.	Y_9	0.465	0.361	Valid
10.	Y_10	0.560	0.361	Valid
11.	Y_11	0.653	0.361	Valid
12.	Y_12	0.642	0.361	Valid
13.	Y_13	0.561	0.361	Valid
14.	Y_14	0.668	0.361	Valid
15.	Y_15	0.715	0.361	Valid

Source: Primary data processed, 2024

From all the statements for each variable (supervision, motivation, work discipline, training, and work performance), it can be seen that the validity test results of the r calculated value are greater than those in the r table, namely the r calculated value of 0.361. Thus, the conclusion is that all variables are declared valid.

Reliability Test

Question items are said to be reliable or reliable if someone's answer to the question is consistent (Sunyoto, 2015). A construct or variable is said to be reliable if it provides a Conbarch Alpha value > 0.60 (Ghozali, 2013).

วารสารสหวิทยาการ มหาวิทยาลัยชินวัตร ปีที่ 2 ฉบับที่ 1 (มกราคม 2568 - เมษายน 2568)
Multidisciplinary Journal of Shinawatra University, Volume 2 Issue 1 (January – February 2025)

Table 7: Questionnaire Reliability Test Results for product design, product quality, price, and promotion on purchasing decisions

No.	Variabel	Cronbach Alpha	Information
1	Product Design	0.862	Reliabel
2	Product Quality	0.951	Reliabel
3	Price	0.884	Reliabel
4	Promotion	0.927	Reliabel
5	Buying decision	0.725	Reliable

Based on these values, it can be concluded that the statement items for each research variable are reliable.

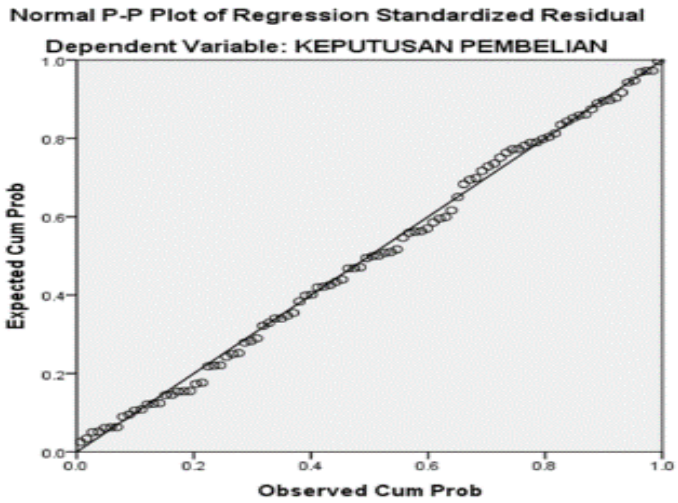
Data Analysis Techniques

The data analysis technique in this research uses parametric statistics. The data analysis process was carried out with the help of the SPSS for Windows program. The level of error tolerance determined in this research is 5%.

RESEARCH RESULTS AND DISCUSSION

Normality Test

If the residual data distribution is normal, then the line depicting the actual data will follow the diagonal line (Ghozali, 2013).



It can be seen from the P-P Plot normality graph that the points are spread around the diagonal line and the distribution follows the direction of the diagonal line. So it is concluded that it meets the normality assumption.

Multicollinearity Test

The cut off value that is commonly used to indicate the presence of multicollinearity is a tolerance value > 0.0, or the same as a VIF value < 10. If the detection assumptions above are not found in the regression model, then the regression model used in this research is free from multicollinearity, and vice versa (Ghozali, 2013).

Table 8: Multicollinearity Test

Model		Collinearity Statistics	
		Tolerance	VIF
1	(Constant)		
	Product Design	.905	1.105
	Product Quality	.969	1.032
	Price	.918	1.090
	Promotion	.854	1.171

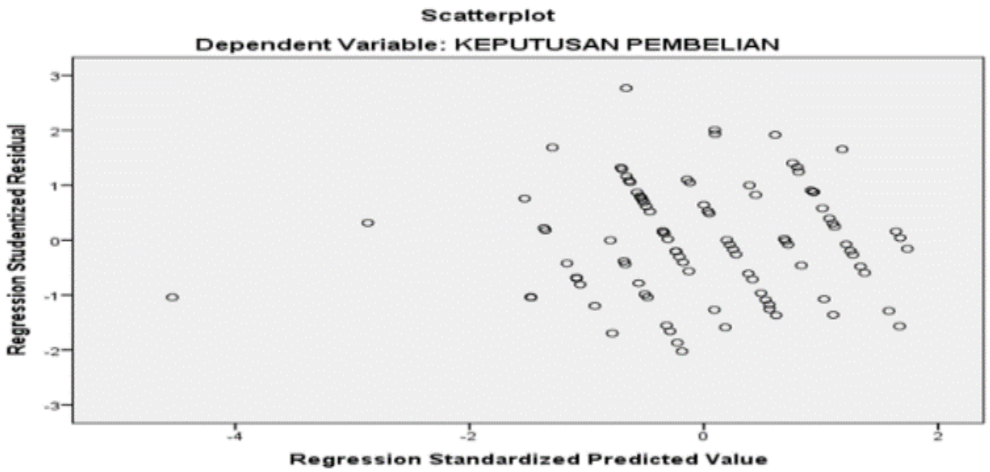
a. Dependent Variable: PURCHASE DECISION

Based on Table 8 above, all independent variables have a tolerance value greater than 10% (0.10), and the VIF value is smaller than 10, so it can be concluded that the regression model is nonmulticollinear.

วารสารสหวิทยาการ มหาวิทยาลัยชินวัตร ปีที่ 2 ฉบับที่ 1 (มกราคม 2568 - เมษายน 2568)
Multidisciplinary Journal of Shinawatra University, Volume 2 Issue 1 (January – February 2025)

Heteroscedasticity Test

If a certain pattern is regular then heteroscedasticity occurs. And if there is no clear pattern and the points spread above and below the number 0 on the Y axis, then heteroscedasticity does not occur (Ghozali: 2013).



Source: Primary data processed SPSS 22, 2024

From the output results above, it can be seen that the points do not form a clear pattern. The points spread above and below the number 0 on the Y axis. So it can be concluded that there is no heteroscedasticity problem in the regression model.

วารสารสหวิทยาการ มหาวิทยาลัยชินวัตร ปีที่ 2 ฉบับที่ 1 (มกราคม 2568 - เมษายน 2568)
Multidisciplinary Journal of Shinawatra University, Volume 2 Issue 1 (January – February 2025)

Multiple Linear Regression

Table 9: Regression Equations

Coefficients[a]						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	4.285	1.348		3.179	.002
	Product Design	.201	.022	.293	9.069	.000
	Product Quality	.043	.017	.082	2.627	.010
	Price	.071	.021	.106	3.309	.001
	Promotion	.091	.022	.135	4.060	.000

a. Dependent Variable: PURCHASE DECISION

Based on this table, the regression equation for the variables product design, product quality, price, promotion on purchasing decisions is:

$\mathbf{Y = a + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + e}$

$Y = 4.285 + 0.201\ X_1 + 0.043\ X_2 + 0.071\ X_3 + 0.091\ X_4 + e$

Model interpretation:

a. Constant (a) = 4,285, indicating a constant price, if the value of the independent variable = 0, then the purchasing decision value (Y) will be 4,285;
b. The product design variable has a regression coefficient value of 0.201, this means that if the value of other independent variables is fixed or does not change, then every 1 point or 1% increase in the product variable will increase purchasing decisions by 0.201. The product coefficient is positive, meaning that there is a positive relationship between the product and the purchasing decision, meaning that as the product value increases, the purchasing decision can increase;
c. The product quality variable has a regression coefficient value of 0.043. This means that if the value of other independent variables is constant or does not change, then every 1 point or 1% increase in the price variable will increase purchasing decisions by 0.043. The price coefficient is positive, meaning that there is a positive relationship between price and purchasing decisions, meaning that as the price value increases, purchasing decisions can increase;
d. The price variable has a regression coefficient value of 0.071, this means that if the value of other independent variables is fixed or does not change, then every 1 point or 1% increase in the place variable will increase purchasing decisions by 0.071. The place coefficient is positive, meaning that there is a positive relationship between place and purchasing decisions, meaning that as the value of place increases, purchasing decisions can increase;
e. The promotion variable has a regression coefficient value of 0.091, this means that if the value of other independent variables is fixed or does not change, then every 1 point or 1% increase in the promotion variable will increase purchasing decisions by 0.091. The promotion coefficient is positive, meaning that there is a positive relationship between promotion and purchasing decisions, meaning that as the promotion value increases, purchasing decisions can increase.

Hypothesis Testing

In this study, the t-table value was 1.987, the decision criteria were as follows:

1. If t-count > t-table, then H0 is rejected or Ha is accepted

วารสารสหวิทยาการ มหาวิทยาลัยชินวัตร ปีที่ 2 ฉบับที่ 1 (มกราคม 2568 - เมษายน 2568)
Multidisciplinary Journal of Shinawatra University, Volume 2 Issue 1 (January – February 2025)

2. If t-count < t-table, then H0 is accepted or Ha is rejected. Data was processed using a sample of 96 people with the following results.

Table 10: t Test Results for Product Design Variables, Product Quality, Price, Promotion on Purchasing Decisions

Coefficients[a]						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	4.285	1.348		3.179	.002
	Product Design	.201	.022	.293	9.069	.000
	Product Quality	.043	.017	.082	2.627	.010
	Price	.071	.021	.106	3.309	.001
	Promotion	.091	.022	.135	4.060	.000

a. Dependent Variable: PURCHASE DECISION

Based on the table above, the results of the t test analysis are as follows

a. The product design variable (X_1) partially has a positive and significant effect on the decision to purchase Yamaha Motorbikes at PT. Alfa Scorpi Batam Center. This can be seen from the

significant product (X_1) 0.000 < 0.05, and the t-count value 9.069 > t-tabe 1.987, so H0 is rejected and H1 is accepted. So the hypothesis which states that there is an influence of product design on purchasing decisions is accepted;

b. The product quality variable (X_2) partially has a positive and significant effect on purchasing decisions. Yamaha Motorcycles at PT. Alfa Scorpi Batam Center This can be seen from the significant price (X_2) 0.010 < 0.05, and the t-count value 2.627> t-table 1.987, so H0 is rejected and H2 is accepted. So the hypothesis which states that there is an influence of product quality on purchasing decisions is accepted;
c. The price variable (X_3) partially has a positive and significant effect on the decision to purchase Yamaha Motorbikes at PT. Alfa Scorpi Batam Center. This can be seen from the significant place (X_3) 0.001 < 0.05, and the t-count value 3.309> t-table 1.987, so H0 is rejected and H3 is accepted. So the hypothesis which states that there is an influence of price on purchasing decisions is accepted;
d. The promotion variable (X_4) partially has a positive and significant effect on purchasing decisions for Yamaha Motorbikes at PT. Alfa Scorpi Batam Center. This can be seen from the significant promotion (X_4) 0.000 < 0.05, and the t-count value 4.060> t-table 1.987, so H0 is rejected and H4 is accepted. So the hypothesis which states that there is an influence of promotion on purchasing decisions is accepted.

F Test Results

In this study, the f-table value was 2.32, the decision criteria were as follows:

1. If f-count > f-table, then H0 is rejected or Ha is accepted
2. If f-count < f-table, then H0 is accepted or Ha is rejected.

วารสารสหวิทยาการ มหาวิทยาลัยชินวัตร ปีที่ 2 ฉบับที่ 1 (มกราคม 2568 - เมษายน 2568)
Multidisciplinary Journal of Shinawatra University, Volume 2 Issue 1 (January – February 2025)

Table 11: F Test Results Product design variables, product quality, price, promotion on purchasing decisions

ANOVA[a]						
Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	383.320	5	76.664	193.607	.000[b]
	Residual	35.638	55	.396		
	Total	418.958	60			

a. Dependent Variable: KEPUTUSAN PEMBELIAN

b. Predictors: (Constant), PRICE, PRODUCT QUALITY, PRODUCT DESIGN, PROMOTION

Based on the test results in the table above, it can be seen that the F-count value is 193,607 with an F-table value of 2.32 so that the F-count value is greater than the F-table (193,607> 2.32), and the significance level is 0.000 < 0.05, so H0 is rejected and H6 is accepted , So the hypothesis which states that there is an influence of product design, product quality, price, promotion has a significant influence on the decision to purchase Yamaha Motorbikes at PT. Alfa Scorpi Batam Center.

Coefficient of Determination (R^2)

The numerical coefficients shown show the extent to which the model formed can explain the actual conditions.

วารสารสหวิทยาการ มหาวิทยาลัยชินวัตร ปีที่ 2 ฉบับที่ 1 (มกราคม 2568 - เมษายน 2568)
Multidisciplinary Journal of Shinawatra University, Volume 2 Issue 1 (January – February 2025)

Table 12: Coefficient of Determination Test Results (R2) Product design variables, product quality, price, promotion on purchasing decisions

Model Summary[b]				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.957[a]	.915	.910	.62927

a. Predictors: (Constant), PRICE, PRODUCT QUALITY, PRODUCT DESIGN, PROMOTION

b. Dependent Variable: PURCHASE DECISION

Source: Primary data processed SPSS 22, 2024

Based on the table above, the coefficient of determination (Adjusted R Square) obtained is 0.915. This means that the ability of the independent variable to explain the dependent variable is 91%; the remaining 9% is explained by other variables outside of product design, product quality, price, and promotion.

DISCUSSION

This research indicates that product design partially has a positive and significant effect on purchasing decisions at PT. Alfa Scorpi Batam Center. This can be seen from the significant product (X_1) 0.000 < 0.05, and the t-count value 9.069> t-table 1.987, so H0 is rejected and H1 is accepted. So the hypothesis, which states that there is an influence of product design on purchasing decisions, is accepted.

This research is in line with research conducted by Tina Martini (2019) Analysis of the Influence of Price, Product Quality and Design on Decisions to Purchase Honda Brand Scooter Motor Vehicles.

The results of this research indicate that product quality partially has a positive and significant effect on purchasing decisions at PT. Alfa Scorpi Batam Center. This can be seen from the significant product quality (X_2) 0.010 < 0.05, and the t-count value 2.627> t-table 1.987, so H0 is rejected and H2 is accepted. So the hypothesis which states that there is an influence of product quality on purchasing decisions is accepted.

This research is in line with research conducted by Dwi Wahyo (2020) The Influence of Price, Product Design, Product Quality and Brand Image on Consumer Purchasing Decisions on Yamaha Products in Yogyakarta

The results of this research show that the price variable (X3) partially has a positive and significant effect on purchasing decisions at PT. Alfa Scorpi Batam Center. This can be seen from the significant value (X_3) 0.001 < 0.05, and the t-count value 3.309> t-table 1.987, so H0 is rejected and H3 is accepted. So the hypothesis which states that there is an influence of price on purchasing decisions is accepted.

This research is in line with research conducted by Mustikasari (2021) The Influence of Product Quality, Product Design and Price on Yamaha Gresik Purchase Decisions.

The results of this research show that promotion (X_4) partially has a positive and significant effect on purchasing decisions at PT. Alfa Scorpi Batam Center. This can be seen from the significant promotion (X_4) 0.000 < 0.05, and the t-count value 4.060> t-table 1.987, so H0 is rejected and H4 is accepted. So the hypothesis which states that there is an influence of promotion on purchasing decisions is accepted.

This research is in line with research conducted by Diputra and Kuaat et al (2020) The Influence of Products, Services and Promotions on Customer Satisfaction in Purchasing Decisions for Yamaha Semarang.

The results of this research show that there is a significant influence of product design, product quality, price, promotion on purchasing decisions at PT. Alfa Scorpi Batam Center. This can be

seen from the F-count value of 50,121 with an F-table value of 2.43 so that the F-count value is greater than the F-table (193,607> 2.43), and the significance level is 0.000 < 0.05, so H0 is rejected and H5 is accepted.

This research is in line with research conducted by Tina Martini (2019), Wahyo (2020), Mustikasari (2021), Kuat et al (2020).

Conclusion

Based on the results and discussion above, it can be concluded as follows:

a. Product design has a significant influence on purchasing decisions at PT. Alfa Scorpi Batam Center;
b. Product quality has a significant influence on purchasing decisions at PT. Alfa Scorpi Batam Center;
c. Price has a significant effect on purchasing decisions at PT. Alfa Scorpi Batam Center;
d. Promotion has a significant effect on purchasing decisions at PT. Alfa Scorpi Batam Center;
e. Product design, product quality, price and promotion significantly influence purchasing decisions at PT. Alfa Scorpi Batam Center.

Suggestion

Based on the results of this research, the following suggestions or input can be concluded:

a. From the product design variable, Yamaha is expected to provide product variants and always update product designs;

b. From the product quality variable, it is hoped that Yamaha will improve the quality of its products, especially on automatic motorbikes;

c. From the price variable, it is hoped that Yamaha will increase the number of discount promotions;

d. From the promotional variable, it is hoped that Yamaha will expand its promotions, such as local Batam and social media promotions.

e. 91% of purchasing decisions are influenced by product design, product quality, price, and promotion, while the remaining 9% are influenced by other variables not examined in this research. It is hoped that further research can add other variables that can influence purchasing decisions at PT. Alfa Scorpi Batam Center.

References

Alma, B. (2016). **Manajemen Pemasaran dan pemasaran jasa**, Bandung : Alfabeta

Budiwati, H. (2018). Implementasi Marketing Mix dan pengaruhnya terhadap keputusan pembelian konsumen pada produk unggulan kripik pisang agung dikabupaten lumajang", **Jurnal Wiga, Vol 2**, N0 2. ISSN 2088-0994.

Ghozali, I. (2013). **Aplikasi Analisis Multivariate Dengan Program IBM, SPSS21.** edisi ke-7. Semarang: Badan Penerbit Universitas Diponogero.

Kotler, A. (2016). **Principles of Marketing, 15th Edition,** New Jersey: Pearson Prentice Hall.

Sunyoto, D. (2015). **Manajemen dan Pengembangan Sumber Daya Manusia Cetakan Pertama.** Yogyakarta: CAPS (Center for Academic Publishing Service),

Tjiptono. (2018). **Service, Quality & Satisfaction.** Yogyakarta: Andi