Chatbot Platform Selection in Marketplace using AHP-TOPSIS Methods: A Case Study in Indonesia

Desi Triyana, Armand Omar Moeis
Departemen Teknik Industri, Fakultas Teknik
Universitas Indonesia, Depok, Indonesia
desi.triyana01@ui.ac.id , armand.omar@ui.ac.id

Abstract

A chatbot is the most recent application which can optimize service distribution to the customer by minimizing the communication with live human agents in the first level. Chatbot's conversation could be applied via text or text-to-speech or voice. The marketplace growth itself is mounting in past years. The main purpose of this paper is to consider the best chatbot platform using Analytic Hierarchy Process (AHP) combined with Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS) methods for the marketplace in Indonesia. Thus, the marketplace could gain a competitive advantage and achieve customer satisfaction with responsive service delivery supported by a selected chatbot platform.

Keywords
Chatbot, Platform, Marketplace, Natural Language Processing, AHP

1. Introduction
In 1950 Alan Turing published a paper entitled Computing and Machinery Intelligence which examined the interaction between humans and computers where the Turing test tested three objects, one of which was a human being able to communicate with two other objects in the form of machines through text media. Alan Turing himself is known as the originator of the first digital computer and artificial intelligence as evidenced by his involvement in breaking the German Enigma code in the second world war using the help of machine translator, Bombe.

Artificial intelligence combined with language studies is a research that began to be noticed at the beginning of the 21st century that can be useful for various industries (Kibble, 2013). According to Davenport et al., (2020) artificial intelligence can help the sales department in terms of communicating in real time in the future so that it can analyze customer complaints through customer voices and find advanced solutions with the help of the sales department who is a real human. This can also overcome the limitations of human resources available in a company. On the other hand, artificial intelligence can also be a threat because it can cancel some human works in the service process (Huang & Rust, 2018)

Hodgkin & Huxley (1952) researched the interaction of neurons in the human brain with electromagnetic waves which ultimately helped in the development of NLP (Natural Language Processing) and artificial intelligence (Foote, 2021). Artificial intelligence has broad advantages in adding value to a business (Enholm et al., 2021). The combination of NLP algorithms on chatterbots or better known as chatbots can make it easier to recognize and respond to an appropriate word in response to questions posed by customers. Without NLP support, chatbots can respond to words only based on input from the user's text, so platforms supporting chatbots are important to consider only. The chatbot itself began to be widely known around 1966 under the name ELIZA (ZEMČÍK, 2019).

Chatbots can connect customers and customer support services indirectly without interacting with humans at an initial level with the support of artificial intelligence that is responded to via text, images and sound. Thus, repetitive questions from customers will be easily responded by the machine as quick as possible (Chung et al., 2020). However, human interaction is limited in terms of advanced information exchange and there is a possibility of failure in service distribution in the use of service-based artificial intelligence (Um et al., 2020).

In addition, according to (Adam et al., 2021), chatbot software is able to save costs and time, however, customer dissatisfaction responses are still visible where users still do not comply with requests made by chatbots. Research

conducted by (De Cicco et al., 2020), analyzed using a factorial design to respondents how the relationship between visual effects (avatars) and social interactions on chatbots can attract the attention of millennial users or young users. This can be implemented in the retail process.

This is inseparable that to achieve a competitive advantage, an organization is expected to implement a management strategy that is obtained through characteristics and resources (Porter, 1985). The competitive advantage aims to achieve customer satisfaction (Chopra, 2003). The choice of chatbot technology is expected to be able to achieve a company's competitive advantage, especially the marketplace or better known as the marketplace in Indonesia and achieve customer satisfaction.

Marketplace itself becomes an online meeting place between buyers and sellers that is used by consumers to assist the process of buying a product that is needed and sellers in marketing their products. This has now become a trend that is increasingly being followed and needed by people from various walks of life, both from the lower middle class and for the upper middle class because there are various kinds of products that can be selected with various categories and as well as the price suitability desired by consumers. In addition, the features presented by the chatbot are also attractive and easy to use for various groups who use it. It can be seen from the number of visitors to several market workplacewebsites in Indonesia which continues to increase in the third quarter of 2021 in Figure 1. The five well known marketplaces have used chatbots as supporting software in the customer assistance service process.

In previous research that has been done, chatbots that exist in e-commerce can be built with several programming languages and MySQL as a database (Oguntosin & Olomo, 2021). However, there is no method for selecting the appropriate chatbot platform criteria in this study. Similar to that expressed by Illescas-Manzano et al. (2021) that the implementation of the ManyChat chatbot platform for Facebook Messenger in an e-commerce can have a very good impact. Therefore, this research is expected to be able to bridge the shortcomings of these studies by using the Analytic Hierarchy Process (AHP) and Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS) methods for the selection of criteria for the chatbot platform that is in accordance with the needs of the marketplace companies in Indonesia being studied.
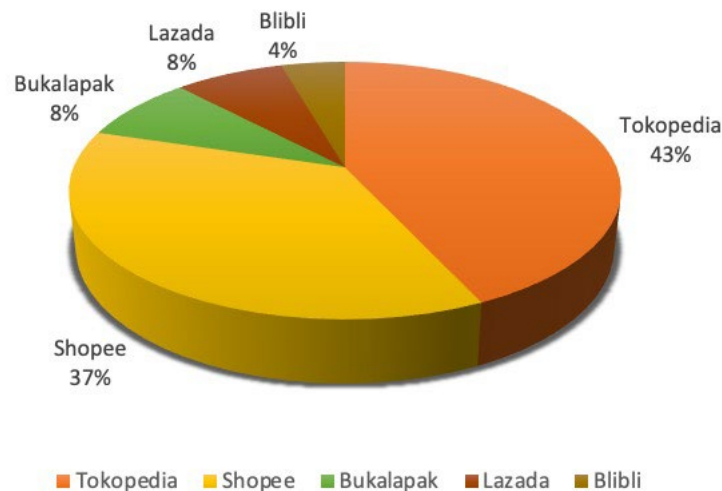

Figure 1. Marketplace Website Visitors Q3 2021

2. Literature Review
2.2 The Beginning of the Digital Computer
Before the introduction of communication tools that could help customers to submit complaints to sellers online, as currently, customer complaints are made by telephone. The telephone itself was first invented by Alexandre Graham Bell in 1878 and then continued by Almon Strowger in 1891 where he invented a telephone based on electromechanical technology making it easier for customers to communicate directly the purpose of either complaints, suggestions or requests to a company in circa 1900 (Hochheiser, 2013).

In this regard, various studies and discoveries have been carried out to find other alternatives to facilitate two-way communication. Alan Turing (1950) started his exploration in terms of conversations between humans and machines where there were three objects tested, one of which was a machine which was better known as the Imitation Game, the first object was a woman or a man, the second object was a machine. and the last object is the examiner. The success of the Turing test which proved that machines can think and communicate in two directions with humans was the beginning of the birth of artificial intelligence, machine learning, natural language processing (NLP) and the invention of the digital computer that we know today to replace analog computers and can used universally and helps human activities both in simple and complex work so as to achieve efficiency in terms of processing. Since then the development of artificial intelligence and machine learning began to steal the attention in various parts of the world. In the traditional process of exchanging information between humans and humans, it is gradually being replaced by the presence of chatbots that have been implemented in various industrial sectors globally to reduce interactions between customers and human agents at the initial level of customer service in a company or organization.

2.3 Artificial Intelligence
In a study conducted by Dhamija et al. (2020) suggested that artificial intelligence can be implemented in smart factories to manage the overall production and operational processes. While Kang et al. (2019) distinguishes between the primacy of technology and R&D in the manufacturing and service industries. Where there are three very important things in the two industries, namely artificial intelligence, Big Data and IoT (Internet of Things). Artificial intelligence itself was introduced by John McCarthy in 1956 where he explained that with the presence of artificial intelligence as a tool that can help as technology is growing (Nishika, 2017).

Several countries in the Asian region have implemented national artificial intelligence strategies such as Singapore and China in the same sectors such as market locations, manufacturing, smart city vehicles, policy and finance. On the other hand, Indonesia itself has not implemented this. (International Institute of Communications, 2020).

According to a study conducted by the BPPT (Agency for the Assessment and Application of Technology), there are five priorities that are considered for Indonesia's artificial intelligence as a national strategy which include the following: health, bureaucratic reform, education and research, food security and mobility and smart cities. In the implementation process, artificial intelligence is also regulated in laws and regulations so that it can still be accessed transparently but still safe in terms of users' personal data in accordance with applicable laws in Indonesia (2020). Data consultancy and research Gartner predicts the growth of acquired artificial intelligence-based software in the world market will increase in 2021 from 14.01% to 21.03% and revenue to also increase from 51.50% in 2021 and to 62.46% in 2022

2.4 The Development of Chatbots in Various Industrial Sectors in the World
According to Sari et al., (2020) chatbots can be adapted by various industries including education, social media, gaming and business. According to Business Wire (2022), the chatbot market experienced an increase during 2015-2020 and continues to grow by 25% until 2026 according to CAGR calculations. Cassilo et al (2020), conducted a study involving chatbots as tutors for employee training in a company so as to simplify complex work. Various industries have implemented chatbots in their organizations including manufacturing, banking, education, marketplace and health.

2.4.1 Manufacturing
Chatbots related to questions and answers combined with Virtual Reality are able to respond to consulting questions regarding engineering (engineering consultation) in manufacturing companies so that they can help provide the right solution (Trappey et al., 2022).

2.4.2 Banking

The algorithms provided by chatbots in the banking world can respond quickly and accurately to questions made by customers and are very helpful during social restrictions during the COVID-19 pandemic (Karia et al., 2021).

2.4.3 Education

In a study conducted by Sandu & Gilde, (2019), it was explained that as many as 48% of students asked questions to the chatbot with responses to these questions being received quickly (Lee, 2020).

2.4.4 Marketplace

In the process of product searching, sales and marketing of products, chatbots help facilitate communication with customers in the market place (Solis-Quispe et al., 2021).

2.4.5 Health

In connection with the COVID-19 pandemic which began around 2019 in China and has spread throughout the world until now, chatbot applications are very helpful in processing health services known as telemedicine where the role of chatbots can accelerate the distribution of health services and medical consultations themselves (Bharti et al., 2020).

2.5 Development of Market Places in Indonesia

According to data compiled from BPS (2021), 50.87% of market workplaces in Indonesia have started their business since 2017-2020, 2010-2016 are 30.57 percent and over ten years are 18.56%.

During the COVID-19 pandemic, the role of the marketplace was to help the product circulation process quickly. The most important factor in terms of market workplace readiness to face a pandemic in the creative industry is seen as very important, especially the use of technology (Priambodo et al., 2021).

According to iPrice statistics, Shopee ranks first in the third quarter of 2021 with more than 8 million followers to date. Thus, it can be assumed that the marketplace has the highest level of popularity compared to Tokopedia and Lazada followers of 3 million and 1.9 million (Putri et al., 2021).

3. Methods

3.1 Multiple-Criteria Decision-Making (MCDM)

MCDM is a method of decision making by determining the best alternative from a number of different alternatives based on certain criteria. MCDM is the main method at the market place to determine the Decision Support System (DSS) for the best product (Kizielewicz et al., 2021). Mardani et al., (2015) MCDM is a complex method of decision making that can be determined using qualitative and quantitative factors. MCDM can be used to determine the best products and services in the market place (Baczkiewicz, 2021). Pramudhita et al., (2015) divide the steps that will be taken in decision making as follows:
1. Identify a problem
2. Determine the conditions
3. Checking the best alternatives
4. Choose the best value
In determining a choice, it can be combined with hybrid methods, namely AHP and TOPSIS which are branches of MCDM itself.

3.2 Analytic Hierarchy Process (AHP)

Based on the explanation put forward by Thomas L. Saaty about AHP is a method where determining the best decision selection with multi-criteria problems can be used in a management (Seri, 2009). There is scale of importance in AHP process as mentioned on Table 1. This scale determined how importance one element to another element. Each respondent has to determine based on the scale provided.

Table 1. Scale Importance

Priority Scale	Descriptions
1	Equal Importance
3	Moderate Importance
5	Strong Importance
7	Very Strong Importance
9	Absolute Importance
2,4,6,8	Moderate Values

3.3 Technique for Order of Preference by Similarity to Ideal (TOPSIS)

TOPSIS process as follows:
1. Define Criteria and Alternatives in the Matrix
2. Normalized Matrix Weighting
3. Creating a Normalized Decision Matrix
4. Calculating the Alternative Distance with Positive & Negative Ideal Solution
5. Calculation of Negative and Positive Solutions
6. Calculation of Preference Value

4. Data Collection

In the research process, the data collection method is carried out as follows:
1. Conducting interviews with respondents who have experience and understand about chatbots at local Marketplace company and what obstacles the company copes in implementing chatbots on websites and mobile applications on smartphones.
2. Submitting a questionnaire to the respondents who are several chatbot experts at Marketplace company where they complete paired data between the criteria being compared.

5. Results and Discussion

From the data obtained can be processed into two ways, AHP and TOPSIS. Based on Saaty (2008), to decide the priority researcher need to conducted four steps as follows:
1. Outline a problem and decide the purpose
2. Construct problem to a hierarchy
3. Build a set of pairwise comparison matrix
4. Structure priority for each element on hierarchy

In the study, 4 were determined criterion which can be seen in Table 2. Some criterion can be obtained from some literatures review which has been studied in advance researches.

Table 2. Criterion

Criterion	Literature Review
Feature	(Hanine et al., 2016)
Function	(Hanine et al., 2016)
Cost	(Ngoc Toan et al., 2021)
Integration Model	(Bataineh et al., 2017)

5.1 Analytic Hierarchy Process (AHP)

According questionnaire result obtained by respondents, the process can be seen as follows:
Geomean formula needed to eliminate deviation from the questionnaire which defined on Table 3.

$$G = \sqrt[n]{X_1 \quad X_2.. \quad X_n}$$

G = Geometric mean
n = Number of values
Xi = Values of average

Table 3. Pair-wise Matrix Comparison

Criterion	Feature	Function	Cost	Integration Model
Feature	1	0,50	5,94	6,95
Function	2,00	1	6,95	6,60
Cost	0,17	0,14	1	0,64
Integration Model	0,14	0,15	1,55	1
Total	3,31	1,80	15,45	15,20

Priority value resulted by calculating *Eigen Vector(λmax)* of matrix in following formula which can be :

$$\lambda max = \Sigma x / n$$

Table 4. Normalized Matrix Data

	Matrix				
	Feature	Function	Cost	Integration Model	Priority
Feature	0,30	0,28	0,38	0,46	0,36
Function	0,60	0,56	0,45	0,43	0,51
Cost	0,05	0,08	0,06	0,04	0,06
Integration Model	0,04	0,08	0,10	0,07	0,07
Total	1,00	1,00	1,00	1,00	

Table 5. RCI Value

Criterion(n)	Value RCI
1	0
2	0
3	0.58
4	0.90
5	1.12
6	1.24
7	1.32
8	1.41
9	1.45

10	1.49

Consistency Index (CI) verified the consistency of matrix pairwise comparison:

$$CI = \frac{\lambda max - n}{n - 1}$$

To check *consistency ratio* (CR) result can be calculated as follows formula:

$$CR = \frac{CI}{RCI}$$

The CR result 0,05 < 0,10 means consistent and valid. When the value result exceeded, the data must be recalculated.

Table 6. Comparison Alternative x Criterion

	Feature	Function	Cost	Integration Model
BOTSIFY	0,22	0,28	0,03	0,03
MANYCHAT	0,06	0,14	0,02	0,02
CHAT FUEL	0,07	0,09	0,01	0,01

Table 7. Alternative Rank

RANK		
1	BOTSIFY	0,57
2	MANYCHAT	0,24
3	CHAT FUEL	0,19

5.2 Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS)
The steps of TOPSIS is almost the same with AHP, what makes it different is the additional calculation of Positive & Ideal Solution which finalized by Preference Value (Rank) as per table results below.

Table 8. Pair-wise Matrix Comparison

	Feature	Function	Cost	Integration Mode	Priority
BOTSIFY	0,62	0,56	0,48	0,47	2,13
MANYCHAT	0,18	0,27	0,28	0,32	1,05
CHAT FUEL	0,20	0,18	0,24	0,21	0,82

Table 9. Positive Ideal Solution

Positive Ideal Solution	
Botsify	1,66
ManyChat	2,74
Chatfuel	2,96

Table 10. Negative Ideal Solution

Negative Ideal Solution	
Botsify	-0,74
ManyChat	0,33
Chatfuel	0,56

Table 11. Preference Value

Preference Value		Rank
Botsify	-0,81	1
ManyChat	0,11	2
Chatfuel	0,16	3

6. Conclusions

Nowadays, Chatbot is the is the most recent application which can optimize service distribution to the customer by minimizing the communication with live human agents in the first level. However, the distribution service can be distracted by the slow response from the marketplace without supported by advanced application. To achieve customer satisfaction, a company must to consider a helpful application such as Chatbot. Based on analysis conducted by using the AHP and TOPSIS techniques, it can be concluded that the best platform of Chatbot is Botsify with the first rank is Botsify, the second is ManyChat and the last is Chatfuel, these platforms defined as per justification interview with Chatbot expertise. The study hopefully could gain a competitive advantage and achieve customer satisfaction with responsive service delivery supported by a selected chatbot platform especially for marketplaces in Indonesia.

References

Adam, M., Wessel, M., & Benlian, A. AI-based chatbots in customer service and their effects on user compliance. Electronic Markets, 31(2), 427–445, 2021.

Adamopoulou, E., & Moussiades, L. Chatbots: History, technology, and applications. Machine Learning with Applications, 2(July), 100006. 2020.

Agarwal, J., Gulati, N., & Tyagi, V. New Era of Vernacular Voice Assistant. Smart Innovation, Systems and Technologies, 243, 553–564, 2022.

Baczkiewicz, A. MCDM based e-commerce consumer decision support tool. Procedia Computer Science, 192, 4991–5002, 2021.

Badan Pengkajian dan Penerapan Teknologi. Strategi Nasional Kecerdasan Artifisial Indonesia. 194, 2020. https://ai-innovation.id/server/static/ebook/stranas-ka.pdf

Badan Pusat Statistik. Statistik E-Commerce 2021, 2021.

Bataineh, O., Hjeelah, D. A., & Arabiat, S. Multi-Criteria Decision Making Using AHP to Select the Best CAD Software. *Advances in Intelligent Systems and Computing*, 680, 106–115, 2017.

Bharti, U., Bajaj, D., Batra, H., Lalit, S., Lalit, S., & Gangwani, A. Medbot: Conversational artificial intelligence powered chatbot for delivering tele-health after covid-19. *Proceedings of the 5th International Conference on Communication and Electronics Systems, ICCES 2020*, Icces, 870–875, 2020.

Casillo, M., Colace, F., Fabbri, L., Lombardi, M., Romano, A., & Santaniello, D. Chatbot in industry 4.0: An approach for training new employees. *Proceedings of 2020 IEEE International Conference on Teaching, Assessment, and Learning for Engineering*, TALE 2020, 371–376, 2020.

Chopra, S. M. P. Supply chain management: strategy, planning, and operation - third edition. 2003.

Chung, M., Ko, E., Joung, H., & Kim, S. J. Chatbot e-service and customer satisfaction regarding luxury brands. *Journal of Business Research, 117(October 2018*), 587–595, 2020.

Davenport, T., Guha, A., Grewal, D., & Bressgott, T. How artificial intelligence will change the future of marketing. *Journal of the Academy of Marketing Science*, 48(1), 24–42, 2020.

De Cicco, R., e Silva, S. C., & Alparone, F. R. Millennials' attitude toward chatbots: an experimental study in a social relationship perspective. International Journal of Retail and Distribution Management, 48(11), 1213–1233. 2020.

Dhamija, P., & Bag, S. Role of artificial intelligence in operations environment: a review and bibliometric analysis. TQM Journal, 32(4), 869–896, 2020.

Enholm, I. M., Papagiannidis, E., Mikalef, P., & Krogstie, J. Artificial Intelligence and Business Value: a Literature Review. Information Systems Frontiers, August. 2021.

Foote, D. K. Artificial Intelligence, Machine Learning, and Data Protection. 2021. Dataversity. https://www.dataversity.net/artificial-intelligence-machine-learning-and-data-protection/#

Hanine, M., Boutkhoum, O., Tikniouine, A., & Agouti, T. Application of an integrated multi-criteria decision making AHP-TOPSIS methodology for ETL software selection. 2016.

Hochheiser, S. Stars: Electromechanical telephone switching. *Proceedings of the IEEE*, 101(10), 2299–2305, 2013.

Hodgkin, A. ., & Huxley, A. Currents carried by sodium and potassium ions through the membrane of the giant axon of Loligo. J Physiol, 449–472,1952.

Hsu, C. H., Yang, C. M., Chen, T. C., & Chen, C. Y. Applying AHP method select online shopping platform. *2010 7th International Conference on Service Systems and Service Management*, 912–916, 2010.

Huang, M. H., & Rust, R. T. Artificial Intelligence in Service. *Journal of Service Research*, 21(2), 155–172, 2018.

IBM Cloud Education. What is Natural Language Processing? | IBM. 2020. https://www.ibm.com/cloud/learn/natural-language-processing

Illescas-Manzano, M. D., López, N. V., González, N. A., & Rodríguez, C. C. Implementation of chatbot in online commerce, and open innovation. *Journal of Open Innovation: Technology, Market, and Complexity*, 7(2). 2021.

International Institute of Communications. Artificial intelligence in the Asia-Pacific region. 2021.

Kang, J., Kim, J. S., & Seol, S. The prioritization of technologies and public R&D roles between the manufacturing and service industries in the fourth industrial revolution. Foresight, 21(6), 680–694, 2019.

Karia, S., Mehta, M., Konar, K., & Kabli, N. BankBot: Contactless Machine Learning Chatbot for Communication during COVID-19 in Bank. SSRN Electronic Journal, 1–6, 2021.

Kibble, R. Introduction to Natural Language Processing. In University of London (Vol. 1, Issue 2). 2013.

Kizielewicz, B., Shekhovtsov, A., Sałabun, W., Sankar Sana, S., Sadhukhan, S., & Ahn, H. Methodical Aspects of MCDM Based E-Commerce Recommender System. J. Theor. Appl. Electron. Commer. Res, 16, 2192–2229, 2021.

Lee, S. B. Chatbots and Communication: The Growing Role of Artificial Intelligence in Addressing and Shaping Customer Needs. Business Communication Research and Practice, 3(2), 103–111, 2020.

Mardani, A., Jusoh, A., Nor, K. M. D., Khalifah, Z., Zakwan, N., & Valipour, A. Multiple criteria decision-making techniques and their applications - A review of the literature from 2000 to 2014. *Economic Research-Ekonomska Istrazivanja* , 28(1), 516–571, 2015.

Meghan Rimol. Gartner Forecasts Worldwide Artificial Intelligence Software Market to Reach $62 Billion in 2022. 2021. https://www.gartner.com/en/newsroom/press-releases/2021-11-22-gartner-forecasts-worldwide-artificial-intelligence-software-market-to-reach-62-billion-in-2022

Micu, A., Geru, M., Capatina, A., Constantin, A., Rusu, R., & Panait, A. A. Leveraging e-Commerce Performance through Machine Learning Algorithms. Annals of Dunarea de Jos University of Galati. Fascicle I. Economics and Applied Informatics, 25(2), 162–171, 2019.

Ngoc Toan, P., Dang, T.-T., Thi Thu Hong, L., Tomášková, H., Mls, K., & Wilhelm Weber, G. E-Learning Platform Assessment and Selection Using Two-Stage Multi-Criteria Decision-Making Approach with Grey Theory: A Case Study in Vietnam. 2021.

Nishika, G. A literature survey on artificial intelligence. *International Journal of Engineering Research & Technology (IJERT)*, 5(19), 1–5, 2017.

Oguntosin, V., & Olomo, A. Development of an E-Commerce Chatbot for a University Shopping Mall. *Applied Computational Intelligence and Soft Computing*, 2021.

Piris, Y., & Gay, A. C. Customer satisfaction and natural language processing. *Journal of Business Research, 124(December 2020)*, 264–271, 2021.

Porter, M. E. Technology and competitive advantage. *Journal of Business Strategy*.1985.

Pramudhita, A. N., Suyono, H., & Yudaningtyas, E. Making dengan Metode Topsis dalam Penempatan Karyawan. 91–94, 2015.

Priambodo, I. T., Sasmoko, S., Abdinagoro, S. B., & Bandur, A. E-Commerce Readiness of Creative Industry During the COVID-19 Pandemic in Indonesia. *The Journal of Asian Finance, Economics and Business, 8(3)*, 865–873, 2021.

Putri, R. A., Vivin, & Devita. Report: Peta Persaingan E-commerce Q3 2021. 2021. https://iprice.co.id/trend/insights/report-peta-persaingan-e-commerce-q3-2021/

Rajak, M., & Shaw, K. Evaluation and selection of mobile health (mHealth) applications using AHP and fuzzy TOPSIS. *Technology in Society, 59(April),* 2019.

Romeo, L., Loncarski, J., Paolanti, M., Bocchini, G., Mancini, A., & Frontoni, E. Machine learning-based design support system for the prediction of heterogeneous machine parameters in industry 4.0. *Expert Systems with Applications,* 140, 2020.

Saaty, R. W. (2008). The analytic hierarchy process-what it is and how it is used. *Mathematical Modelling, 9(3–5)*, 161–176, 2008.

Sandu, N., & Gide, E. Adoption of AI-chatbots to enhance student learning experience in higher education in india. *2019 18th International Conference on Information Technology Based Higher Education and Training, ITHET 2019*, 1–5, 2019.

Sanny, L., Susastra, A. C., Roberts, C., & Yusramdaleni, R. The analysis of customer satisfaction factors which influence chatbot acceptance in Indonesia. *Management Science Letters, 10(6)*, 1225–1232, 2020.

Sarfaraz, A., Mukerjee, P., & Jenab, K. E. D.-M. M. on E. an O. E.-C. P. A. C. S. pd. Using fuzzy analytical hierarchy process (AHP) to evaluate web development platform. *Management Science Letters, 2(1)*, 253–262, 2012.

Sari, A. C., Virnilia, N., Susanto, J. T., Phiedono, K. A., & Hartono, T. K. Chatbot developments in the business world. *Advances in Science, Technology and Engineering Systems, 5(6)*, 627–635, 2020.

Seri, R. (2 The Analytic Hierarchy Process and the Theory of Measurement. 2009.

Sfenrianto, & Vivensius. Analyis on factors influencing customer experience of e-commerce users in Indonesia through the application of Chatbot technology. *Journal of Theoretical and Applied Information Technology, 98(7)*, 953–962, 2020.

Solis-Quispe, J. M., Quico-Cauti, K. M., & Ugarte, W. Chatbot to Simplify Customer Interaction in e-Commerce Channels of Retail Companies. 561–570, 2021.

Syamsuddin, I., & Warastuti, S. W. Selecting ChatBot Platform for Health Enterprise Training: A Fuzzy AHP Approach. 756–760, 2022.

Trappey, A. J. C., Trappey, C. V., Chao, M.-H., & Wu, C.-T. (2022). VR-enabled engineering consultation chatbot for integrated and intelligent manufacturing services. *Journal of Industrial Information Integration, 26(October 2021),* 2022.

Turing, A. I.—Computing Machinery and Intellegent. 236, 433–460, 1950.

Um, T., Kim, T., & Chung, N. How does an intelligence chatbot affect customers compared with self-service technology for sustainable services? Sustainability (Switzerland. 2020.

ZEMČÍK, M. T. A Brief History of Chatbots. *DEStech Transactions on Computer Science and Engineering.* 2019.

Zhang, H. Research and Modelling on the E-commerce Consumer Behavior based on Intelligent Recommendation System and Machine Learning. *DEStech Transactions on Social Science, Education and Human Science.* 2016.

Biographies

Desi Triyana currently pursues her Master Degree in Industrial Engineering Department, Universitas Indonesia with concentration in Industrial Management class of 2020. She earned a Bachelor in German Literature Department, Universitas Indonesia, Depok, Indonesia. Now, she is working in a global Information Technology company as Asia Pacific Operation Executive, handling operations for 6 countries.

Armand Omar Moeis is a lecturer in Industrial Engineering Department Faculty of Engineering Universitas Indonesia. He holds a Bachelor of Engineering degree in Industrial Engineering from Universitas Indonesia, a Master degree in Engineering and Policy Analysis from Delft University of Technology, Netherlands. His research interests are System Dynamics and Collaborative Analysis and Learning whereas his main application areas are public services and energy.