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Research Article

Strengthening TINA: Using Pugh Matrix and Kano Analysis to Improve Its Design Threshold and Performance Criteria

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ABSTRACT

Amidst the pandemic, the Teknoy-Inquiry Assistant (TINA) system was created to accommodate student institution–related questions while following the restrictions implemented by the government. Due to the rushed design, users experience untimely response problems when using the service. The research aims to investigate and propose improvements to the TINA system for the sustainability of the service. The researchers focused on the turn-around time for the replies to the questions in the TINA system. To further justify the importance of addressing the turn-around time of replies, the researchers also investigated the meaningful relationship between student satisfaction and response time. The researchers addressed and resolved the reply time using Kano Analysis. The research also used purposive sampling, using researcher-made survey questionnaires to find the relationship between student satisfaction and the timeliness of replies. With the help of the Pearson correlation coefficient, the researcher found a positive correlation between student satisfaction and reply time, with a positive correlation value of 0.4090. Since a positive correlation is found between student satisfaction and reply time, improving the turn-around time of reply certainly increases student satisfaction. Therefore, to improve TINA, the researchers advocate implementing its Artificial Intelligence Chatbot version to improve reply time. The research is the first to contribute to the Field of Technology and University Services within the local context since it may give practical suggestions on properly creating an Inquiry Assistant System among regional universities.

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Keywords: *Ticketing system, Teknoy-Inquiry Assistant System, Turn-around Time, Chatbot, Kano Analysis, Institutional Service*

Introduction

We can never predict the future, just like how the pandemic strikes the world by surprise in 2020 and halts many vital sectors, including the academic sector (Oneyema et al., 2020). Due to tight health guidelines imposed by the World Health Organization (WHO), face-to-face setups, the conventional way of teaching commonly used by educational institutions, are forbidden to minimize the spread of disease. Despite this predicament, the academic sector finds its way to overcome the problem of the prohibition of face-to-face class sessions by implementing full online class sessions in the curriculum globally (Leal Filho et al., 2022). With the pandemic and its tight guidelines, the conventional face-to-face setup used by students to ask institution-related questions also becomes a problem for the school staff (Sá et al., 2021). To address this problem, the Management Information System (MIS) department of an academic institution designs a program and service to accommodate institution-related questions of students called the Teknoy-Inquiry Assistant (TINA) system by integrating a ticketing system technique wherein it is activated with the help of Microsoft Power Apps. It is currently operated by the Enrollment Technical Office of the academic institution. Since it is a service, it must prioritize the quality of its products to retain customer satisfaction. For that to happen, management activities and functions must receive utmost attention to maintain excellence in establishing quality policymaking, quality assurance and control, and quality improvement (Naini et al., 2022). This study aims to enhance the efficiency and effectiveness of the Teknoy-Inquiry Assistant (TINA) system of the academic institution through the application of Kano Analysis. A survey by Dewi (2019) supports that Kano Analysis is feasible for assessing service quality by categorizing service attributes that satisfy customer needs. Goldstein (2024) finds that implementing a customer-based service delivery strategy is significant in the usage of chatbots to contact responders. Gupta and Shri (2018) highlight in their journal the applicability of the Kano Model in customer satisfaction to create chatbots that prioritize features according to client needs. The study is necessary for research on academic sustainability in the country to address the recurring problem of local educational institutions regarding resource optimization, cost efficiency, and environmental impact (Pandey et al., 2022). Since the study is the first to contribute to the local field of research, it is necessary to identify and prioritize the features and functionalities of TINA that contribute most significantly to student satisfaction by employing the Kano Analysis. Numerous facets of online query management tools and digital ticketing systems in the academic sector have been examined in previous theoretical and empirical research. Nonetheless, a significant void exists in the literature regarding the explicit application of Kano Analysis to improve the threshold and performance qualities of these systems, particularly in the field of higher education institutions (Madzík et al., 2019). The researchers aim to contribute towards higher education's institutional services and provide suggestions for academic institutions seeking the enhancement of their digital service offerings amidst the challenges posed by digital transformation and the evolving needs of students.

Objectives

The study aimed to investigate and propose improvements to the TINA system, a service designed to accommodate institution-related questions of students at the academic institute, by employing the Kano analysis. This helped determine its implications and further contributed to the theories and practices in the technology and service design of academic institutions and their sustainability aspect.

Specifically, the research aimed to:

1. To investigate the importance of turn-around time service of the TINA system at the academic institute.

2. To determine the significant relationship between response time and student satisfaction.
3. To propose a better alternative or improvement of the service to increase TINA's sustainability

Methodology

This research used a quantitative approach, collected numerical data to improve the TINA institutional service by reducing turnaround time using design on Pugh Matrix and Kano Analysis. It also employed Pearson Correlational Design to examine the relationship between response time and student satisfaction with TINA. The study had a cross-sectional time horizon, gathered data at a specific moment to provide an overview of the current situation among respondents. The study took place at an academic institution in Cebu City, Philippines, focusing on the TINA system, a service used by academic institutions. The study employed a purposive sampling method to select participants who met predefined criteria: bona fide students at the academic institute during the 2021-2022 and 2022-2023 academic years who used the TINA service. To ensure authenticity, respondents provided their school ID number and course. The sample size was determined using G power under the bivariate average model of correlation test, with a minimum required sample size of 84, a correlation p value of 0.3, and a statistical power value of 0.8. An additional 20% was added for statistical treatment, resulting in a sample size of 101 (Etikan, 2016). To collect the necessary data, researchers requested TINA response data from the Enrollment Technical Office for the academic years 2021-2022 and 2022-2023. They also created a structured survey questionnaire to assess the correlation between timely response and service satisfaction, as well as the importance of service features. The survey contained 22 questions divided into three sections: satisfaction with TINA services, satisfaction with timely responses, and satisfaction with TINA system features. Each section had questions rated on a 4-point Likert scale for the first two sections and a 10-point Likert scale for the third. The survey was validated using Cronbach's alpha test, achieving a high reliability score of 0.7443 from a pilot test with 30 students separate from the main 101 respondents. This validation ensured the survey's credibility and consistency. Data from the survey were organized and analyzed using the weighted mean and Pearson Correlation Coefficient to measure the linear relationship between response time and student satisfaction. Researchers informed respondents about the study's aims through an invitation to participate form and obtained consent via an informed consent form, ensuring confidentiality and participant rights. Conflicts of interest were avoided. Data were securely stored and planned for deletion after five years, with anonymization applied to the Enrollment Technical Office data. Respondents were briefed on the study's details and given the option to participate or refuse, ensuring informed consent. Ethical standards were maintained, with no harm to respondents and full disclosure of the study's goals, methods, and benefits. Researcher approval was obtained prior to the study.

Results and Discussions

The researchers had employed two quantitative tools to accomplish the objectives of the study – the Kano Analysis and Pearson Correlation Coefficient to interpret the data findings. The statistical tool Pearson Correlation Coefficient was utilized to determine the level of a significant relationship between response time and student satisfaction; this was accomplished with the help of a research instrument. The research instrument was a researcher-made survey questionnaire validated with the help of the Cronbach Alpha Test. Additionally, to verify the most necessary feature of the service TINA, the researchers had employed Kano Analysis. The fourth section of the study was divided into two parts, and the two sets of data gathered by the researchers were explained. The researchers collected the first data after requesting it from the Enrollment Technical Office, and the second data was gathered from the results of research survey questionnaires. The first data, which revolved more around the Turn-around Time of the Service, was extracted at the Enrollment Technical Office of the aca-

demic institute upon the request of the researchers. It exhibited how long a service in the TINA system usually took to complete. Furthermore, the second datum in this study was extracted from the researcher-made survey questionnaires, which showed the satisfaction level of the students in a Likert scale model, which had been interpreted using the tools Kano Analysis and Pearson Correlation Coefficient.

TINA Turn-around Time Datum Analysis

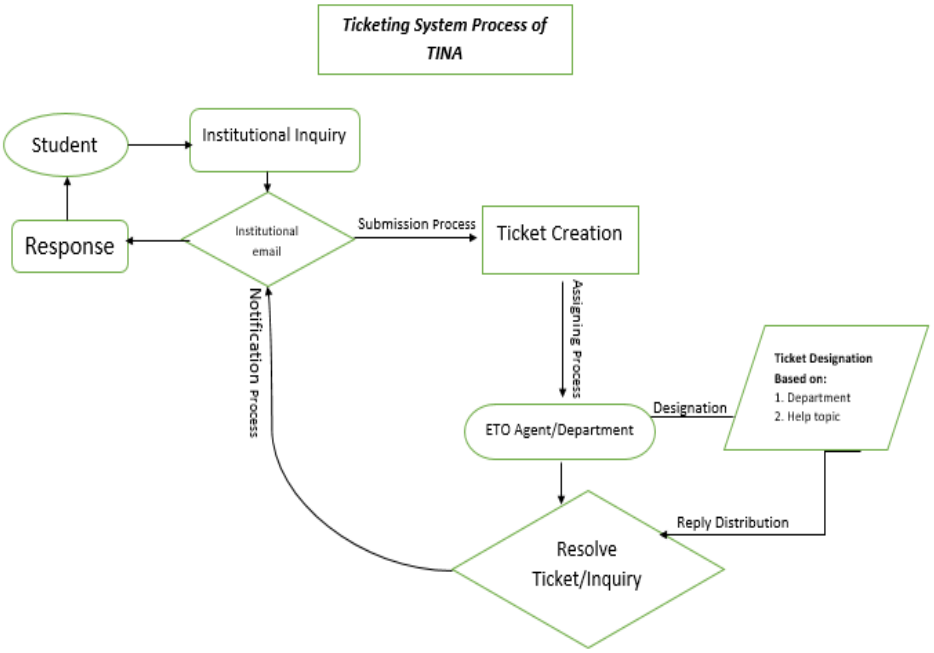

Figure 1. TINA System Ticketing Process

A ticketing system aided both support groups and internal members of a company by tracking all incidents and requests tickets for their clients, despite its limited features (Aglibar et al., 2022). The TINA System implemented a ticketing system technique in its program, and students had to adhere to a specific process to complete the service transaction. So, in Figure 1: TINA System Ticketing Process shown above, for a student to avail of the service, they had to submit an institutional inquiry using their institutional email provided upon enrollment at the academic institution. After submitting the inquiry, the created ticket was received by an employee or staff member of the Enrollment Technical Office, who would then designate the ticket according to the topic of the inquiry if the topic could not be answered directly by the staff of the Enrollment Technical Office. Then, the tickets were allocated to the different departments of the academic institution for a reliable answer to the institution-related questions. After that, it was resolved and sent back to the student via institutional email. From this process, the researchers deduced that the TINA System needed better design to monitor inquiries and their status, which resulted in a heavy backlog of inquiries. Sometimes, the response took up to two whole months before the inquiry was resolved, or, worse, it was never resolved even after the semester ended because it was buried along with many other inquiries due to the backlog in the system. This was not surprising since the TINA system was a rushed design created to accommodate institution-related questions while following the health protocols of the World Health Organization. With this, the researchers opted to investigate the system further and proposed an improved design where the timeliness of response was enhanced.

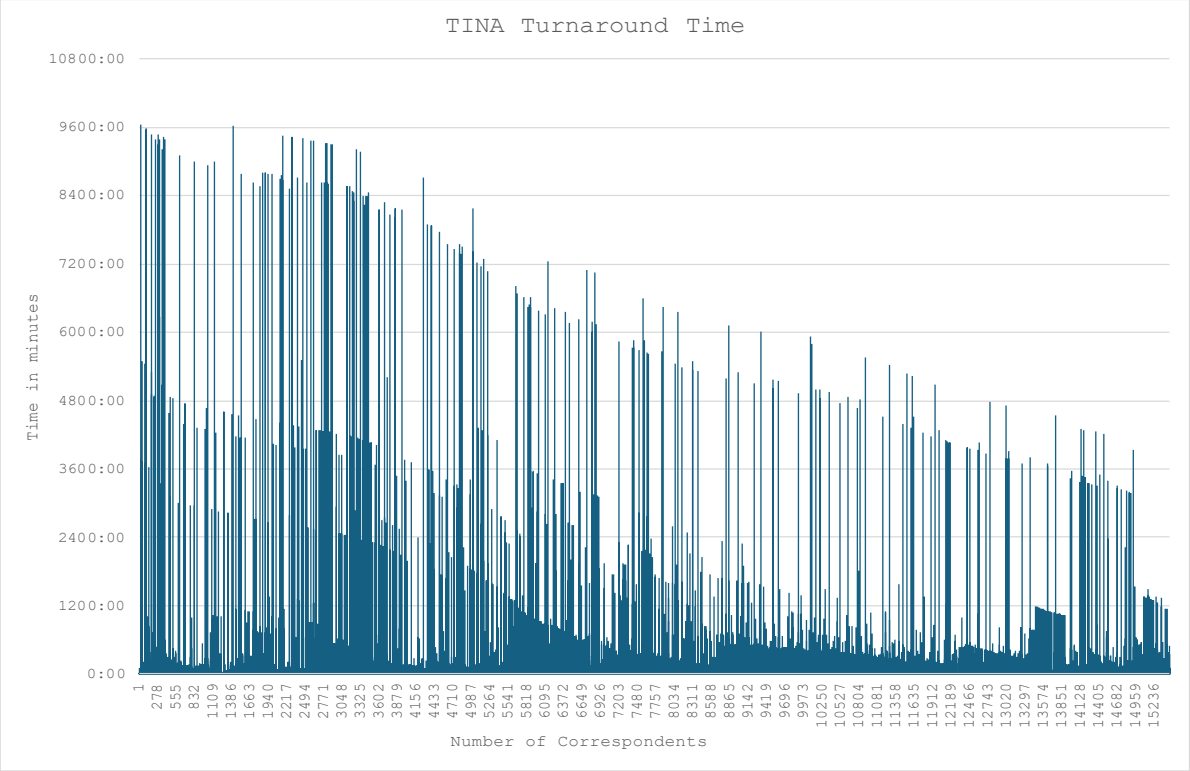

Figure 2. Column Chart of TINA System Turn-around Time

In Figure 2, Column Chart of TINA System Turn-around Time shown above, the researchers observed that the service, while not designed well enough, was still popular, given that in the span of two academic years, 15,483 students availed the service. The researchers discovered that TINA was modified by two different entities: the system itself and the personnel of the system. However, since modification by the system signified an automatic adjustment, it was not acknowledged by the researchers, meaning that any modification not made by personnel was regarded as unreliable source data. Additionally, any modification that was not more significant than five (5) minutes on the turn-around time was not acknowledged, since the time for a response to be created usually took a minimum of five minutes, according to the staff of the Enrollment Technical Office. With this, the researchers determined that the number of students who availed the service and had their inquiries answered was 9,208. According to the data the researchers requested from the Enrollment Technical Office, the number of correspondents modified by personnel above the time of five (5) minutes was 7,511. Of these 7,511 correspondents, 6,957 received their responses in over a day. Out of these 6,957 correspondents, 473 received their responses more than a week later. From this data alone, the researchers observed an average turn-around time of 243 minutes (about 4 hours) for a response to be created by the service, which was a considerable amount of time. The researchers inferred that the timeliness of responses needed to be improved. Additionally, turn-around time was vital for the improved performance of a service (Dawande et al., 2022).

Kano Analysis

Table 1. TINA System Service Features and its corresponding Students' Satisfaction level and Place of Lifestyle

#	Feature Name	Satisfaction Level	Place in Lifestyle
1	Functionality	6	7
2	Reliability	7	6
3	Ease of Use	5	8
4	Response Time	8	6
5	Accuracy	8	5
6	Customization	5	4
7	Integration with Other Systems	6	10
8	Personalization	8	9
9	Aesthetic Design	9	9

A study by Kermanshachi et al. (2022) claimed that Kano Analysis aided service providers in realizing the relative importance of the attributes of their service in evaluating the impacts of their current practices on customer satisfaction levels. With the help of a survey questionnaire, the researchers took the average satisfaction level of the TINA system's features and the level of its place in the respondent's lifestyle. The first three features referred to the must-have attributes of a service or the essential functions present in a service or product. In comparison, the following three features referred to the one-dimensional characteristics of a service or its satisfiers, wherein these attributes could better satisfy the users if they were present in a product. The last three chosen features referred to the service's attractive attributes, which could help attract users to patronize the service due to their presence. The table was divided into three parts, showing the feature name, satisfaction level, and place in lifestyle. The satisfaction level was scaled from 1 to 10, where one (1) was the lowest level, and ten (10) was the highest, while in the place in lifestyle, it was also scaled from 1 to 10, but in this case, 10 was the lowest level of prioritization, and 1 was the highest level of prioritization. Also, the scale in the table above was the average number of 101 respondents and was rounded to the nearest whole number. The table above showed that aesthetic design gave most users the highest satisfaction level, while ease of use and customization had the lowest satisfaction level. It was also shown that users tended to prioritize the accuracy of TINA rather than its capability to integrate into other systems, with an average prioritization level of 5 and 10, respectively. From the table alone, the researchers figured that the most balanced feature out of the nine (9) features was the customization feature since it was scaled near the middle of the maximum scale.

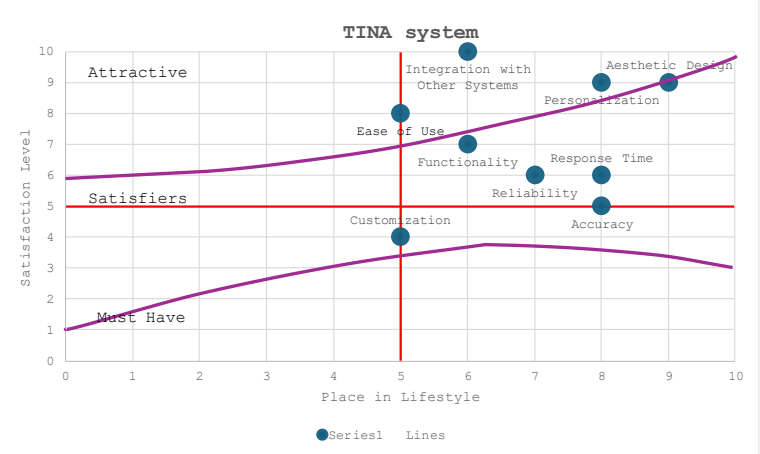

Figure 3. Kano Analysis Graph of TINA System Service Features

Student expectations were crucial in-service development since they influenced perceived service quality, the service delivery method, and the output of higher education institutions. Hence, students assessed the perceived or cognitive value of services based on their prior experience with the service provided. That was why students were considered critical customers in the context of higher education (Onditi & Wechuli, 2017). Product quality, service quality, and customer satisfaction significantly impacted a customer's loyalty (Firmansyah, 2023). Thus, to make an institution or business profitable and develop rapidly, it had to prioritize the quality of its products to retain customer satisfaction. For that to happen, management activities and functions needed to be given utmost attention to maintain excellence in establishing quality policy-making, quality assurance and control, and quality improvement (Naini et al., 2022). In this figure, Table 1: TINA System Service Features and its corresponding Students' Satisfaction Level and Place of Lifestyle was simply turned into a scatter plot chart to better understand the gathered data regarding the service features called "TINA." The figure showed that Customization and Accuracy Features diverged more towards the lower linear curve line, representing that these two attributes should have been a part of the expected quality of the service. In the case of aesthetic design, integration with other systems, customization, functionality, and ease of use, these features diverged more towards the upper linear curve line, which meant that these attributes were the exciting quality of the service. Lastly, reliability and response time features were found more in the middle part of the two linear curve lines, meaning that these attributes represented the average quality of the service. This meant that the researchers should have focused on the expected quality of the service followed by regular and exciting attributes. However, given the time constraints of this research, the researchers deduced that response time should have been the feature that this study emphasized more.

Design on Pugh Matrix

Table 2. Assessment of Alternative Designs of the TINA System

Design	Weight	TINA integration to CIT-U pinnacle	Designation of a definite office for handling TINA	Chatbot version of TINA	Create an on-site Digital Directory Kiosk for TINA
Timeliness of response	0.25	0	0.25	0.25	0.25
Student-Satisfaction	0.15	0	0	0.15	0.15
Reliability	0.15	-0.15	0.15	0	-0.15
User-friendly	0.15	0	0	0.15	0.15
Costefficiency	0.15	0.15	0	-0.15	-0.15
Time-friendly	0.1	0.1	0	0.1	0.1
Security	0.05	0	0.05	0	0
	+	0.25	0.45	0.65	0.65
	0	0.6	0.55	0.2	0.05
	-	0.15	0	0.15	0.3
	TOTAL SCORE	**0.1**	**0.45**	**0.5**	**0.35**

The total scores provided a clear ranking of the alternatives, with Alternative 3 scoring the highest, followed by Alternative 2, Alternative 4, and Alternative 1. Alternative 1 gained the lowest score compared to the other four (4) alternatives since most of its solution score was synonymous with the standard solution. It also had a 14% unfavorable score compared to the standard solution on its reliability criterion. Alternative 2 was only next to the overall highest Pugh matrix score since it was the only alternative that did not have a negative score in the predefined criteria. It was next to Alternative 1 regarding scores synonymous with the

standard solution. Also, only this alternative had a positive score on its reliability criterion since it would have been closely monitored by a designated agent who could think critically, providing much more reliable answers to student queries. Alternative 4 ranked third in the overall ranking of the Pugh matrix score. While having almost identical scores to Alternative 1, it gained a second negative score under the reliability criterion since the chatbot would only have gotten its quality according to its inputted data on its server, and its answers were unlikely to be monitored daily. Alternative 3 gained the overall highest score; while having almost identical scores as Alternative 4, it only had one negative score on its overall criteria, specifically on the cost-efficient criterion, since procuring this machine and integrating it with the service TINA was costly. Thus, the most appropriate improvement the researchers could propose was implementing the chatbot version of TINA since it had the highest matrix score out of the four (4) alternatives of TINA. Developing an AI-enabled chatbot for admission support had its own merits. It could be programmed to be available 24/7, for 365 days (about 12 months). Rieke and Martins (2023) declared that a chatbot could offer optimal solutions for streamlining university admissions by helping students or parents gain access to and understand the enrollment process. Since manually authorizing staff to answer simple and frequent questions from students took a lot of time and workforce, and considering minor and significant mistakes due to firsthand interaction with students, developing and implementing an AI-enabled chatbot for school service would have been a perfect solution for such a case. This would have aided the university in saving some of its workforce and controlling the errors that would have arisen (Su et al., 2020). Additionally, Lin et al. (2023) investigated the development of an educational chatbot system to enhance students' biology learning performance, underscoring the potential of chatbots in supporting learning outside the classroom. By the end of this experimentation, it yielded a positive impact on respondents' learning achievements. In a sense, chatbots needed to upgrade their information and service quality to improve user satisfaction (Ashfaq et al., 2020).

Table 3. Interrelationship between Students' Satisfaction and Response Time

Relationship Between Satisfaction Level and Timely Response		
	Student Satisfaction Level	**Timely Response**
Student Satisfaction Level		0.409
Timely Response	0.409	

Note: Correlation is significant at the 0.01level (2-tailed)

Caruelle et al. (2023) had already established that customer satisfaction tended to be higher when service waiting time was shorter than customer expectation. Additionally, Daengs and Istanti (2022) explicitly stated that punctual delivery of service had a significant effect on customer satisfaction and loyalty. With the help of the Pearson Correlation Coefficient and weighted mean average per question, the researchers found a low positive correlation between student satisfaction level and timely service response. The coefficient (r) value was 0.4090, with a T-statistic value of 4.46 and a p-value of 0.00002168. Despite having a low correlation value, it was still positive, which meant that student satisfaction level and timely service response had a significant relationship. Also, the correlation used a 0.01 significance level at the 2-tailed test.

Conclusion

The investigation revealed significant flaws in the TINA system's current architecture, particularly regarding its sustainability as an institutional function. Analyzing extensive data from the academic institute's Enrollment Technical Office highlighted key shortcomings such as an inadequate process for tracking queries, resulting in a significant backlog, and an unacceptably poor turnaround time, with responses

sometimes taking over two months or not being returned at all. The application of the Pugh Matrix provided a clear ranking of alternatives for system improvement. Alternative 3 emerged as the highest-scoring option, followed by Alternative 2, Alternative 4, and Alternative 1. Alternative 1 received the lowest score, primarily due to its similarities with the standard solution and a 14% unfavorable score on its reliability criterion. Alternative 2, while close to Alternative 3 in the overall ranking, did not have any negative scores in the predefined criteria and had a positive reliability score due to its close monitoring by a designated agent. Alternative 4 ranked third, with similar scores to Alternative 1 but a second negative score under the reliability criterion. Alternative 3, though having a high overall score, had a negative score on the cost-efficiency criterion due to the high cost of procurement and integration. Thus, the researchers recommended implementing the AI chatbot version of TINA, given its highest matrix score among the alternatives. The study highlighted the critical importance of quick responses in ensuring student satisfaction, as indicated by the low positive correlation between student satisfaction and response time. The recommendation aligns with students' prioritized features, focusing on improving responsiveness to meet their expectations more effectively.

The study faced limitations related to sample size, which may impact the generalizability of the findings. Future research should aim to expand the sample population and include data from other universities with similar digital service systems or chatbots to enhance the study's external validity. This broader scope will provide a more comprehensive understanding of the system's effectiveness across different institutional contexts. To better understand TINA's position, examining similar systems used in other countries can provide valuable insights. Many universities worldwide have implemented AI-driven chatbots to streamline service processes and improve user interaction. Comparing TINA with these international systems can offer perspectives on effective practices and areas for improvement. The implementation of an AI chatbot solution holds significant promise for transforming university services. AI chatbots can offer 24/7 support, manage a high volume of inquiries, and reduce human error. Exploring how such technology can be adapted and scaled across various university services could yield further insights into its benefits and challenges. Future research should focus on longitudinal studies to assess the impact of system enhancements on students' satisfaction over time. Scholars could investigate how ongoing improvements in AI chatbots influence service quality and student engagement and evaluate the long-term benefits of these systems. This study not only provides practical recommendations for enhancing the TINA system but also contributes to the broader discussion on technology integration and service design in higher education. By addressing identified gaps and obstacles, the study sets a precedent for future research and innovation aimed at improving university services and advancing inquiry assistant systems.

References:

Aglibar, K. D., Alegre, G. C., Del Mundo, G., Duro, K. F., & Rodelas, N. (2022). Ticketing system: Descriptive research on the use of ticketing system for project management and issue tracking in its companies. *arXiv preprint arXiv:2202.06213*. Retrieved on May 18, 2024, from https://doi.org/10.25147/ijcsr.2017.001.1.90

Ashfaq, M., Yun, J., Yu, S., & Loureiro, S. M. C. (2020). I, Chatbot: Modeling the determinants of users' satisfaction and continuance intention of AI-powered service agents. *Telematics and Informatics*, *54*, 101473. Retrieved on May 18, 2024, from https://doi.org/10.1016/j.tele.2020.101473

Caruelle, D., Lervik-Olsen, L., & Gustafsson, A. (2023). The clock is ticking—Or is it? Customer satisfaction response to waiting shorter vs. longer than expected during a service encounter. *Journal of Retailing*, 99(2), 247–264. https://doi.org/10.1016/j.jretai.2023.03.003

Daengs G., & Istanti, E. (2022). The role of timeliness in improving customer satisfaction,

customer loyalty of pt. Jne. IJEBD(International Journal of Entrepreneurship and Business Development), 5(2), 339–345. Retrieved on June 3, 2024, from https://doi.org/10.29138/ijebd.v5i2.1782

Dawande, P. P., Wankhade, R. S., Akhtar, F. I., & Noman, O. (2022). Turnaround time: An efficacy measure for medical laboratories. *Cureus*. Retrieved on May 17, 2024, from https://doi.org/10.7759/cureus.28824

Dewi, S. K. (2019). Service quality assessment using servqual and kano models. *Jurnal Teknik Industri*, 20(1), 94–104. Retrieved on June 3, 2024, from https://doi.org/10.22219/JTIUMM.Vol20.No1.94-104

Etikan, I. (2016). Comparison of convenience sampling and purposive sampling. *American Journal of Theoretical and Applied Statistics*, 5(1), 1. Retrieved on May 17, 2024, from https://doi.org/10.11648/j.ajtas.20160501.11

Firmansyah, A. (2023). THE EFFECT OF PRODUCT, BRAND ASSOCIATION, BRAND PERSONALITY AND ENDORSER IN INTENSE BUYING. *Media Mahardhika*, *22*(1), 41-47. Retrieved on June 2, 2024, from https://doi.org/10.29062/mahardika.v22i1.508

Goldstein, K. (2024). Kano analysis: The kano model explained. *Qualtrics*. Retrieved on May 18, 2024, from https://www.qualtrics.com/experience-management/research/kano-analysis/

Gupta, M., & Shri, C. (2018). Understanding customer requirements of corrugated industry using Kano model. *International Journal of Quality & Reliability Management*, 35(8), 1653–1670. Retrieved on May 18, 2024, from https://doi.org/10.1108/IJQRM-04-2017-0074

Kermanshachi, S., Nipa, T. J., & Nadiri, H. (2022). Service quality assessment and enhancement using Kano model. *PloS one*, *17*(2), e0264423. Retrieved on May 18, 2024, from https://doi.org/10.1371/journal.pone.0293766

Leal Filho, W., Lange Salvia, A., Abubakar, I. R., Mifsud, M., Azadi, H., Sharifi, A., LeVasseur, T., Luetz, J. M., Velazquez, L., Singh, P., Pretorius, R., Akib, N. A. M., Savelyeva, T., Brandli, L., Muthu, N., & Lombardi, P. (2022). Impacts of the covid-19 pandemic on routines of higher education institutions: A global perspective. *Sustainability*, 14(21), 14105. Retrieved on May 1, 2024, from https://doi.org/10.3390/su142114105.

Madzík, P., Budaj, P., Mikuláš, D., & Zimon, D. (2019). Application of the kano model for a better understanding of customer requirements in higher education—A pilot study. *Administrative Sciences*, 9(1), 11. Retrieved on April 28, 2024, from https://doi.org/10.3390/admsci9010011

Naini, N. F., Santoso, S., Andriani, T. S., Claudia, U. G., & Nurfadillah, N. (2022). The effect of product quality, service quality, customer satisfaction on customer loyalty. Journal of Consumer Sciences, 7(1), 34–50. Retrieved on June 2, 2024, from https://doi.org/10.29244/jcs.7.1.34-50

Onditi, E. O., & Wechuli, T. W. (2017). Service quality and student satisfaction in higher education institutions: A review of literature. *International journal of scientific and research publications*, *7*(7), 328-335. Retrieved on June 2, 2024, from https://www.academia.edu/download/100178425/ijsrp-p6737.pdf

Onyema, E. M., Eucheria, N. C., Obafemi, F. A., Sen, S., Atonye, F. G., Sharma, A., & Alsayed, A. O. (2020). Impact of Coronavirus pandemic on education. *Journal of education and practice*, *11*(13), 108-121. Retrieved on May 1, 2024, from https://doi.org/10.7176/JEP/11-13-12.

Pandey, N., de Coninck, H., & Sagar, A. D. (2022). Beyond technology transfer: Innovation cooperation to advance sustainable development in developing countries. *Wiley Interdisciplinary Reviews: Energy and Environment*, 11(2), e422. Retrieved on May 1, 2024, from https://doi.org/10.1002/wene.422.

Rieke, T., & Martins, H. (2023). The relationship between motives for using a Chatbot and

satisfaction with Chatbot characteristics: An exploratory study. *SHS Web of Conferences*, 160, 01007. Retrieved on June 3, 2024, from https://doi.org/10.1051/shsconf/202316001007

Sá, M. J., Santos, A. I., Serpa, S., & Miguel Ferreira, C. (2021). Digitainability—Digital competences post-covid-19 for a sustainable society. *Sustainability*, 13(17), 9564. Retrieved on April 27, 2024, from https://doi.org/10.3390/su13179564

Su, L. H. S., Truong, D.-H., Tran, T.-Y.-L., Nguyen, T.-D.-N., Ly, B.-T., & Nguyen, H.-P.-T. (2020). Development of an air chatbot to support admissions and career guidance for universities. *IJEMR*, 4(2), 11–17. Retrieved on May 17, 2024, from https://doi.org/10.22662/IJEMR.2020.4.2.011

Yen-Ting Lin, Y.-T. L., & Yen-Ting Lin, J.-H. Y. (2023). Development of an educational chatbot system for enhancing students' biology learning performance. *Journal of Internet Technology*, 24(2), 275–281. Retrieved on June 3, 2024, from https://doi.org/10.53106/160792642023032402006