

University's Service Delivery Improvement Through a DSS-enabled Client Feedback System

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Abstract—The expansion of products and services on a global scale demands the improvement of an organization's performance. In addition to addressing the challenges of improving product and service delivery, companies must focus not only on meeting customer expectations but also on surpassing them. Consequently, valuing the opinions of clients, giving the best client experience, and measuring client satisfaction are deemed vital not only for the company's survival but also for gaining a competitive edge for the organizations in the wired communities. It is because of these premises that the Client Feedback System was developed in this study for the university's service delivery improvement. This system captured the results of the Client Satisfaction Survey for School Year 2015-2016 to School Year 2020-2021. Interpretation of these captured data were made and action for the improvement of service delivery for each department in this university was recommended using the Decision Support System (DSS) technique. The system was created using the Rapid Application Development (RAD) method and utilized various software and technologies such as HTML, CSS, and JavaScript for the front-end development, MySQL and PHP for the back-end, and Apache as the local server of the system during its development and pilot testing.

Keywords—Decision support system; client satisfaction; client feedback system; rapid application development; service delivery improvement

I. INTRODUCTION

Technological innovation posed an important driver of competitive success for most organizations nowadays to compete successfully and participate in the globalization of markets. Because of this, businesses are under pressure from both domestic and international competition to continuously innovate in order to produce differentiated goods and services.

Many leading companies worldwide place a strong emphasis on prioritizing exceptional customer experiences. They go beyond merely meeting customer expectations and strive to surpass them. Indeed, a world-class performance outcome is necessary so that clients and customers would be satisfied with what the company offers. As a result, it is crucial to evaluate client satisfaction. Client satisfaction describes a customer's perception of the company's quality, value, and expectations. Client satisfaction surveys, a tool used by businesses to gauge how satisfied their clients are with their goods and services, can be used to quantify customer satisfaction [1]. With this system, recognizing dissatisfied clients is just as crucial as identifying those who are really satisfied.

More so, evaluating the satisfaction of customers/clients is needed to understand what the customers expect from the product or service that the company provides. In addition to helping the business retain more customers, doing so enables it to spot and address any critics. A satisfaction survey would allow for the gathering of useful consumer feedback that could be used to ensure total customer experience and satisfaction.

Five benefits of customer satisfaction were presented by Bernazzani [2]. Accordingly, customer satisfaction (a) helps the organization understand where it excels; (b) aids the company in recognizing areas for improvement; (c) leads to higher customer loyalty and advocacy; (d) increases customer retention and reduces stir-up and, (e) increases the client lifetime value. Evaluating customer/client satisfaction indeed can make the organization understand what and where the business is doing well, what business strategy is to be done if the improvement is necessary and what ways could be done in order for the clients to refer new leads to the company and generate more testimonials for their experience. Likewise, satisfied clients will not seek out competition if the company keeps them happy. Customer happiness, therefore, is critical for improving service metrics and ensuring that the firm provides the greatest possible experience.

Assessing client satisfaction was very much imperative in almost all facets of business and service industries such as logistics, food industries, financial institutions, construction industries, hospital general, maternal, and senior health care as well as in educational sectors. Further, businesses and government agencies alike throughout the nation are concerned about the value of exceeding customer expectations. This is embodied in the Philippine Development Plan of the National Economic and Development Authority [3]. The government wants to provide the impression that it is constantly working to make its services cleaner, more effective, and more focused on the needs of its citizens. Similarly, the Civil Service Commission's directives and the Red Tape Act of 2007 [4], include provisions for gathering client satisfaction feedback through surveys.

Higher education from across the globe has long recognized the value of DSS by which it combines data and intelligence, generates the most accurate and likely options and explanations, and fine-tunes uncertain decisions and conclusions, particularly for the improvement of the school's performance [5]. Setting up of DSS is deemed appropriate and well suited for the school's educational mission, cutting-edge research, advanced data collection strategy, and academic activities that are provided to society such as its extension

programs. Hence, the use of DSS in higher education's Information and Communication Technology structures would be a cost-cutting measure for the institution and would enable the school to concentrate on the most important issues of drafting and understanding the best decisions, as higher educational systems delegate involvedness.

Likewise, client satisfaction surveys are also carried out at State Universities and Colleges (SUCs) around the nation, just like they do at other government organizations. Several studies on client satisfaction feedback were conducted in academe that had given insights to the researchers to embark on this topic. St. Paul University Philippines (SPUP) conducted customer satisfaction surveys (CSSs) to assess how well it has succeeded in providing quality services and products both to its internal and external customers. This is a routine activity conducted by the university in its quest for standards of quality and excellence in its delivery of service to clientele. This school evaluates the graduates of post-baccalaureate degrees on their satisfaction with respect to the quality of services provided to them by its academic and non-academic support staff, learning support facilities, learning experience, and research-related matters [6]. Likewise, the study of Ventayen and Orlanda-Ventayen [7] regularly measures the satisfaction rating of the students on the Open University Systems in terms of timeliness, access, convenience, and staff attitude. The results of these surveys and actions taken by the institutions are being validated when they apply for quality assurance evaluations, like the Accrediting Agency of Chartered Colleges and Universities in the Philippines (AACUP) Accreditation, International Standards Organization (ISO), and Institutional Sustainability Assessment (ISA).

Thus, for upholding the Catanduanes State University (CatSU)'s tradition of excellence in service delivery, the researchers conducted this study to assess the effect of client satisfaction evaluations on the performance of the university's offices and departments and improve service delivery using decision support systems (DSS). A computer-based program called a "Decision Support System" (DSS) gathers, organizes, and analyzes data to support good managerial, operational, and planning decision-making. Organizations can identify issues, find solutions, and take choices with the use of DSS analysis [8]. A DSS captures and analyzes data, synthesizing it to produce comprehensive reports. The organization then uses these reports to help in decision-making for the improvement of its goods or services [9].

The following industries use DSS: (a) retail stores to plan strategies to boost sales and advertise their goods; (b) banking institutions to analyze financial data asset reports and income statements; hospitals to improve the workflow of their key medical tasks; (c) farming businesses to plan effective crop-planting procedures; and (d) manufacturing industries to plan out efficient production plans and processes. Universities and academic institutions are also using DSS in order to identify the best course alternatives and provide appropriate amenities, including housing or eating options, and track the number of registered students [10]. Because they help university administrations better plan for student-related expenses, these programs may be especially useful when they create a yearly budget. A DSS system can also be used by administrators to

assess students' academic progress, redesign a course's syllabus, or choose which on-campus services to give the highest priority.

Further, using DSS in Higher Educational Institutions (HEIs) resulted in reduced manual work, better data analysis, and ease of decision-making process, thus it helped increased productivity, employee and customer satisfaction, and revenue and profitability. With the COVID-19 pandemic, DSS helped improved the e-learning process by combining students with similar learning styles and assessing student profiles such as gender, age, the number of hours spent on a course, average time spent per week, and the like [11]. Additionally, the use of web technologies and user experience (UX) in enhancing CRM Business Intelligence applications were considered important factors in the study of Gharaibeh [12]. By leveraging web technologies and optimizing the UX, HEIs can improve their business intelligence implementation, leading to more profitable customers and reduced costs.

Given these assumptions and the significance of implementing DSS in HEIs, this study, therefore, developed an automated web system for collecting information on client satisfaction survey results, performing data analysis, and providing comments or recommendations for improving the university's service delivery using decision support system (DSS). The system developed in this study captured client satisfaction survey results from School Years 2015-2016 to 2020-2021. It likewise stored, organized, and analyzed the data gathered in a database system. From the interpreted result, the system presented a corresponding decision and recommendation for the improvement of the university's service delivery to its clientele.

II. RELATED WORKS

Continuous performance evaluation of an organization enables management to determine if anything has improved or worsened the way clients see a company's business. Meaningful reward and recognition systems can only operate in businesses where there is an accurate and visible process of performance feedback and discussions. The integration of a Decision Support System further improves business processes by recommending valuable actions based on actual data from client satisfaction surveys. The following were the studies reviewed relative to the use of such system. Articles in relation to the use of Decision Support Systems specifically in client satisfaction research were scarce during the time of gathering related articles of this study. Hence, articles relative to Decision Support System, in general, were considered in this paper.

A decision support model was proposed in the study of Dweiri, Kumar, Khan, & Jain. Their model was for supplier selection in the automotive industry. The model was based on the analytic hierarchy process (AHP). The criteria considered in the model were price, quality, delivery, and service. Sensitivity analysis checked the robustness of the decision using Expert Choice software. The suppliers were selected and ranked based on sub-criteria. Sensitivity analysis suggested the effects of changes in the main criteria on the suppliers ranking [13]. The use of AHP in supplier selection gives the decision-

maker confidence in the consistency and robustness of the developed system throughout the process.

A platform that utilized the Decision Support System approach had also been done by Yazdani, Zarate, Coulibaly, & Zavadskas [14]. Their paper proposed a decision support system for selecting logistics providers based on the quality function deployment (QFD) and the technique for order preference by the similarity to the ideal solution (TOPSIS) for the agricultural supply chain in France. The proposed model looked at the decision problem from two points of view which were technical and customer perspectives. The main customer criteria that were considered were confidence in a safe and durable product, emission of pollutants and hazardous materials, and social responsibility while the main technical factors were financial stability, quality, delivery condition, and services. The outcome of this research was a group decision-making system that put into account decision-makers and customer values to aid agricultural partners and investors in the selection of third-party logistic providers. Likewise, the fuzzy linguistic variables enabled to assist agricultural parties in uncertain situations. The integrated decision support system overall enhanced the quality and reliability of the decision-making of the agricultural supply chain.

Similarly, a decision support model was designed by Kucukaltan, Irani, & Aktas for the identification and prioritization of key performance indicators in the logistics industry. The authors designed a stakeholder-informed Balanced Scorecard (BSC) model with the use of the Analytic Network Process (ANP) method to identify key performance indicators as well as various stakeholders in the logistics industry and analyzes the interrelationships among the indicators. The results show that educated employee (15.61%) is the most important indicator of the competitiveness of logistics companies [15].

While the reviewed articles on decision support systems in industries and logistics services demonstrated positive outcomes in enhancing service delivery particularly in logistics services and automotive industries, no article was found and reviewed on client satisfaction survey systems utilizing the DSS approach specifically for higher educational institutions. The integration of this approach to business processes, however, instills greater confidence in decision-makers, as it enables them to make informed decisions based on accurate data as processed by the system. This study, therefore, filled this gap by developing a DSS-Enabled Client Feedback System specifically designed for implementation at Catanduanes State University. The system ensured the accuracy and reliability of suggestions or recommendations by utilizing actual data from client satisfaction surveys conducted every semester.

III. METHODS

This study employed the systems development method and documentary analysis. System development is a process of developing a software or application that will answer the user's needs, particularly on client satisfaction feedback that employed the DSS concept [16], [17]. In their study on the suitability of agile development methodologies for Decision Support Systems (DSSs), Gharaibeh & Abu-Soud discussed the use and effectiveness of agile development methodologies

[18]. Being a progressive agile method, the researchers specifically employed the Rapid Application Development model in developing the application for this study.

The results of a customer satisfaction survey were recorded and used in a documentary analysis for the academic years 2015-2016 through 2020-2021. System development was utilized in the conceptualization, prototyping, and actual development of the system. The system created and recorded the customer satisfaction survey results for the relevant academic year and provided recommendations for the college's or department's service performance.

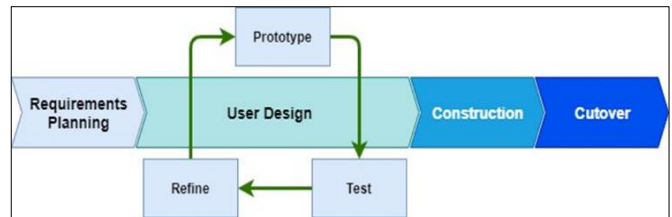


Fig. 1. RAD model.

The development approach used in the study adopted the Rapid Application Development method of Requirements Planning, User Design (iterative method of Prototype, Test, and Refinement), Construction, and Cutover [19], [20], [21], [22]. However, the steps were customized to the actual processes undertaken during the development of the system. Fig. 2 illustrates the activities undertaken in the actual development of the system in this study that was adopted through the RAD model presented in Fig. 1. It could be gleaned from the figure that seven (7) steps were carried out to conceptualize present the finished product and have the user accept them. These steps were: (1) Conceptual Modeling; (2) Gathering and Analysis of Survey Results and User's Requirements for the system; Step 3 is an iterative process of (3-a) Designing of Logical Schema and Developing of Prototype; (3-b) Refinement of the Design and Systems Design; (3-c) Interface Design and (3-d) Database Design; (4) Pilot Testing of the New System; (5) Systems Installation Implementation and Deployment; and (6) User Training.

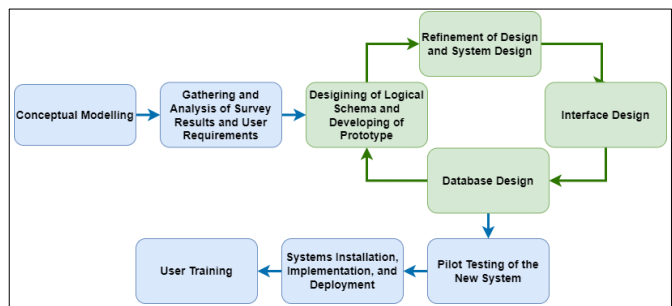


Fig. 2. Step-by-step approach in the development of the system.

The process flow of the system is shown in Fig. 3. From the figure, the client satisfaction survey results were then put through statistical testing using frequency counting, weighted means, and percentages. To establish the system-wide mean for each customer evaluation, these tests were included as part of the system's process. The system calculated the grand mean for

the client satisfaction rating received per semester from all the client evaluations, and from there it calculated the grand mean for each indication or parameter. The method derived an interpretation from the grand mean based on the study's 5-point Likert Scale. The grand mean result was interpreted using DSS. The system would specify a general impression. Likewise, the Lowest Rating and Highest Rating for each parameter would be specified while highlighting the department's or college's service strengths and flaws. The suggestions/recommendations made by the system through its DSS notion would be taken into consideration by a department when deciding what to do or for some corrective actions to make.

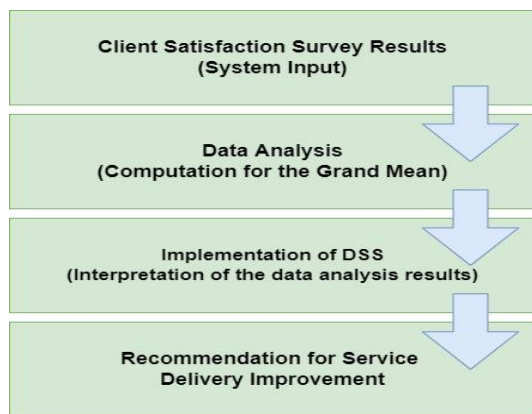


Fig. 3. Process flow of the system.

In addition, the process of capturing, data analysis, and providing recommendations for the system as shown in Fig 3 could be interpreted as follows: (a) it starts with entering the client satisfaction survey results through the user interface, which would be automatically stored in the Database. These results would serve as the knowledgebase of the DSS. The knowledgebase is the information used as basis in the interpretation and implementation of DSS; (b) The system would then analyze this information and then obtain the overall mean for each parameter and the grand mean for each semester; (c) Through the data analysis results, the system would be able to make an interpretation and its DSS part would be recommending actions for the service delivery improvement of the unit. The areas of application of the DSS module and basis of interpretation for the results of data analysis are shown in Fig. 4 and Fig. 5, respectively.

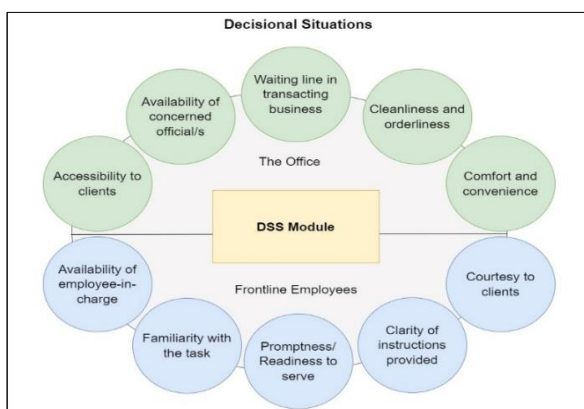


Fig. 4. Areas of application of the DSS module.

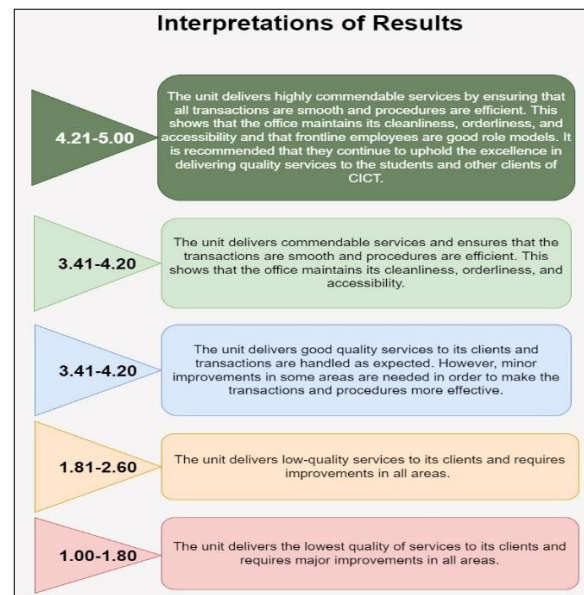


Fig. 5. Range and interpretation of client satisfaction survey results.

The developed system was flexible, maintainable enough, and could easily be migrated to another environment. The system was implemented in CatSU's College of Information and Communications Technology (CICT) for pilot testing purposes. Positive responses and feedback were obtained from end-users; hence, this was recommended to be utilized in the entire university.

IV. RESULTS

The problem proffered in this study was about the development of the Decision Support System for the client satisfaction survey feedback results for bettering the offered services of the departments in the university. As mentioned in the Methods section of this article, the development of the system followed the Rapid Application Development (RAD) approach as specified in Fig. 1. This software development model suggests constant meetings with the end-users during the development process. Before the actual development of the system, prototypes were designed and presented to the end-users. Modifications and refinements were done with the prototype to suit the needs of the users. The actual development of the system commenced after the prototype and its refinements were approved by the users.

Fig. 6 below shows the integration of the DSS and its components into the system developed in this study.

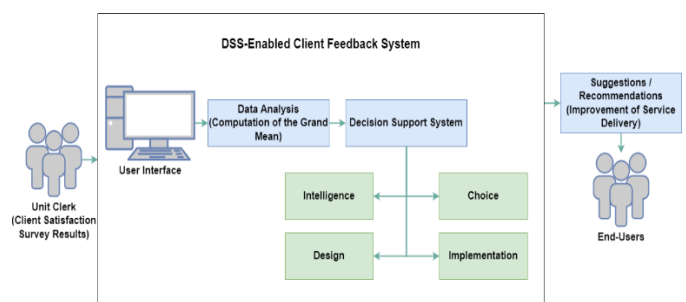


Fig. 6. Integration of the decision support system.

Input to the system was the client satisfaction survey results of the unit through the user interface, which could be done by the unit clerk. These inputs were analyzed by the system to provide the necessary data for the DSS such as the grand mean. The DSS was then implemented to provide suggestions/recommendations for the service delivery improvement of the unit. The DSS module was based on the development framework by Juneja which was comprised of four (4) basic stages, namely Intelligence, Design, Choice, and Implementation [23]. The following are the stages undertaken in the development and integration of the DSS into the system:

Stage 1: Intelligence. The DSS module started after the data analysis of the system. Fig. 8 shows the components of the Intelligence stage which were the Problem Identification (Areas for Improvement) and DSS Objectives and Resources. The DSS was designed to identify the areas where the unit has the highest and lowest rating. The areas identified were then given interpretations based on what the unit needs. The areas were also categorized into two, as shown in Fig. 5, which were “The Office” and “Frontline Employees”. This is to ensure that the recommendations and interpretations given by the DSS were specific to its areas. Fig. 7 shows an actual screenshot of the system which shows the lowest and highest rating and its corresponding interpretation and recommendation for service delivery improvement.

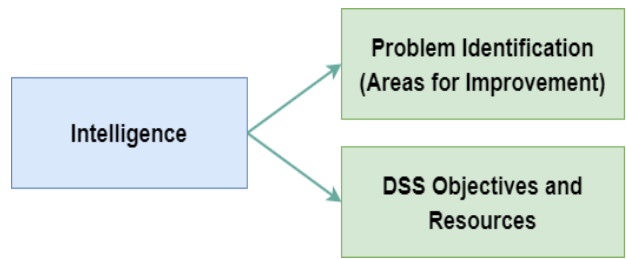


Fig. 8. DSS development framework: intelligence.

Stage 2: Design. The design stage of the DSS development was broken down into two components, namely the System Design and System Structure, as shown in Fig. 9. System Design included identifying all the necessary technical requirements for the DSS and finalization of the User Interface (UI). This was also where all possible courses of action or recommendations for service delivery improvement were established. System Structure, on the other hand, includes the planning of the development and integration of the DSS into the UI. Having the system browser-based (run using a browser such as Chrome, Opera, Firefox, and the like), integrating the DSS required programming in the back-end using scripting languages such as PHP and JavaScript.

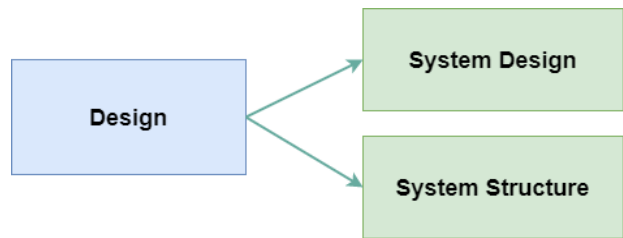


Fig. 9. DSS development framework: design.

Stage 3: Choice. Once all the possible actions or recommendations were identified, integration of DSS took place in this stage. Sets of recommendations were stored in the Database for easy retrieval. The DSS used the client satisfaction survey results and its grand mean to identify the areas with the lowest and highest ratings. The system then provided a general impression of the grand mean. It also provided the best possible actions to better the unit’s service delivery by providing its interpretation and recommendations for the areas with the lowest and highest rating, as shown in Fig 8. Fig. 10 shows the actual screenshot of the system showing the grand mean of the unit’s results together with the general impression provided in the system.

Interpretation of Lowest of Highest and Recommended Actions				
Highest/Lowest	Mean	Indicator	Interpretation	Recommendations
HIGHEST RATING	4.76	Familiarity with task	<ul style="list-style-type: none"> Analyzes the full dimension of complex problems in the task. Commits to performing the requests of the client immediately Aid the clients when necessary. 	<ul style="list-style-type: none"> The employees should make sure that they perform their tasks faster but without compromising the quality of services being provided. All the files of the office may be organized by type/academic year/semester (depending on the type of document) for easy retrieval of needed documents.
HIGHEST RATING	4.76	Clarity of instructions provided	<ul style="list-style-type: none"> Consistently communicates in a clear, effective, timely, concise, and organized manner. Is articulate and persuasive in presenting suggestions and instructions. 	<ul style="list-style-type: none"> Procedures/instructions to accomplish tasks/office transactions be displayed in conspicuous places in the office. Frontline employees are recommended to give clear instructions on how tasks would be accomplished.
LOWEST RATING	4.60	Availability of concerned officials	<ul style="list-style-type: none"> The official/s is/are highly approachable. Take action immediately to the client's concern. Fairness while providing service to the client. Professionalism 	<ul style="list-style-type: none"> The unit may opt to assign a buddy system (the buddy system is an effective method by which a deployed staff member shares in the responsibility for his or her partner's safety and well-being) by which another employee could tend to the needs of the client. If in case the client needs the services of the concerned official, the office could create an appointment of when the client could come back.

Fig. 7. Recommendations for the service delivery improvement of the unit.

Weighted Mean:	4.67	The unit delivers highly commendable services by ensuring that all transactions are smooth and procedures are efficient. This shows that the office maintains its cleanliness, orderliness, and accessibility and that frontline employees are good role models. It is recommended that they continue to uphold the excellence in delivering quality services to the students and other clients of CICT.
Quantitative Equivalent:	5	
Qualitative Equivalent:	Excellent	

Fig. 10. General impression of the system with the grand mean.

Stage 4. Implementation. The system was deployed in the CICT for pilot testing. During the pilot testing, comments, suggestions, and recommendations for the improvement of the system were sought from the faculty and were integrated into the final deployment of the system for the university. The screenshots of the developed system are shown below. Fig. 11 displayed the login process.

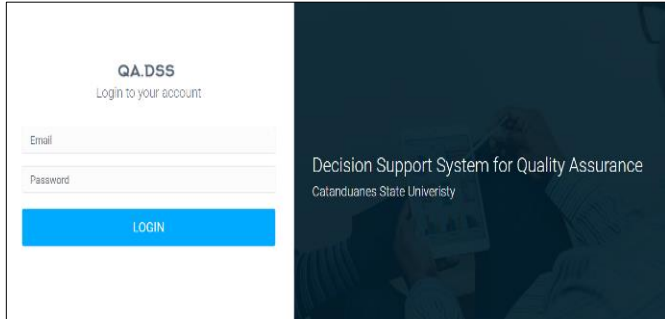


Fig. 11. System's login page.

Fig. 12 displayed the webpage for obtaining the Client Satisfaction Survey Results for a particular semester and school year. Likewise, Fig. 13 displayed the overall results of data analysis and a summary of ratings for the Office and Frontline Employees. Lastly, Fig. 14 displayed the system's dashboard.



Fig. 12. Webpage for obtaining the client satisfaction survey results.

Indicator	Ratings		
	Weighted Mean	QuanE	QualE
THE OFFICE			
Accessibility to clients	4.61	5	Excellent
Availability of concerned officials	4.58	5	Excellent
Waiting time in transacting business	4.61	5	Excellent
Cleanliness and orderliness	4.73	5	Excellent
Comfort and convenience	4.62	5	Excellent
FRONTLINE EMPLOYEES			
Availability of employee-in-charge	4.68	5	Excellent
Familiarity with task	4.76	5	Excellent
Promptness/Readiness to serve	4.73	5	Excellent
Clarity of instructions provided	4.69	5	Excellent
Courtesy to clients	4.71	5	Excellent

Legend

- WM = Weighted Mean
- QuanE = Quantitative Equivalent
- QualE = Qualitative Equivalent

Fig. 13. Results and summary of ratings.



Fig. 14. System's dashboard.

V. CONCLUSION AND RECOMMENDATIONS

The study captured data relative to Client Satisfaction Survey Results for School Year 2015 -2016 to School Year 2020-2021, developed, deployed, and tested the system. The system does interpretations as to the overall mean for each Client Satisfaction Indicator and computed for the grand mean. From the grand mean, a general impression and recommendation as to better the service for a certain department in this university. Employment of DSS enables the system to recommend action to do for the improvement of the service delivery of each department in this university. For each Client Survey Indicator, the system is also recommending action to do. Recommended action of the system served as a guide for the improvement of the delivery of the service for a department in this university. The developed system was pilot tested in one of the colleges of the university and the positive results of the pilot testing enabled the university to adopt it. Adoption of the system as the university's gauge to evaluate a department's performance as perceived by the client had brought an advantage to the university's performance in its external performance evaluators.

The following recommendations were drawn for this study:

(1) Valuing the opinions of customers, giving the best customer experience, and measuring customer satisfaction, especially with the utilization/integration of Information and Communications Technology and the DSS principle must be among the top-priority of every government office in this country to constantly improve their manner of service delivery; (2) The system developed should be utilized in full for each department since the system would be of help in the betterment of the service delivery of the entire university; and (3) The recommended actions by the system developed for improving the service delivery of each unit in the university should be put into life (action) to ensure a total client satisfaction or perhaps even exceeding expectations of clients.

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REFERENCES

- [1] K. Corona, "Customer satisfaction (CSAT) survey: Definition and examples," Pipefy, <https://www.pipefy.com/blog/customer-satisfaction-survey>.
- [2] S. Bernazzani, "What is customer satisfaction? 5 reasons it's important in service," HubSpot, <https://blog.hubspot.com/service/what-is-customer-satisfaction>.
- [3] "PDP Chapter 5: Ensuring people-centered, clean, and efficient governance," Good Governance Philippines, <https://governance.neda.gov.ph/pdp-chapter-5-ensuring-people-centered-clean-and-efficient-governance/>.
- [4] "Report Card Survey," Civil Service Commission, <http://www.csc.gov.ph/2014-02-21-08-16-56/2014-02-21-08-17-48/2014-02-28-06-38-42.html>.
- [5] K. Fakeeh, "Decision Support Systems (DSS) in Higher Education System," *International Journal of Applied Information System (IJ AIS)*, vol. 9, no. 2, pp. 32-40, 2015.
- [6] J. B. Pizarro, "Sustaining Clients' Index of Satisfaction at the Graduate School Level in a Catholic University in Northern Philippines," *American Journal of Educational Research*, 7(4), pp. 338-342, 2019.
- [7] R. J. M. Ventayen and C. C. Orlanda-Ventayen, "Customer Satisfaction Results of the Open University Systems," *SSRN*, 2018.
- [8] M. Rouse, "Decision support system," Techopedia, <https://www.techopedia.com/definition/770/decision-support-system-dss>.
- [9] T. Segal, "Decision support system (DSS): What it is and how businesses use them," Investopedia, <https://www.investopedia.com/terms/d/decision-support-system.asp>.
- [10] "FAQ: What is a decision support system? (and how to use one) - indeed," Indeed, <https://www.indeed.com/career-advice/career-development/how-to-use-decision-support-system>.
- [11] R. Shalabi, "The Importance and Application of Decision Support Systems (DSS) in Higher Education," 2020.
- [12] N. K. Gharaibeh, "Enhancing crm business intelligence applications by web user experience model," *International Journal of Advanced Computer Science and Applications*, vol. 6, pp. 1-6, 2015. doi: 10.14569/IJACSA.2015.060701
- [13] F. Dweiri, S. Kumar, S. A. Khan, and V. Jain, "Designing an integrated AHP based decision support system for supplier selection in automotive industry," *Expert Systems with Applications*, vol. 62, pp. 273-283, 2016. doi:10.1016/j.eswa.2016.06.030
- [14] M. Yazdani, P. Zarate, A. Coulibaly, and E. K. Zavadskas, "A group decision making support system in logistics and Supply Chain Management," *Expert Systems with Applications*, vol. 88, pp. 376-392, 2017. doi:10.1016/j.eswa.2017.07.014
- [15] B. Kucukaltan, Z. Irani, and E. Aktas, "A decision support model for identification and prioritization of key performance indicators in the Logistics Industry," *Computers in Human Behavior*, vol. 65, pp. 346-358, 2016. doi:10.1016/j.chb.2016.08.045
- [16] "Systems Development Definition," Law Insider, <https://www.lawinsider.com/dictionary/systems-development>.
- [17] "What is Systems Development?," www.faculty.fairfield.edu/winston/Phase1-4.pdf.
- [18] N. K. Gharaibeh and S. A. Soud, "Software Development Methodology for Building Intelligent Decision Support Systems," in *DCSOFT*, 2008.
- [19] A. R. Chrismanto, B. H. A. Wibowo, R. Delima and R. Ariel, "Developing agriculture land mapping using rapid application development (RAD): A case study from Indonesia," *International Journal of Advanced Computer Science and Applications*, vol. 10, no. 10, 2019.
- [20] "4 Phases of Rapid Application Development Methodology," L.C. Team, <https://www.lucidchart.com/blog/rapid-application-development-methodology>.
- [21] "SDLC - RAD Model," Tutorialspoint, https://www.tutorialspoint.com/sdlc/sdlc_rad_model.htm.
- [22] "What is rapid application development," OutSystems, <https://www.outsystems.com/glossary/what-is-rapid-application-development/>.
- [23] P. Juneja, "Decision Support Systems – Introduction, Categorization and Development," Management Study Guide, <https://www.managementstudyguide.com/decision-support-systems.htm>.