Analysis of the use of Analytics Platform for the Commercial Value of Mud crab Production using Non-parametric Model

Rossian V. Perea
Graduate Program
Technological Institute of the Philippines
Manila, Philippines
mrvperea@tip.edu.ph

Enrique D. Festijo
Technological Institute of the Philippines
Manila, Philippines
enrique.festijo@tip.edu.ph

2022 IEEE 12th Annual Computing and Communication Workshop and Conference (CCWC) | 978-1-6654-8303-2/22/$31.00 ©2022 IEEE | DOI: 10.1109/CCWC54503.2022.9720844

Abstract*— There are several procedures presently involving how to handle the grow-out culture method in mud crab propagation. Unfortunately, due to the lack of administration in the decision-making process, low productivity in mud crab farming remains uncontrollable. The commercial value of crabs have been sacrificed through market pricing and defining quality of crabs, most especially the S. Serrata which is invincible in price and quality. The Mud crab Analytics Platform (MAP) is a state-of-the-art innovative technology that supports the decision-making process involving the use of machine learning algorithms to calculate the units of analytics. Through the MAP, the data transformed into information to gain new knowledge until forming wisdom to decision-making. The paradigm of the mud crab analytics platform execution and control process standard (MAPExeCPS) is a guide on how the platform works following the phases; data collection, data modeling, data analytics, visualization, and decision-making. To assess the commercial value of mud crab through the use of MAP, the survey questionnaires are distributed to the respondents (N=110) and the research report is created using quantitative information. The results of statistical analyses were calculated such as measuring reliability, descriptive statistics, normality test, and non-parametric test which gave precise findings for the investigation. Therefore, it proved that satisfaction upon using the analytics platform was measured and the decision-makers are more likely satisfied with their works for managing mud crab farming to increase the commercial value of their product.

Keywords—analytics platform, mud crab production, commercial value, evaluation, non-parametric test

I. Background of Works

From the time that mud crab farming of Scylla species has existed and is very popular in many Asian nations, many crab farmers developed with polyculture pond with fish and shrimp at very low density[1]. According to the works of literature found [2],[3],[4], China is the world's largest producer of farmed Indo-Pacific mud crabs, however, the Philippines, Indonesia, India, Myanmar, Vietnam, and Bangladesh also contribute significantly to crab production. Stock size estimation is a prerequisite for projecting a fishery's production potential and, as a result, for creating ecologically appropriate management strategies [5]. From the datasets of mud crab production reviewed from the monitoring institutions by each municipality in coastal areas of Cavite, only 30-70% is harvested over the total population of stocking densities. The reasons for low production are lack of growth monitoring, increase of mortality rate, skinny and unhealthy limbs, the crabs acquiring different viruses, and sometimes the crabs are out of the pond when water is overflowing due to heavy rains. In commercial applications, such behavioral changes could lead to lower production or more crop management [6]. Due to the farmers' preference for *S. serrata* among the mangrove crab species, it is more profitable to produce in the hatchery. *S. serrata's* life cycle can be completed in a year, and seed production and adult crabs are now commercially available [3]. In the local or international market, the *S.serrata* is more expensive than the other types of mud crab species based on the market demand and quality of this product [2], [7], [8].

The datasets collected from the sampling activity and production volume in terms of metric tons are only accessed via using spreadsheet and are not presented the exact interpretation on how data express. The comma-separated values (CSV) is a simple file format used for storing tabular data in electronic spreadsheet. The monitoring institution (MI) and other decision-makers in the mud crab industry have limited knowledge to perform data visualization with analytics. The advanced analytics can show a predicted value that is very useful to see the future. Additionally, according to certain study [9], businesses with correct prescriptions can make more trustworthy and effective decisions. It is better to understand that prescriptive analytics has two levels of human intervention such as decision support, (providing recommendations) and decision automation (implementing the prescribed action) [9]. From this, the need's analysis have been identified such as; (a) is the mud crabs growth every sampling activity is accurately monitored or analyze the growth stages of crabs from juvenile to marketable size using spreadsheets alone?, and (b) is the higher sales could be missing out by not having an analytics platform to determine the future value or price of crabs base on weight, sex, and weather conditions to obtain the growth?

Hence, establishing a good decision-making process is one of the target factors to assess the commercial value of mud crab production through the use of the analytics platform which is called as Mud crab Analytics Platform (MAP) compare to the old use of electronic spreadsheet or tabular database which is the main objective of the study to emphasize the usefulness of applying this platform as a symbol of the advancement of technology. After the development phase of the MAP, the evaluation phase must next to see the accuracy of this platform based on the satisfaction of the respondents. This study was concluded using a structured survey instrument acquired from the technical experts, MI, and mud crab pond owners and farmers to analyze the clarity and accuracy of functions upon using the analytics platform for mud crab's growth and production condition through statistics and analyses.

II. Related Literature

A. Application of analytics platform

The business intelligence analytics (BIA) platform gathers heterogeneous data from many data sources and uses it to store, transform, and visualize data per business

978-1-6654-8303-2/22/$31.00 ©2022 IEEE

needs[10]. It is important to understand that business intelligence (BI) analyzes past and present data to efficiently operate current businesses (also known as historical data), whereas business analytics (BA) analyzes past data to evaluate current states and prepare for future works (also known as predictive analytics). In recent years, the use of analytics has gotten complicated and no longer as simple as selecting a database and an analytics package in today's world of operational analytics. In a modern analytics environment, there are numerous new tools and technologies to consider [11]. Business intelligence and analytics is the process of obtaining a large amount of historical data generated by businesses and presenting it in a meaningful actionable way to the appropriate people, at the right time, to make better real-time decisions [10]. Organizations should evaluate a set of basic core attributes throughout the evaluation process to analyze the quality of the output data visualizations to be utilized in the decision process to select a modern analytics platform that can be accepted and effectively deployed [12].

Different data analyses in mud crab studies have been found from different articles but none of these were applied analytics. Some various analytics platforms can be similarly applied for the growth and the production condition of mud crabs. It is almost the same in the application of the AquaSmart platform [13],[14] which employs very precise data analysis and predictive modeling to help the industry better understand the knowledge that can be derived from massive amounts of data. Make better-educated assessments based on this data and KPIs, which will affect the decision-making process and lead to increased efficiencies and capital growth. Since data analytics contribute to the economical level of various organizations, the analytics platform for intelligent agriculture [15] is also the same execution. It also uses machine learning algorithms to support projected inputs, allowing for more effective decision-making alternatives through the use of data analytics, which benefits the economy.

B. *The commercial value of mud crabs*

According to the stated global distribution [1], the Philippines is one of the producers of the mud crab species such as *S. serrata, S. olivacea,* and *S. tranquebarica* [3],[16], [17]. Crabs having a bigger claw size to body size ratio, with the claws containing about half of the crab's meat, have more meat and thus more value [18].

Similar things were reported in many studies using various grading systems. Grading may differ based on sex, weight, and for both domestic and international markets [2]. Grading of gathered mud crabs with mixed composition begins in a big depot, where male and female crabs are separated, legs are tightened, and the crabs are transported through a bamboo basket [19]. For crab marketing, there is some specific grading available. Market-sized but lean crabs (soft shell), eggless females or are any crabs with physical damage such as broken legs or claws are generally rejected for exportation and sometimes be found at a reasonable price in both local and international markets, [1]. Oftentimes, the only target selling place for farmers is local markets within the area.

C. *Mud crab production in the Philippines*

Upon observing the data accessed from the database of the Philippine Statistics Authority (PSA), the volume of mud crab production is presented the low and highly mud crab producers by region. On the contrary, the regions with low mud crab productions as of 2015 are CALABARZON, MIMAROPA, SOCCSKSARGEN, and ARMM [3]. The data shows that the mud crab total production per cropping, for instance in CALABARZON is very low in volume. Lack or low quality of seed stocks is one of the main factors for the decrease of volume in production. The increase in production is corresponding to an increase in value [20].

Therefore, the government should prioritize mud crab cultivation in specified regions and provinces, according to the analytical circumstance. It is necessary to recognize that for a fishery to be called sustainable, it must meet three sustainability dimensions: ecological, economic, and social [21].

D. *Non-parametric test*

Non-parametric tests commonly use ordinal data types, meaning that they are not dependent on arithmetic features. As a result, all tests requiring data ranking are non-parametric, and no assertion about data distribution is made [22], [23]. Ordinal data, such as Likert scale data containing the determination of bigger or smaller, is subjected to non-parametric procedures, which are most commonly used in data ranking [24]. Moreover, since nonparametric statistical tests do not assume a normally distributed parameter, they are acceptable and accurate even when the sample value is not normally distributed. [25].

III. Methodology

To determine the precise flow of the objective of the study, the paradigm for the mud crab analytics platform execution and control process standard (MAPExeCPS) is presented. This consists of how the MAP works following the five phases such as data collection, data modeling, data analytics, visualization, and decision-making.

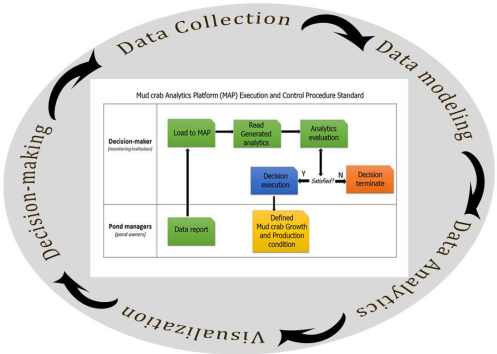

Fig. 1. MAPExeCPS paradigm

The paradigm of MAPExeCPS (Figure 1) is a guide on how does the platform works. This refers to the use of regular and consistent processes in issuing directions in a testing environment to control all factors in this study.

The MAPExeCPS is consists of two parties such as pond managers and decision-makers wherein the data reports were loaded to MAP, then the decision-makers have read the generated analytics by the MAP, then afterward they evaluate if the data visualizations with analytics are accurate, if they are satisfied, the decision execution will next and they can now define the mud crab growth and production condition, otherwise, the decision will be terminated and run another insight. This paper discusses the purpose of five phases involving how the MAP works. First, the datasets collected were loaded to the MAP such as sampling and production dataset. Second, the data modeling starts to generate insights. Third, the data analytics works using a machine learning algorithm such as applying K-means to cluster the mud crab maturity growth that could be easily defined to apply a grading system for marketing of crabs according to sex, weight, and price and the main producers of crabs by region or province wherein predicted and prescriptive analytics are also presented. The data visualization of all analytics units was then performed. Lastly, the decision-making process will apply by the decision-makers according to the output analytics generated on the MAP.

To analyze the use of this analytics platform to assess the commercial value of mud crab production, the evaluation tool is devised based on the previous studies [12], [26] in which the analytics platform would be addressed or supported. The survey items have measured using a 5-point Likert scale [27] ranging from “Strongly Agree” to “Strongly Disagree” marks. The 21-item survey data used is considered ordinal data because it defined rankings of self-satisfaction [28] upon using the analytics platform. The list of research variables used to make the data clear to use in the study is shown in Table 1.

TABLE I. VARIABLE LIST FOR THE SURVEY QUESTIONNAIRE

Variables	Number of items
Information delivery (ID)	4
Dashboard capabilities (DC)	5
Analysis (A)	4
Ease of use (EU)	4
Deployment flexibility (DF)	4

This study involves different respondents (N=110) with experience in the ICT and analytics field, aquaculture field, and aquafarm business with different roles in the organization and has been used data analysis which categorized as technical experts or ICT and analytics literate, monitoring institution or the decision-makers, and pond managers.

IV. RESULTS AND DISCUSSION

This section contains the results of all statistical analyses and findings based on the study's methodologies and aims.

A. Advanced data visualization by MAP

The state-of-the-art presentation of different analytics in MAP gave a new motivation to the decision-makers and pond managers who will use the platform. The descriptive, predictive and prescriptive analytics were generated successfully as a guide for real-time decision support by the intended users. The data reports collected from the pond managers have been loaded to the MAP by the MI and the MAP generates a data modeling to produce insights that are read by the MI also. Through the application of machine learning and algorithm such as K-means, the MAP generates different units of analytics to calculate KPIs to stand the prediction and identify the decision variables for prescription. It presented different data visualizations that are used for evaluating the output analytics by the MAP to determine if these model analytics can be used for the decision-making process. The results were identified based on the phases performed:

- Data collected=>sampling and production datasets
- Data model=>generated insights to build analytics following MAPExeCPS
- Data analytics=>the K-means equation has been made upon clustering the price based on weight and width of crabs in producing 3 clusters with a maximum number of iteration:

KMeans(algorithm='auto', copy_x=True, init='k-means++', max_iter=300, n_clusters=3, n_init=10, n_jobs=1, precompute_distances='auto', random_state=None, tol=0.0001, verbose=0) *(1)*

- Visualizations=> different data visualizations with analytics are available in MAP that shows the transformed data into information.

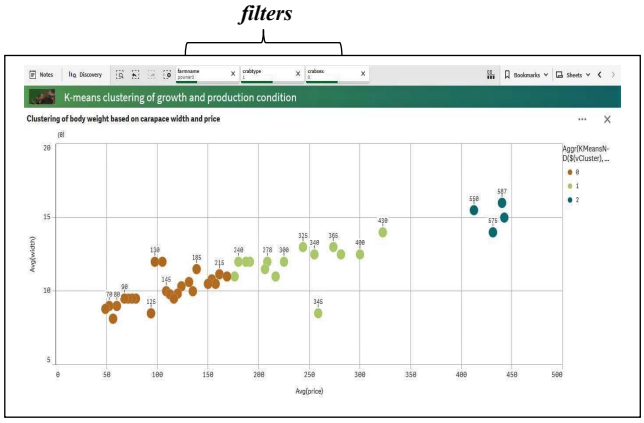

Fig. 2. Clustering of body weight based on width and price using K-means algorithm

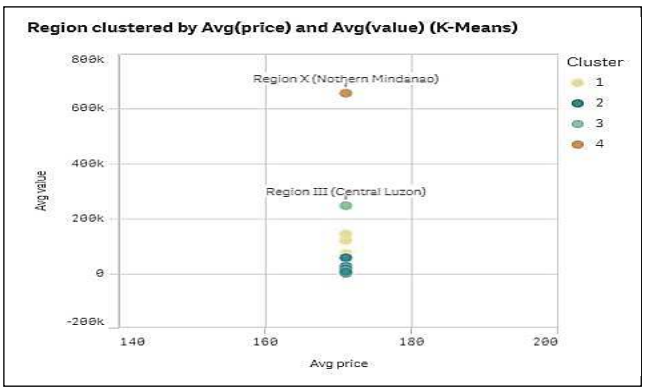

Fig. 3. Clustering by price and value per region

Since the focus of the study is to assess the commercial value of mud crabs using the MAP, the grading system is important to perform for marketing. Figure 2 present the clustering of body weight (g) based on carapace width (cm) and price. Clustering using the MAP is now easy by filtering the sexes and crab type that assist the decision-makers to assess the commercial value of grading of crabs for marketing. It identified that clusters 2 and 3 with female *S. serrata* species with the average price of Php235 to Php590 (per piece) are the marketable sizes that could be sold in the local or external markets. The clustered price and value of crabs were classified by region (Figure 3), that shows interpretation for the monitoring institution in which provinces/regions are need to be trained to elevate mud crab farming management.

- Decision-making=>Therefore, the decision-making process was executed by the MI from this new information going to complete knowledge (insight), wisdom (purpose), and the right decision for their organization.

B. *Distribution of respondents*

To simplify the results of the evaluation about the analysis of the use of MAP, the responses to these quantitative survey questions are examined, and a research report is created using this quantitative information. The results of the distribution of the categories of evaluators is identified (Figure 4), wherein 56% comes from technical experts (n=62), 18% from the monitoring institutions (n=20), and 26% from the pond owners (n=28).

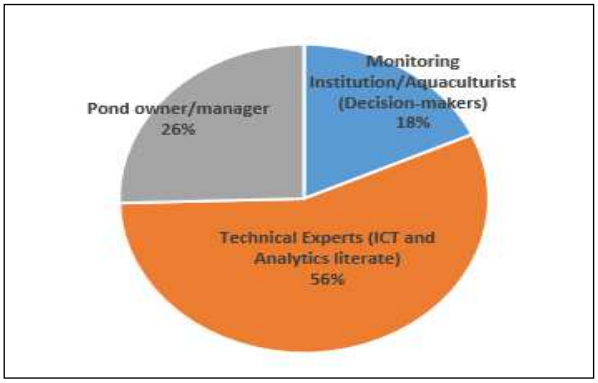

Fig. 4. Distribution of evaluators

C. *Mud crab farming information of pond managers*

The distribution of mud crab farming information in Figure 5 is gathered to determine the technical considerations and the conducted need's analysis if the analytics platform is truly applicable to this study.

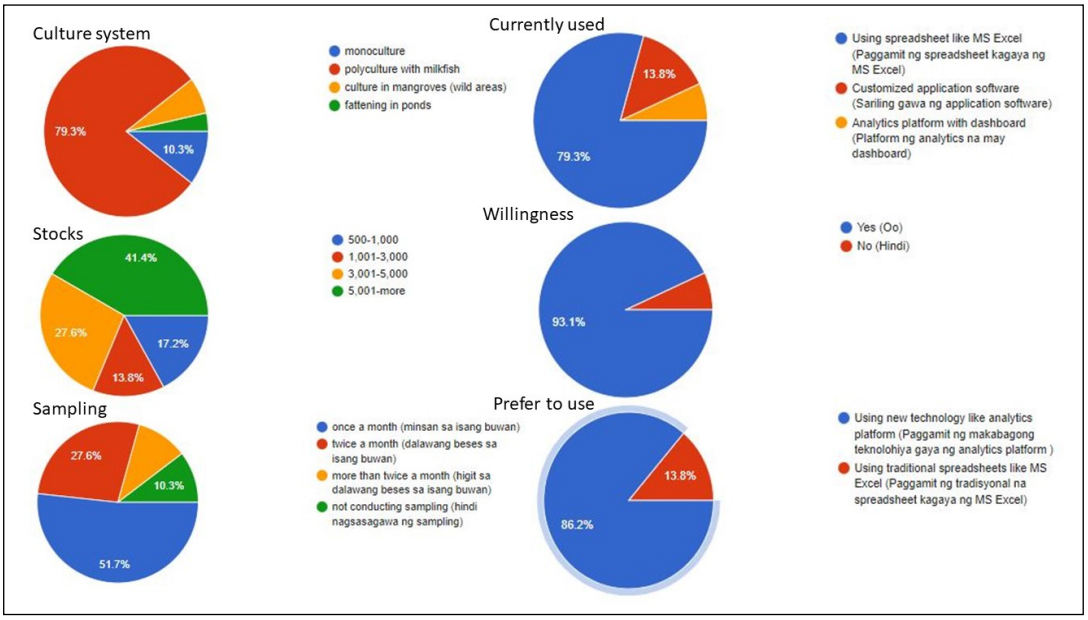

Fig. 5. Distribution of information for mud crab farming management

Figure 5 is the summary of results from the survey showing the distribution of information for mud crab farming management. The most common mud crab grow-out culture method/system is polyculture with milkfish, which is used by 79.3% of pond owners, while only 3.4% are using fattening in ponds because according to them this is laborious and expensive. Many of the aquafarm managers have preferred to stock more than 5,000 seeds every season. Many of them are conducting a sampling activity to monitor the crabs' growth every once to more than twice a month where some of them are thrice. Unfortunately, there were 10.3% of them are not conducting sampling. There were 79.3% are using an electronic spreadsheet for the decision-making process upon monitoring the culture crabs and 6.9% of them were already using an analytics platform with a dashboard. Moreover, 93.1% expressed their willingness to use an analytics platform with a data management system for the decision-making process to ease their works in mud crab farming management. In the final assessment of referring decision- making, 86.2% prefer to use the new technology like analytics platform than a traditional spreadsheet.

D. Statistics and analyses

The factors utilized to interpret the study's findings are presented in different statistics such as constructs of reliability, descriptive statistics, normality test, and non-parametric test.

The Cronbach alpha (or coefficient alpha α) is a measure of reliability, or more specifically, of internal consistency, but it's perhaps best described as a scale's internal consistency index [29] which tests to see if questions in Likert scale surveys are reliable. The results depict that the Cronbach's alpha of 4 variables such as ID, A, EU, and DF was higher than 0.9 which indicates the excellent consistency of the questionnaire while the DC variable got below 0.9 which still indicates good consistency of the questions of the construct (Table II).

TABLE II. CONSTRUCT OF RELIABILITY

Variable	Cronbach's alpha	No. of items
Information delivery (ID)	.929	4
Dashboard capabilities (DC)	.881	5
Analysis (A)	.903	4
Ease of use (EU)	.929	4
Deployment flexibility (DF)	.926	4

To analyze the results of the descriptive statistics which calculated the variables used in the study. Among the list of items, seven questions got the minimum value of 2, which corresponds to the disagree equivalent while the maximum value of all the items is 5, which corresponds to strongly agree.

When the test of normality of the table's values is investigated (Table III), the data acquired from the used scales revealed no normal distribution. As a result of this finding, it was determined that the non-parametric test should be used in data analysis.

TABLE III. TEST OF NORMALITY

Scales	Kolmogorov-Smirnov			Shapiro-Wilk		
	S	N	*p*	S	N	*p*
Information delivery	.323	110	.000	.758	110	.000
Dashboard capabilities	.200	110	.000	.832	110	.000
Analysis	.275	110	.000	.764	110	.000
Ease of use	.284	110	.000	.767	110	.000
Deployment flexibility	.253	110	.000	.754	110	.000

The results show that all item questions occur with equal probabilities whereas the Kolmogorov-Smirnov plot shows that test distribution is normal with a mean of 4.609 and 0.51 SD.

In this study, hypothesis tests were used to determine the effect or relationship between variables. To carry out the non-parametric test, the comparison of the two possible tests such as Kruskal-Wallis and Friedman tests is conducted to determine which one is applicable to use. Table IV shows that the Friedman test is the applicable method because the five variables are significant in non-parametric analysis. Hence, all variables used in the study were supported.

TABLE IV. NON-PARAMETRIC TESTS

Metrics	FRIEDMAN test	KRUSKAL-WALLIS test
P value	0.0228	0.5332
Exact or approximate P value?	Approximate	Approximate
Are means signif. different? (P < 0.05)	**Supported**	**Not supported**
Number of groups	5	5

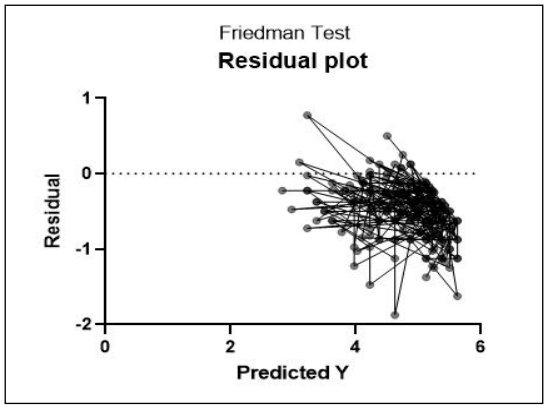

Fig. 6. Residual plot in Friedman Test

So that, the *P* value in this study refers to a likelihood rather than a certainty. Findings shows that, as the null hypothesis is rejected since the p-value is less than the significance level *(p<0.05)*, indicating that the data are statistically significant. Therefore, it shows that more than 95% satisfaction is more likely satisfied with the use of analytics platform for their decision-making for managing mud crab farming that helps to improve the commercial value of their product. The significance of data analytics in the transformation of data into information may be used to make a meaningful decision in the sector of aquaculture which is becoming increasingly important.

V. CONCLUSION

The contribution of data analytics in the mud crab farming sector is very specific in this study and must be addressed with an appropriate methodology for training and testing datasets with no missing values. The assessment formed in the given datasets gave challenges for this study to meet the objectives. This is particularly important to apply an analysis tool to develop this analytics platform to mine data to form new knowledge going to a concrete decision. Through the injected datasets on the MAP, the deeper insights on the information retained in the collected data were provided using different dimensions and metrics to evaluate the data models used in this study. The use of MAPExeCPS following the phases from the data collection, data models, data analytics, visualizations, through decision-making will assists the decision-makers on how to embrace this analytics platform for the ease of works in monitoring and managing mud crab farming. These include a grading system of crabs, grow-out monitoring, volume and value of production, and viewing some predictive and prescriptive analytics. The statistical calculations and analyses helped to show evidence to accept the introduced technology based on the satisfaction of the respondents (N=110) who evaluated the accuracy of the MAP using the scales such as

information delivery, dashboard capabilities, analysis, ease of use, and deployment flexibility. Most of the variables were measured the reliability and gave excellent consistency. In the test of normality, it analyzed that the scales showed no normal distribution of data so that non-parametric tests have been calculated. It concluded that the non-parametric Friedman analysis show a lessen *p* value (supported) than non-parametric Kruskal-Wallis (not supported). It determines the correlation between variables after testing hypotheses and finds that the p-value is less than the significance level ($p<0.05$), implying that the null hypothesis is rejected and the results are statistically significant. As a result, they have chance to employ this analytics platform to make decisions compared to the traditional use and basic analysis tools such as electronic spreadsheets alone which helps them to improve the commercial value of mud crab production.

The following suggestions for potential R&D work based on research findings need to be addressed. First, the study suggests considering the TAM or UTAUT with external factors to verify the user's intentions and acceptance in applying the technology for work improvement. Second, perform a comparison or uniqueness of the innovation, such as rate of calculations using other machine learning tools such as Python, R, Rapidminer, Weka, and the like.

REFERENCES

[1] J. Bir, S. S. Islam, W. Sabbir, M. R. Islam, and K. A. Huq, "Ecology and reproductive biology of Mud Crab Scylla spp: A study of commercial mud crab in Bangladesh," *Int. J. Acad. Res. Dev.*, vol. 5, no. 2, pp. 1–7, 2020.

[2] A. I. Mahmud, "Marketing of Mud Crab Scylla serrata (Forksal) from Khulna District to International Markets," vol. 11, no. January, pp. 61–67, 2013.

[3] E. T. Quinitio, "Overview of the Mud Crab Industry in the Philippines," pp. 1–12, 2017.

[4] D. M. Naim, S. A. M. Nor, and S. Mahboob, "Reassessment of species distribution and occurrence of mud crab (Scylla spp., Portunidae) in Malaysia through morphological and molecular identification," *Saudi J. Biol. Sci.*, vol. 27, no. 2, pp. 643–652, 2020, doi: 10.1016/j.sjbs.2019.11.030.

[5] T. A. Hay, "Methods for Monitoring the Abundance of the Northern Australian Mud Crab Scylla serrata," 2009.

[6] M. A. Jones, "Using light to improve commercial value," *Hortic. Res.*, vol. 5, no. 1, 2018, doi: 10.1038/s41438-018-0049-7.

[7] H. Alberts-Hubatsch, S. Y. Lee, J. O. Meynecke, K. Diele, I. Nordhaus, and M. Wolff, "Life-history, movement, and habitat use of Scylla serrata (Decapoda, Portunidae): current knowledge and future challenges," *Hydrobiologia*, vol. 763, no. 1, pp. 5–21, 2016, doi: 10.1007/s10750-015-2393-z.

[8] H. Jahan, M. S. Islam, and S. Islam, "Economic performance of live crab (Scylla Serrata) business in the southwest coastal region of Bangladesh," *Int. J. Fish. Aquat. Stud.*, vol. 4, no. 1, pp. 453–457, 2016.

[9] K. Lepenioti, A. Bousdekis, D. Apostolou, and G. Mentzas, "International Journal of Information Management Prescriptive analytics : Literature review and research challenges," *Int. J. Inf. Manage.*, vol. 50, no. April 2019, pp. 57–70, 2020, doi: 10.1016/j.ijinfomgt.2019.04.003.

[10] P. Sudhakaran, "Research of Business Intelligence and Analytics Platforms," no. July, 2021.

[11] B. Franks, "Creating an Analytics Platform," *Anal. Revolut.*, pp. 117–145, 2014, doi: 10.1002/9781118936672.ch5.

[12] J. Parenteau, "Evaluation Guide: How to choose the right modern BI & analytics platform [White Paper]," *Tableau*, pp. 1–21, 2020.

[13] J. Sarraipa *et al.*, "Aquaculture Production Optimization through Enhanced Data Analytics."

[14] J. P. Costa, "Data analytics in aquaculture," no. January 2016, 2017.

[15] K. Sumathi, K. Santharam, and N. Selvalakshmi, "Data analytics platform for intelligent agriculture," *Proc. Int. Conf. I-SMAC (IoT Soc. Mobile, Anal. Cloud), I-SMAC 2018*, pp. 647–650, 2019, doi: 10.1109/I-SMAC.2018.8653740.

[16] B. D. Paterson and D. L. Mann, *Mud Crab Aquaculture*. 2011.

[17] E. T. Quinitio, "Status of Mud Crab Industry in the Philippines," *Repository.Seafdec.Org*, pp. 27–35, 2012.

[18] M. Dunning *et al.*, "With assistance from and," no. August 2015.

[19] "Study for Assessing Mud Crab (Scylla Serrata , Forskal , 1755)," vol. 46, no. 2, pp. 263–273, 2018.

[20] K. Ashok Kumar, D. Divya Chowdary, and C. Divya Sree, "Data Analysis and Prediction on Cloud Computing for Enhancing Productivity in Agriculture," *IOP Conf. Ser. Mater. Sci. Eng.*, vol. 590, no. 1, 2019, doi: 10.1088/1757-899X/590/1/012014.

[21] Yayasan Masyarakat dan Perikanan Indonesia, "Data collection protocol for mud crab (Scylla spp.) fishery in Indonesia," 2017.

[22] P. Krisen, "Non-Parametric Test Presented by :," no. 1210305.

[23] L. Marston, "Non-Parametric Tests," *Introductory Statistics for Health and Nursing Using SPSS*. pp. 154–172, 2012, doi: 10.4135/9781446221570.n10.

[24] C. Mircioiu and J. Atkinson, "A Comparison of Parametric and Non-Parametric Methods Applied to a Likert Scale," *Pharmacy*, vol. 5, no. 4, p. 26, 2017, doi: 10.3390/pharmacy5020026.

[25] M. Qualls, D. J. Pallin, and J. D. Schuur, "Parametric versus nonparametric statistical tests: The length of stay example," *Acad. Emerg. Med.*, vol. 17, no. 10, pp. 1113–1121, 2010, doi: 10.1111/j.1553-2712.2010.00874.x.

[26] B. Informatics, "Informatyka ekonomiczna," vol. 3, no. 33, 2014.

[27] O. Kayode and A. Morakinyo, *Responsible design, implementation and use of information and communication technology*, vol. 2. 2020.

[28] I. H. Witten and E. Frank, *Data Mining: Practical Machine Learning Tools and Techniques, Second Edition (Google eBook)*. 2005.

[29] I. Šerbetar and I. Sedler, "Assessing Reliability of a Multi-Dimensional Scale," *Rev. za Elem. Izobr. št.*, vol. XIX, no. September, pp. 9–11, 2009.