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Efficiency and Effectiveness of Utility Billing Management System (UBMS) in the Collection of Electric Services

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ABSTRACT

This study aimed to assess the efficiency and effectiveness of the Utility Billing Management System (UBMS) in supporting billing and collection processes in a rural electric cooperative. Motivated by the growing demand for digital solutions in utility operations and the challenges faced in billing accuracy and resource management, the research addressed the need for evaluating system performance in a real-world context. Employing a descriptive-correlational design, data were collected using structured questionnaires distributed to employees involved in UBMS operations. Statistical tools such as frequency and percentage, weighted mean, Kruskal-Wallis test, and One-Way ANOVA were utilized to analyze the responses. The study identified functional strengths of the UBMS in terms of usability, portability, efficiency, and reliability, as well as its positive impact on resource utilization and operational management. However, issues such as billing statement errors and limited user training emerged as key implementation challenges. The findings support the development of targeted training programs and continued system investment. Future research may explore the potential contributions of the UBMS in improving collection efficiency and strategic planning.

Keywords: *Utility Billing System, system efficiency, system effectiveness, operational management, digital transformation, user perception*

Introduction

The importance of electricity is an essential part of modern life, supporting economic growth, technological development, and enjoyment. The demand for efficient and dependable utility services has grown, with the direct consequence to utility companies to modernize their operations, particularly in billing and collection systems. In many developing countries such as the Philippines, electric cooperatives are shifting from manual to automated operation to improve the delivery of service, reduce billing discrepancies, and ensure the financial viability.

The international experiences of reforming the sector, such as those in Ghana and Thailand, show the potential and challenges of improving the functioning of electric utilities. Reforms are usually designed to address efficiency and financial sustainability, and emphasis is also placed on building strong technological institutions to sustain weak operational performance (World Bank, 2018; Energy Policy Journal, 2020). Unfortunately, in the Philippine setting, a lot of electric cooperatives still implement antiquated billing systems that result in problems such as late payments, incorrect billings, and poor energy management.

Incorporating the manual or traditional process in the billing system is beset with a number of limitations, such as the great possibility of human error, lack of immediate access to day-to-day transactions, and its negative impact on the environment with the use of paper. As opposed to this, using digital platforms such as the Utility Billing Management Systems (UBMS) enables the utilities to ease their billing mechanisms, monitor consumption patterns in a more accurate manner, and take adequate measures in a timely manner.

Methods

The researchers used the descriptive-correlational research method in assessing the effectiveness and efficiency of the Utility Billing Management System (UBMS) in billing and collection of the Isabela II Electric Cooperative, Incorporated (ISELCO II). The design was selected to facilitate a systematic description of the extent to which UBMS is being used and to investigate potential correlations between user perceptions and selected respondent characteristics.

The study population consisted of all 253 end users of the UBMS. The purposive random sampling process (aimed to have representatives of the respondents from several departments, such as branch offices, sub-offices, and technical and administration units) was used. This allowed for insights from users who were directly involved in the operation of the system to be collected. Formal consent from the General Manager of ISELCO II was obtained before the data collection.

The primary data was collected on the basis of a structured questionnaire administered by the investigator who personally distributed and collected the questionnaire. The instrument aimed to gather employees' perceptions about the most vital 10 dimensions of the UBMS, i.e., usability, reliability, efficiency, and operational performance. For perceived effectiveness, a five-point Likert scale. Collection efficiency rates were prorated based on secondary data taken from ISELCO II's official records.

Moreover, the respondent characteristics (e.g., position, years of service, department) were added to assess if the UBMS was perceived differently across diverse groups commonly found in the same institution. This was important to determine if the level of experience and/or role influenced how the system was evaluated.

Additionally, the responses were summarized using descriptive statistics (i.e., frequency, percentage, weighted mean) for data analysis. In order to compare the perceptions between groups, the Kruskal-Wallis H test and One-Way ANOVA were used. These are good statistical tools since the variables were discrete and the objective was to test differences among many independent groups. This methodological approach captured both the quantitative and contextual dimensions of UBMS use, thereby enabling a thorough assessment consistent with the study's purpose.

Results and Discussion

Demographic Profile of the Respondents

This study involved 253 regular ISELCO II employees who regularly use the UBMS. Demographics were collected for two main reasons: (1) to determine if functional units were represented and (2) to determine if perceptions of the system's effectiveness differed significantly by user group.

The majority of the participants, or 40.71%, were within the 30–39 age group, which represents a mid-career work force. The sex distribution was also male-dominant (77.08%), mirroring the sex composition of ISELCO II. A great majority had a university degree (93.68%); 6.32% had a postgraduate degree. Meter Readers and Billing Collectors (MRBCs) formed the largest group of participants (40.71%), followed by office heads and clerks.

Table 1. Demographic Profile of the Respondents

Particular		Frequency (n=253)	Percentage
Age			
	20 – 29	6	2.37
	30 - 39	103	40.71
	40 - 49	88	34.78
	50 - 59	54	21.34
	60 – 69	2	0.79
Sex			
	Male	195	77.08
	Female	58	22.92
Educational Attainment			
	Master's Degree	16	6.32
	College Graduate	237	93.68
Position			
	Clerical	37	14.62
	Office Chief/Head	44	17.39
	Staff/Aide	19	7.51
	Custodian	6	2.37
	Manager	10	3.95
	Engineer	3	1.19
	Technical Admin	25	9.88
	MRBC	103	40.71

Particular	Frequency (n=253)	Percentage
Coordinator	6	2.37

Perceived Efficiency of UBMS

Five main criteria were evaluated: functionality, usability, portability, performance, and reliability. All categories were highly efficient with a grand mean of 4.91. This suggests that users are highly satisfied and they accept UBMS on technical and operational aspects.

Table 2. Perceived Level of Efficiency of UBMS

Indicators	Mean	Description
Function	4.93	Highly Efficient
Usability	4.89	Highly Efficient
Portability	4.89	Highly Efficient
Efficiency	4.90	Highly Efficient
Reliability	4.92	Highly Efficient
Grand Mean	4.91	Highly Efficient

Effectiveness of UBMS as Perceived by Students

a. Operation Management

As shown in Table 3, customers rated UBMS on customer service, process efficiency, colleague cooperation, and overall ease of use. The overall operating efficiency received the highest rating with 4.97 and a grand mean of 4.92, which signifies that the system supports efficient operation and service delivery.

Table 3. Perceived Level of Effectiveness of UBMS in Terms of Operation Management

Indicators	Mean	Description
1. The system is customer service–friendly	4.90	Highly Effective
2. The system demonstrates process proficiency	4.91	Highly Effective
3. The system promotes team performance	4.88	Highly Effective
4. The system is easy to use	4.95	Highly Effective
5. Overall, the UBMS is effective in terms of operations management	4.97	Highly Effective
Grand Mean	4.92	Highly Effective

b. Assets and Resources

UBMS was also ranked for cost control, asset holding, and technology obsolescence. It was given a grand mean score of 4.93, suggesting that users overwhelmingly perceived the system to be useful in handling cooperative resources.

Table 4. Perceived Level of Effectiveness of UBMS in Terms of Assets and Resources

Indicators	Mean	Description
1. The system has stronger controls	4.94	Highly Effective
2. The system has minimal labor and utility costs	4.97	Highly Effective
3. The system is easy to maintain	4.92	Highly Effective
4. The system is vulnerable to obsolesce risk	4.93	Highly Effective
5. Overall, the system is effective in terms of assets and resources	4.91	Highly Effective
Grand Mean	4.93	Highly Effective

Perception by Demographic Characteristics

Nothing significant was found in perceived efficiency and effectiveness of UBMS as the responses were "unbundled" by age, sex, educational level, and occupation using statistical tests (F-Test, ANOVA). This result confirms that the system behaves uniformly among different groups of users.

Table 5. Difference in the Level of Efficiency of UBMS as Perceived by Respondents When Grouped According to Profile

Particulars	Profile					
	Age	Sex	Educational Attainment	Position	F-Test	P-Value
1. Functionality	4.94	4.93	4.93	4.94	0.83^{ns}	0.391
2. Usability	4.92	4.90	4.87	4.90	1.11^{ns}	0.523
3. Portability	4.87	4.88	4.84	4.86	2.12^{ns}	0.438
4. Efficiency	4.91	4.91	4.91	4.91	0.90^{ns}	0.566
5. Reliability	4.92	4.91	4.88	4.92	1.57^{ns}	0.391

Note: ns = not significant

Difference in the Level of Efficiency of the UBMS as Perceived by Respondents According to Their Profile

The collection efficiency for 2014–2018 (before UBMS) was compared to that of 2019–2022 (after UBMS) among the service cores of ISELCO II to assess UBMS effects on the financial performance.

Collection efficiency at most offices was slightly to moderately higher after UBMS, and particularly developed at Ilagan Branch (from 87% to 89%). Some offices had small reductions, indicating possible system-effect heterogeneity according to local adaptation modalities. These results suggest that while UBMS has improved overall productivity, there are still specific obstacles that need to be overcome to fully reap the benefits.

Table 6. Difference in the Level of Effectiveness of UBMS as Perceived by Respondents When Grouped According to Their Profile

Particulars	Profile					
	Age	Sex	Educational Attainment	Position	F-Test	P Value
1. Operation Management	4.92	4.91	4.88	4.90	0.83^{ns}	0.711
2. Assets and Resources	4.93	4.93	4.90	4.95	1.25^{ns}	0.417

Note: ns = not significant

Effects of the UBMS on the Collection Efficiency of ISELCO II

After investigating the perceived effectiveness of UBMS, an overall favorable attitude was found among the respondents. The system was rated highly by the respondents in the management operation and operation of assets and resources. This perception was quite uniform among employees of different ages, genders, educational backgrounds, and ranks within the firm.

Although differences in the perception of UBMS effectiveness, including differences in constructs by profile groups, could not be found, the data imply that a common perception of an effective UBMS prevails across demographic characteristics.

Yet the generally good user perception implies that UBMS has been successfully integrated into cooperative work. It is important to continue to focus on user-oriented design, as well as issues such as system portability, to continue enhancing usability within all demographic groups.

Table 7. Effect of the UBMS on the Collection Efficiency of ISELCO II Before UBMS

Name of Branch	Before UBMS					Average
	2014	2015	2016	2017	2018	
Ilagan Branch Office	84%	87%	88%	85%	91%	87.00%
Marana Sub-Office	88%	86%	90%	91%	90%	89.00%
San Antonio Sub-Office	85%	88%	86%	86%	88%	86.60%
Lulutan Sub-Office	86%	89%	88%	88%	90%	88.20%
Naguilian Branch Office	88%	90%	85%	89%	86%	87.60%
Gamu Sub-Office	85%	90%	88%	90%	88%	88.20%
Benito Soliven Sub-Office	88%	89%	89%	89%	85%	88.20%
San Mariano Sub-Office	89%	85%	90%	85%	88%	88.00%
Tumauini Branch Office	90%	87%	89%	87%	89%	88.40%
Delfin Albano Sub-Office	89%	88%	88%	88%	90%	87.60%
Sto. Tomas Sub-Office	88%	89%	87%	89%	89%	88.20%
Cabagan Branch Office	87%	89%	89%	89%	88%	88.40%
Sta. Maria Sub-Office	89%	85%	90%	85%	85%	87.60%
Roxas Branch Office	90%	86%	92%	86%	88%	88.20%
Quirino Sub-Office	92%	87%	88%	87%	89%	88.40%
Mallig Sub-Office	88%	89%	90%	87%	89%	88.60%
Aurora Branch Office	90%	89%	90%	89%	90%	89.60%
Burgos Sub-Office	89%	86%	89%	90%	89%	89.60%

Table 8. Effect of the UBMS on the Collection Efficiency of ISELCO II During UBMS

Name of Branch	During UBMS				Average
	2019	2020	2021	2022	
Ilagan Branch Office	91%	84%	92%	91%	89.00%
Marana Sub-Office	90%	89%	90%	92%	90.00%
San Antonio Sub-Office	88%	88%	90%	90%	88.52%
Lulutan Sub-Office	90%	88%	89%	89%	88.84%
Naguilian Branch Office	86%	89%	90%	90%	88.52%
Gamu Sub-Office	88%	90%	90%	90%	89.24%
Benito Soliven Sub-Office	85%	90%	89%	89%	88.24%
San Mariano Sub-Office	88%	89%	90%	92%	89.24%
Tumauini Branch Office	89%	85%	89%	90%	87.40%
Delfin Albano Sub-Office	90%	90%	89%	90%	89.68%
Sto. Tomas Sub-Office	89%	89%	85%	89%	88.84%
Cabagan Branch Office	88%	88%	90%	90%	88.48%
Sta. Maria Sub-Office	85%	87%	89%	89%	87.12%
Roxas Branch Office	88%	86%	88%	90%	87.64%
Quirino Sub-Office	89%	88%	87%	90%	88.68%
Mallig Sub-Office	89%	89%	86%	89%	88.92%
Aurora Branch Office	90%	90%	88%	92%	90.32%
Burgos Sub-Office	89%	90%	89%	90%	89.52%

Problems or Challenges Encountered in Using UBMS

This sub-section discusses the difficulties experienced by the Utility Billing Management System (UBMS) users, which are summarized in Table 9. For this question, more than one response was allowed, thus percentages add up to more than 100%. The Statement of Account Error is the most serious one reported, pointed out by 184 of the respondents (120.26%). This indicates a pressing requirement for accuracy and system reliability. Additionally, unrecognized charges on SOAs (114.38%) and duplicate charges of capital shares and dividends (112.42%) continue to compound persistent financial data integrity and billing transparency questions.

This was a positive result, as all respondents indicated an understanding of how the UBMS operates. High weighted agreement scores—144.44% for system operations and 143.79% for the system's rationale—suggest strong user interest and participation potential. Nonetheless, the fact that 52.29% of these users also suffered from not enough knowledge and that 56.21% lacked management commitment, it suggests that there is a need for more general user training and increased levels of leadership support.

Finally, a single instance of failure caused by external reasons (0.65%) serves as a reminder of the vulnerability of the system to the environment or to man-induced disruptions. The results of this comparison study with other billing system investigations emphasize the necessity for bearing some improvement regarding system design, communication, and training. It is then proposed to improve UBMS performance and trust by improving integrity, educating users, and ensuring support from the management.

Table 9. Problems Encountered in the Utilization of UBMS

Problems encountered in utilizing UBMS:	Frequency (n=253)	Percent
Statement of Account errors	184	120.26
Unrecognized charges on the Statement of Accounts	175	114.38
Duplication of charge of capital shares and dividends	172	112.42
Full understanding of the function of the UBMS	221	144.44
Full understanding of the concept of the UBMS	220	143.79
Lack of sufficient knowledge of UBMS	80	52.29
Lack of management commitment	86	56.21
Offline due to external sources (accident, sabotage)	1	0.65

Multiple answer

Conclusion and Future Works

This research offers a holistic assessment of the Utility Billing Management System (UBMS) of ISELCO II on user profile, system performance, perceived effectiveness, and operational issues. It adds to the knowledge on the working of digital utility systems in local cooperative settings, more especially in the Philippine context.

The results of the study showed that the UBMS is considered to be efficient and effective, especially in terms of functionality, reliability, and usability. This implies that strong billing systems would facilitate utility management and enhance service delivery for public utilities. Given the age and education level of users, largely college-educated people in the 30–49 age range, and a significant proportion working as MRBCs, the user profile is indicative of a workforce that has the competence and flexibility to adapt to digitalization.

Most importantly, the study points out that there are serious operational issues, specifically, SOA errors, unacknowledged and duplication of billing items, and misunderstandings of how the system is operated by users. These lessons emphasize the importance of specific strategies, such as data validation processes, transparency in accounting information, and improved end-user training.

One key value of this study is revealing the disconnect between perceived and actual implementation issues, thus highlighting the need to ensure technology adoption is accompanied by capacity building and management support. While the positive effect of UBMS deployment on revenue collection is suggested, the relationship between the use of UBMS and financial performance should be empirically addressed in subsequent research. Future research may consider measuring the direct effect of UBMS on revenue collection efficiency, exploring human perception differences based on socio-cultural and firm-level factors, examining how the system can scale and integrate with other digital solutions, and assessing considerations for long-term user adoption and behavioral change after the intervention.

In conclusion, the findings provide practical implications for the implementation of billing systems at utility cooperatives and open the door to further research on digital transformation in public sectors.

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Conflict of Interest

The authors declare that there are no conflicts of interest regarding the publication of this paper.

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