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Problems Encountered by Employees in a Low-Voltage Intelligent System Management

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ABSTRACT

The study results show more than 50% were undergraduate and Baccalaureate Degree Holders. Most of them were Director of Operations. The degree of problems encountered by employees in a Low-Voltage Intelligent System Management According to the areas, Frequency of Problems, Magnitude of the Problem and Importance of End-User Requirements were all in a high degree. There is no significant difference in the degree of problems encountered by employees in a Low-Voltage Intelligent System Management according to the area Magnitude of the Problem when grouped and compared according to the variables, age, highest educational attainment and position. There is no significant difference in the degree of problems encountered by employees in a Low-Voltage Intelligent System Management according to the area Magnitude of the Problem when grouped and compared according to the variables, age, highest educational attainment and position. There is no significant difference in the degree of problems encountered by employees in a Low-Voltage Intelligent System Management according to the area Importance of End-User Requirements when grouped and compared according to the variables, age, highest educational attainment and position.

Key Words: Employees Challenges, Low-voltage Intelligent Systems, System Management

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INTRODUCTION

In Chinese power grid, low-voltage power distribution system is an indispensable part of the electric end of the transmission network. Its function is to obtain high-quality electric energy satisfying various technical indexes from the power grid and provide it to the power users, so as to meet the power demand in people's production and life. At present, people's production, work and life need more and more electricity, while people use electricity, there are also some safety accidents, which bring irreparable loss to personal safety and property, we need to better manage low-voltage distribution system, take effective preventive measures to avoid the occurrence of electricity accidents (JiangFeng Liu, 2009).

At the same time of the development of human society science and technology and civilization, our country also pays great attention to the impact of social development on the environment, especially the double carbon goal put forward by our country, to reduce carbon emissions from various social fields, optimize energy utilization, improve production efficiency; Therefore, the energy management system becomes an indispensable tool of energy utilization management for every user. Because of the lack of detection and automatic control of multi-point information in the traditional low-voltage distribution network, it is difficult to help the users to implement the energy management of electric energy. When more and more low-voltage distribution equipment is gradually upgraded to digital intelligent equipment, the low-voltage distribution network established by this digital intelligent distribution equipment can be comprehensively managed by the power quality energy management system, so as to achieve the purpose of better safe operation and optimization of energy utilization efficiency (Dong Zhang, 2010).

Based on the preceding context, this study identifies the variables influencing employees' commitment and explores the possibility of creating an action plan to address the prevailing issues.

OBJECTIVES OF THE STUDY

This study aimed to determine the degree of problems encountered by employees in a low-voltage intelligent system management in China during the first quarter of Calendar Year 2022. Specifically, it seeks to describe the profile of the respondents in terms of age, sex, civil status, and highest educational attainment. It also aims to assess the degree of problems encountered by employees in a low-voltage intelligent system management according to the frequency of problems, magnitude of the problems, and importance of end-user requirements. Furthermore, the study examines whether there is a significant difference in the degree of problems encountered by employees when they are grouped and compared according to the aforementioned demographic variables.

LITERATURE REVIEW

The Theory of Planned Behavior (TPB) has been widely applied to explain behavioral intentions and satisfaction, particularly in studies involving new energy vehicles (NEVs). According to Li et al. (2021), TPB emphasizes that attitudes, subjective norms, and perceived behavioral control are the primary determinants of individual behavior. In this context, the theory provides a useful framework for understanding how individuals form intentions and respond to emerging technologies and systems, including intelligent and technical management environments.

In relation to NEVs, attitudes refer to users' positive or negative evaluations shaped by perceived benefits such as reduced emissions, fuel savings, and improved driving experience. Subjective norms involve social pressures or influences, including environmental awareness and government policies that encourage the use of cleaner technologies. These factors collectively shape how individuals perceive and adopt new systems, which is also relevant in understanding user behavior in technological management systems.

Perceived behavioral control reflects the extent to which individuals believe they have the ability, resources, and opportunities to perform a behavior. In the case of NEVs, this includes access to charging infrastructure and knowledge of vehicle technology. Similarly, in low-voltage intelligent system management, perceived control may relate to employees' access to tools, training, and technical support needed to effectively manage system operations.

Related studies on electric vehicle charging station design emphasize multiple decision-making factors such as economic, environmental, and social considerations. Hosseini and Sarder (2019) used Bayesian network modeling to validate these factors, while Guo and Zhao (2015) applied fuzzy TOPSIS and multicriteria decision-making techniques for site selection. These approaches highlight the complexity of optimizing infrastructure systems, which is also applicable to intelligent system management environments.

Further studies by Ren et al. (2019), Wu et al. (2017), You and Hsieh (2014), and Zhou et al. (2022) applied various optimization models, including genetic algorithms and mixed-integer programming, to improve efficiency in charging station placement. However, many of these studies primarily focus on economic, environmental, and technical aspects, often overlooking user-centered factors such as satisfaction and convenience, which are essential in practical applications.

In response to this gap, the present study emphasizes user satisfaction and convenience from the perspective of end users, particularly employees involved in low-voltage intelligent system management. Similar to findings in customer satisfaction research in the automotive industry, product and service quality, expectations, trust, and experience significantly influence satisfaction levels. Therefore, understanding these factors is essential in improving system efficiency, user experience, and overall operational effectiveness.

METHODOLOGY

This section presents the discussion of the research methodology used, the subjects and respondents of the study, the research instruments used, the validity and reliability of the instruments, the procedure for data gathering, and the statistical tools and procedure for data analysis.

Research Design

Considering the nature of the data involved, a descriptive research design was used in this study to determine the degree of problems encountered by employees in a low-voltage intelligent system management in China during the First Quarter of the Calendar Year 2022.

Descriptive research is valuable in providing facts on which scientific judgment may be based, providing essential knowledge about the nature of objects and persons and for closer observation into the practices, behavior, methods, and procedures, and playing a large part in the development of instruments for the measurement of many gathering instruments like questionnaires, tests, interviews, checklists, score cards, rating scales, and observation schedules, and formulating of policies in the local, national, or international level. (Paler-Calmorin, 2016).

A descriptive research design is valuable to this study as it provides facts and scientific judgment. Also, this design is appropriate for the study as it helps reveal patterns and connections that might otherwise go unnoticed, present situations and determine the prevailing issues making adequate and accurate interpretations of the data.

Study Respondents

The study's respondents were 98 employees from a total of 130 in an XX Enterprise. Since the number of respondents is quite large, stratified sampling and random sampling techniques will be used, and the Cochran formula will be used to find the sample size. To get the percentage, the respondents coming from each department are divided by the total number of respondents and multiplied by the sample size. The researcher will randomly select the respondents from each department using the lottery technique.

Instruments

A researcher-made survey questionnaire was used to gather data on the degree of problems encountered by employees in a low-voltage intelligent system management during the first quarter of Calendar Year 2022. The instrument was divided into two parts: Part I collected the respondents' profile in terms of age, highest educational attainment, and position, while Part II consisted of 30 items distributed equally among Frequency of Problems, Magnitude of the Problem, and Importance of End-User Requirements, measured using a 5-point Likert scale ranging from 1 (almost never) to 5 (always). To ensure validity, the instrument underwent face validation by three experts in the field, who evaluated the appropriateness of the items based on established criteria, resulting in a validity index of 4.78 interpreted as "excellent." The validators included a PhD in Management and dean, a retired PhD holder and businesswoman, and a manager with expertise in Business Administration, with all suggestions incorporated to improve the instrument. For reliability, Cronbach's Alpha was used to measure internal consistency, with a pilot test conducted among 30 employees who were not part of the actual respondents. The instrument obtained a reliability coefficient of 0.919, interpreted as "excellent," confirming that the questionnaire is both valid and reliable for use in the study.

Data Gathering Procedure

After establishing the validity and reliability of the instrument, the researcher wrote a letter to the Manager to ask permission to conduct the study.

Upon approval, the researcher sets a schedule for the data gathering with a letter of request to the department heads.

In the conduct, the researcher explained the purpose of the study, personally administered the questionnaire to the respondents, and guided them carefully in answering and giving the needed data and retrieving the questionnaires. The respondents were assured of the confidentiality of the data gathered. The Statistical Package for Social Sciences (SPSS) was used to process the encoded data.

Data Analysis and Statistical Treatment

For data analysis, different analytical schemes were employed depending on the specific objectives and hypotheses of the study. For Objective No. 1, descriptive statistical tools such as frequency count and percentage were used to describe the profile of the respondents in terms of age, highest educational attainment, and position. For Objective No. 2, descriptive analysis using the mean was applied to determine the degree of problems encountered by employees in a low-voltage intelligent system management in terms of frequency of problems, magnitude of the problem, and importance of end-user requirements. For Objective No. 3, comparative analysis using the Mann-Whitney U Test was utilized to determine whether there were significant differences in the degree of problems encountered when respondents were grouped and compared according to the identified variables.

Ethical Consideration

Participants' personal demographic information results were collected and were noted in the data capturing sheet. These data were essential to establish a possible correlation of the present study. Each participant was given and assigned a unique identifier code, and the participant's anonymity was confidential. The data and information used in the study were treated with strict confidentiality. No information regarding the participant's identity was disclosed unnecessarily in this study. After the data gathering, since there was no need, debriefing was not done by the researcher anymore, as cited in the Data Privacy Act. Since this study is descriptive, it poses no risk for the participants.

RESULTS AND DISCUSSION

This section deals with the presentation, analysis and interpretation of data gathered to carry out the objectives of this study. All these were made possible by following certain appropriate procedures so as to give the exact data and solution to each specific problem.

Profile of the Respondents According to the Variables, Age, Highest Educational Attainment and Position

Table 1

Profile of Respondents

Variables	Categories	Frequency	Percentage
	Younger (below 36 years old)	47	48.00
Age	Older (36 years old and above)	51	52.00
	Total	**98**	**100**

Highest Educational Attainment	Lower (Undergraduate and Baccalaureate)	51	50.8
	Higher (Masters and Doctoral Degree)	47	49.2
	Total	**98**	**100**
Position	Lower (Senior Manager and Systems Engineer)	33	33.7
	Higher (Director of Operations)	65	66.3
	Total	**98**	**100**

The study's first objective is to determine the profile of the employees in terms of the variables age, highest educational attainment and position. As shown in Table 1, most of the employees belong to the older group who are 36 years old and above. 50.80 percent (50.80%) were belonging to a lower educational attainment. Most of them were in a higher position in the company.

The study results show more than 50% were undergraduate and Baccalaureate Degree Holders. Most of them were Director of Operations.

The implication is the management of intelligent low-voltage distribution system needs managers with higher education foundation to implement, at the same time, intelligent low-voltage distribution system is also paid attention to by middle and senior managers of enterprises.

Degree of Problems Encountered by Employees in a Low-Voltage Intelligent System Management According to the Areas of Frequency of Problems, Magnitude of the Problem and Importance of End-User Requirements

Table 2

Degree of Problems Encountered by Employees in a Low-Voltage Intelligent System Management According to the Area Frequency of Problems

Items	Mean	Interpretation
As an administrator of intelligent low-voltage distribution system, the following problems often occur in my work:		
1. The circuit works normally, but the current information is not displayed in the system	3.33	Moderate Degree
2. The controller fuse core in the low-voltage PDC is damaged. The management system generates an alarm	3.99	High Degree
3. The PDC voltage is too high, and the overvoltage is not reported	4.12	High Degree
4. The current is small, and the controller appears lead alarm	3.66	High Degree
5. The capacitor power distribution cabinet compensator generates an overvoltage alarm	3.87	High Degree
6. The circuit breaker is faulty and the management system generates an alarm	3.26	Moderate Degree
7. The switch is faulty due to system operation errors	3.86	High Degree
8. The low-voltage power distribution liaison switch trips	4.61	Very High Degree
9. The management system generates an alarm when the switch is faulty	3.58	High Degree

10. The isolation brake and the drop – down fuse fail	4.00	High Degree
Overall Mean	**3.83**	**High Degree**

In table 2, in the degree of problems encountered by employees in a Low-Voltage Intelligent System Management according to the area Frequency of Problems, in general, was 3.83, which is in a high degree. Item 6, "The circuit breaker is faulty and the management system generates an alarm." Obtained the lowest mean of 3.26, interpreted as moderate degree, while item 8, "The low-voltage power distribution liaison switch trips." Got the highest mean of 4.61, interpreted as very high degree.

This implies that the problems encountered in the management of intelligent low-voltage distribution system, item 8, "The low-voltage power distribution liaison switch trips." appear most frequently, is often troubled by the operation and management of intelligent low-voltage distribution system. Further improvement is needed in the future. The 6 item, "The circuit breaker is faulty and the management system generates an alarm." indicates that the intelligent low-voltage distribution system has done a good job in alarm handling, which can timely warn faults and avoid losses.

Table 3

Degree of Problems Encountered by Employees in a Low-Voltage Intelligent System Management According to the Area Magnitude of the Problem

Items	Mean	Interpretation
As an intelligent low voltage distribution system administrator, I think the following questions are important:		
1. The circuit works normally, but the current information is not displayed in the system	3.92	High Degree
2. The controller fuse core in the low-voltage PDC is damaged. The management system generates an alarm	3.76	High Degree
3. The PDC voltage is too high, and the overvoltage is not reported	3.66	High Degree
4. The current is small, and the controller appears lead alarm	3.39	Moderate Degree
5. The capacitor power distribution cabinet compensator generates an overvoltage alarm	3.83	High Degree
6. The circuit breaker is faulty. The management system generates an alarm	3.90	High Degree
7. The switch is faulty due to system operation errors	3.81	High Degree
8. The low-voltage power distribution liaison switch trips	3.48	Moderate Degree
9. The management system generates an alarm when the switch is faulty	3.76	High Degree
10. The isolation brake and the drop - down fuse fail	3.76	High Degree
Overall Mean	**3.72**	**High Degree**

In Table 3, the degree of problems encountered by employees in a Low-Voltage Intelligent System Management according to the area Magnitude of the Problem, in general, was 3.72, which is in a high degree. Item 4, "The current is small, and the controller appears lead alarm." obtained the lowest mean of 3.39, interpreted as moderate degree, while item 1, "The circuit works normally, but the current information is not displayed in the system." got the highest mean of 3.92, interpreted as high degree.

This implies that the monitoring accuracy of low-voltage intelligent distribution system can be very good, which is reflected in the fourth item. However, the first item indicates that the system is incomplete in displaying circuit working information state parameters, which needs to be improved in the future system development.

Table 4

Degree of Problems Encountered by Employees in a Low-Voltage Intelligent System Management According to the Area Importance of End-User Requirements

Items	Mean	Interpretation
As an administrator of the intelligent low-voltage distribution system, I am eager to improve the following functions of the intelligent low-voltage distribution management system:		
1. The measurement parameters of power quality can be digitally displayed.	4.20	High Degree
2. The measurement parameters of power quality are displayed more accurately.	3.98	High Degree
3. Increase the detection and display of harmonic interference in power quality.	3.68	High Degree
4. The intelligent low-voltage distribution system has the functions of measurement, control and power protection.	3.63	High Degree
5. The digital communication interface of the intelligent low-voltage distribution system can be connected to the computer or network for data acquisition, storage control, remote login and other operations.	3.54	High Degree
6. Test the temperature of the circuit busbar connection.	4.17	High Degree
7. Monitor the circuit breaker status	3.91	High Degree
8. Early warning conditions and control strategies can be customized.	3.73	High Degree
9. As a subsystem module, low-voltage power distribution intelligent system can realize data sharing and compatibility with the overall energy management system of the enterprise.	4.17	High Degree
10. Conduct technical training and management training of intelligent low-voltage distribution system	4.00	High Degree
Overall Mean	**3.94**	**High Degree**

In general, the degree of problems encountered by employees in a Low-Voltage Intelligent System Management according to the area Importance of End-User Requirements, was 3.94, which is in a high degree. Item 5, "The digital communication interface of the intelligent low-voltage distribution system can be connected to the computer or network for data acquisition, storage control, remote login and other operations." obtained the lowest mean of 3.54, interpreted as high degree, while item 1, "The measurement parameters of power quality can be digitally displayed." got the highest mean of 4.20, interpreted as high degree.

This implies that the parameters of power quality can be displayed digitally, which is the biggest feature of intelligent distribution system. It is different from the traditional analog display mode of distribution system, and the information obtained by users is more quantified and accurate. This is reflected in item 1; The 5 item "The digital communication interface of the intelligent low-voltage distribution system can be connected to the computer or network for data acquisition, storage control, remote login and other operations." shows that the intelligent power distribution system not only needs to monitor and feedback the parameters and status of the circuit operation, but also needs to interconnect with different data processing equipment from the outside world, which makes the intelligent power distribution system need to have more connection interfaces and software support, and put forward effective suggestions for future system development, improvement and upgrade.

Comparative Analysis in the Degree of Problems Encountered by Employees in a Low-Voltage Intelligent System Management According to the Areas of Frequency of Problems, Magnitude of the Problem and Importance of End-User Requirements when grouped and compared according to the Variables, Age, Highest Educational Attainment and Position

Table 5

Difference in the Degree of Problems Encountered by Employees in a Low-Voltage Intelligent System Management According to the Area Frequency of Problems According to Variables

Variable	Category	N	Mean Rank	Mann Whitney U	p-value	*Sig. level*	Interpretation
Age	Younger	47	48.85	1168.00	0.827	0.05	Not Significant
	Older	51	50.10				
Highest Educational Attainment	Lower	51	51.49	1097.00	0.467		Not Significant
	Higher	47	47.34				
Position	Lower	33	41.67	814.00	0.050		Significant
	Higher	65	53.48				

Results presented in Table 5 on the difference in the degree of problems encountered by employees in a Low-Voltage Intelligent System Management According to the area Frequency of Problems revealed no significant differences when grouped and compared according to the variables age and highest educational attainment as the computed p-value of 0.827 and 0.467 respectively were greater than the level of significance 0.05. Thus, when grouped and compared according to variables, the hypothesis that there is no significant difference in the degree of problems encountered by employees in a Low-Voltage Intelligent System Management According to the area Frequency of Problems is not rejected. However, when employees are grouped and compared according to position, the computed p-value of 0.050 is equal to the level of significance 0.05. Hence, there is a significant difference in the degree of problems encountered by employees in a Low-Voltage Intelligent System Management According to the area Frequency of Problems when grouped and compared according to position.

This implies that the management of low-voltage intelligent power distribution system, the factor of age is not important, but the important thing is that employees in different positions have different ways of dealing with problems and opinions.

Table 6

Difference in the Degree of Problems Encountered by Employees in a Low-Voltage Intelligent System Management According to the Area Magnitude of the Problem According to Variables

Variable	Category	N	Mean Rank	Mann Whitney U	p-value	*Sig. level*	Interpretation
Age	Younger	47	48.85	1168.00	0.826	0.05	Not Significant

	Older	51	50.10				
Highest Educational Attainment	Lower	51	47.91	1117.50	0.560		Not Significant
	Higher	47	51.22				
Position	Lower	33	49.44	1070.50	0.988		Not Significant
	Higher	65	49.53				

Table 6 presents the difference in the difference in the degree of problems encountered by employees in a Low-Voltage Intelligent System Management According to the area Magnitude of the Problem revealed no significant differences when grouped and compared according to the variables age, highest educational attainment and position as the computed p-value of 0.826, 0.560 and 0.988 respectively were greater than the level of significance 0.05. Thus, when grouped and compared according to variables, the hypothesis that there is no significant difference in the degree of problems encountered by employees in a Low-Voltage Intelligent System Management According to the area Magnitude of the Problem is not rejected.

This implies that as the low-voltage distribution system truly and real-time reflects the running state of the circuit, and is displayed in a digital way with convenient operation, there is little difference between the problems encountered by employees and their age, education level and position.

Table 7

Difference in Degree of Problems Encountered by Employees in a Low-Voltage Intelligent System Management According to the Area Importance of End-User Requirements According to Variables

Variable	Category	N	Mean Rank	Mann Whitney U	p-value	*Sig. level*	Interpretation
Age	Younger	47	47.34	1097.00	0.466		Not Significant
	Older	51	51.49				
Highest Educational Attainment	Lower	51	47.31	1087.00	0.423	0.05	Not Significant
	Higher	47	51.87				
Position	Lower	33	52.50	973.50	0.452		Not Significant
	Higher	65	47.98				

Table 7 presents the difference in the degree of problems encountered by employees in a Low-Voltage Intelligent System Management According to the area Importance of End-User Requirements revealed no significant differences when grouped and compared according to the variables age, highest educational attainment and position as the computed p-value of 0.466, 0.423 and 0.452 respectively were greater than the level of significance 0.05. Thus, when grouped and compared according to variables, the hypothesis that there is no significant difference in the degree of problems encountered by employees in a Low-Voltage Intelligent System Management According to the area Importance of End-User Requirements is not rejected.

This implies that as the end user of low-voltage distribution system and real-time reflects the running state of the circuit, and is displayed in a digital way with convenient operation, there is little difference between the problems encountered by employees and their age, education level and position.

CONCLUSION

The summary of findings reveals that more than half of the respondents were undergraduate and baccalaureate degree holders, with most occupying positions as Directors of Operations. The study further shows that the degree of problems encountered by employees in a low-voltage intelligent system management—specifically in terms of frequency of problems, magnitude of the problem, and importance of end-user requirements—was generally at a high level. However, no significant differences were found in the degree of problems encountered when respondents were grouped according to age, highest educational attainment, and position, particularly in terms of magnitude of the problem and importance of end-user requirements. The findings also suggest that while intelligent low-voltage distribution systems are effective in areas such as alarm handling and monitoring accuracy, challenges remain in fully displaying circuit working information and system parameters, indicating a need for further improvement and development. Additionally, although the system effectively supports digital monitoring of power quality and enhances data accuracy compared to traditional systems, it still requires better integration with external data processing equipment and improved connectivity and software support. Overall, the conclusions indicate that management challenges are more related to operational roles rather than demographic factors, with employees across different age groups, educational levels, and positions experiencing relatively similar issues in system operation and management.

RECOMMENDATIONS

The following recommendations and plan of action were formulated in light of the findings and conclusions derived from the study. However, the system is incomplete in displaying circuit working information state parameters, which needs to be improved in the future system development. The intelligent power distribution system not only needs to monitor and feedback the parameters and status of the circuit operation, but also needs to interconnect with different data processing equipment from the outside world, which makes the intelligent power distribution system need to have more connection interfaces and software support, and put forward effective suggestions for future system development, improvement and upgrade.

Conflict of Interest

The author declares the absence of any conflict of interest that could have influenced the content or conclusions of this paper. She affirms that no financial, personal, or professional relationships with other individuals or organizations have compromised the objectivity, integrity, or impartiality of the research work. As a final point, no external parties influenced the study design, data collection, analysis, or interpretation.

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