

Exploration and Practice of Personnel Allocation Model for County-Level Power Supply Enterprises' Rural Electric Personnel

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ABSTRACT

This study constructs a county-level power supply enterprise personnel configuration model system through mathematical methods, which can predict the total employment, employment distribution, optimize the employee team, and standardize employment strategies. It identifies the corresponding relationships and laws between the development of the county-level power supply enterprise workforce and the scale of business growth, production efficiency, and economic benefits. This achieves the prediction of the quantity, structure, and quality of human resources required for strategic development of enterprises, and formulates effective replenishment strategies based on the supply of internal and external talent markets, optimizing human resource allocation.

KEYWORDS

Power Enterprises; Personnel Allocation; Demand Forecasting.

1. INTRODUCTION

1.1. Requirements of Supply-side Reforms

Currently, the National Development and Reform Commission is studying the formation mechanism of distribution prices. Distribution prices are determined based on the principle of "permitted costs plus reasonable profits." As labor costs are a crucial cost item in cost accounting, county-level power supply enterprises must consider both internal cost-bearing capacity and market competitiveness in terms of staffing and compensation. Therefore, scientifically and reasonably estimating labor costs such as staffing and compensation in human resource allocation has become a problem that county-level rural electric companies must consider in advance.

1.2. Contradiction between Redundancy and Insufficiency of Personnel

Due to historical reasons, the number of staff in rural electric companies exceeds the approved establishment quantity of higher-level departments. However, with the increasing intelligence of electric power infrastructure and the application of information technology, higher requirements are posed for some rural electric work, leading to a significant gap in personnel needed for new skills.

1.3. Talent Quality Requirements for New Personnel in New Businesses

The main body of rural electric personnel consists of village electricians recruited during the 2001 rural electric system reform, whose quality is relatively low. Against the backdrop of further liberalization of the current electricity market, the existing rural electric workforce's quality is unable to meet the increasing external power supply service demands.

2. DATA AND METHODOLOGY

2.1. Data Collection and Processing

Collected comprehensive data indicators for each year and compiled annual statistical data from 2017 to 2020.

Analyzed the importance of indicators and selected key indicators for analyzing and predicting staffing.

2.2. Factor Analysis

Conducted factor condensation analysis using annual equipment quantity and performance indicators.

Calculated the equipment quantity status and key performance status of the power supply company for each year, which are closely related to workload, and workload is linked to staffing.

2.3. Linear Regression Analysis

Developed regression models for the actual number of employees and the estimated staffing of the power supply company based on the key factors obtained from factor analysis.

3. SPECIFIC MEASURES

3.1. Staffing and Replenishment Model

Extracting relevant factors of existing staffing models in the company as independent variables and the actual number of employees within the staffing range as dependent variables, combining data from 18 rural electric companies over the past three years, and conducting factor analysis, the results are as follows:

Table 1. Extraction of Communalities and Rotated Factor Matrix

Index	Independent Variable	Communalities	Rotation Component Matrix
		Initial Value	Extracted Value
X1	Regional Land Area (Square Kilometers, Actual Carrying)	1.000	0.819
X2	Number of 400V Users (10,000 Households, Actual Carrying)	1.000	0.946
X3	Number of 10kV General Purpose Transformers (Including Comprehensive Transformers) (Units, Actual Carrying)	1.000	0.961
X4	Number of 10kV Special Transformers (Units, Actual Carrying)	1.000	0.915
X5	Length of 10kV Overhead Line (Kilometers, Actual Carrying)	1.000	0.915
X6	Length of 10kV Cable Line (Kilometers, Actual Carrying)	1.000	0.958

Results show that Factor X6 (length of 10 kV cable loop in kilometers, actual load) does not aggregate with other factors and has been excluded. After exclusion, the communalities extracted from each indicator are all higher than 0.7.

Table 2. Communalities Extraction and Rotated Factor Matrix (Revised)

Index	Independent Variable Name	Communalities
	Initial Value	Extracted Value
X1	Area of Inland Land (square kilometers, actual load)	1.000
X2	Number of 400 V Users (ten thousand households, actual load)	1.000
X3	Number of 10 kV Public Transformers (including comprehensive transformers) (units, actual load)	1.000
X4	Number of 10 kV Dedicated Transformers (units, actual load)	1.000
X5	Length of 10 kV Overhead Line Loop (kilometers, actual load)	1.000

Using the factors obtained from factor analysis as independent variables and performing linear regression with staffing numbers, the linear regression model obtained is as follows: Estimated staffing number Y1 (R²=0.987): $Y=3.77+0.09*X1+0.78*X2+0.05*X3+0.01*X4+0.01*X5$.

According to the model, the actual staffing numbers and estimated staffing numbers of the agricultural power companies in the past three years were analyzed. The results show that the similarity of staffing numbers is between 94.80% and 96.95%. The results indicate that the model can accurately predict staffing numbers.

Table 3. Predicted Results of Estimated Staffing Numbers

Year	2017	2018	2019	2020
Staffing Number	789	867	885	853
Predicted Number	830	840	858	881
Similarity	94.80%	96.89%	96.95%	96.72%

Note: Similarity with the original model staffing number = $(1 - \text{Predicted Number} - \text{Staffing Number}) / \text{Staffing Number} * 100\%$.

Table 4. Staffing Configuration of Each Agricultural Power Company (Staffing Addition)

No.	Name	Staffing	Actual Staffing Number	Model Calculation Value	Personnel Configuration Rate	Staffing Addition
1	Dingshu Business Office	115	85	123	69.15%	38
2	Fangqiao Business Office	25	22	26	84.21%	4
3	Gaoping Business Office	54	43	57	75.38%	14
4	Guanlin Business Office	55	50	59	84.07%	9
5	Heqiao Business Office	62	44	66	66.56%	22
6	Hufu Business Office	31	25	33	76.85%	8
7	Huankouyuan Business Office	59	49	61	79.97%	12
8	Kaifaqu Business Office	49	40	52	77.62%	12
9	Taihua Business Office	26	23	27	84.87%	4
10	Wanshi Business Office	32	25	35	71.18%	10
11	Xizhu Business Office	28	21	28	73.76%	7
12	Xinjian Business Office	23	22	24	93.57%	2
13	Xinzhuang Business Office	30	24	30	80.27%	6
14	Xushe Business Office	79	60	78	77.42%	18
15	Yangxiang Business Office	42	35	40	86.97%	5
16	Yicheng Business Office	31	41	28	145.57%	-13
17	Zhangzhu Business Office	71	52	71	73.33%	19
18	Zhoutie Business Office	41	34	43	79.66%	9
Total	853	695	881	78.89%	0	

Note 1: Personnel Configuration Rate = Actual Staffing Number / Model Calculation Value * 100%.

Note 2: Staffing Addition = Model Calculation Value - Actual Staffing Number.

3.2. Staff Reduction and Staff Addition Model

Staff Reduction and Staff Addition = Contribution Addition A1 + Management Addition A2 + Retirement Addition B
 Contribution Addition A1: Used to compensate for the number of people transferred to provincial company headquarters and other units last year, public recruitment, etc.
 Contribution Addition A1 = Number of people transferred to provincial company headquarters and other units × 2.0 + Number of people transferred to municipal company headquarters × 1.5 + Number of people transferred to other units of county companies × 1.0 - Number of people transferred to positions by open recruitment × 0.7
 Management Addition A2: Used to better promote the "Three Improvements" and encourage all units to "maximize their efforts".
 Management Addition A2 = Number of employees whose labor contracts were terminated due to violations of the rewards and punishments system, etc. × 1.0
 Retirement Addition B: Based on the number of retirees, combined with the personnel configuration rate of each unit, it is appropriately adjusted.
 Retirement Addition B = Number of retirees in the current year × 50% + Number of retirees in the next year × 30% + Number of retirees in the past five years × 10%.

Table 5. Staff Configuration of Each Agricultural Power Company (Staff Reduction and Staff Addition)

No.	Department	Contribution Addition (Number of People)	Management Addition	Retirement Addition (Number of People)	Staff Reduction and Addition			Redundancy/shortage adjustment number	
					Transferred to Municipal Level Units	Transferred to Headquarters Units	Transferred to Positions Recruitment Selection		Left Dismissed &
1	Dingshu Business Office		2	2			1		22
2	Fangqiao Business Office		2	3			1		1
3	Gaoping Business Office		1	3					10
4	Guanlin Business Office		2	3			1	2	14
5	Heqiao Business Office		3	4			1		9
6	Hufu Business Office		1	4					5
7	Huankouyuan Business Office		3	4			1	2	16
8	Kaifaqu Business Office		3	3			1	3	8
9	Taihua Business Office		1	1			1	2	12
10	Wanshi Business Office		1	2			1	1	8
11	Xizhu Business Office		2	4			1	1	6
12	Xinjian Business Office			1					6
13	Xinzhuan Business Office		1	2			1		6
14	Xushe Business Office			1			2	2	25
15	Yangxiang Business Office			2			1	3	11
16	Yicheng Business Office		4	6			2	1	16
17	Zhangzhu Business Office		2	3		1	1	2	18
18	Zhoutie Business Office			1			1	1	6
Total			28	49		1	17	20	199

3.3. Comprehensive Analysis Model

After the analysis of staffing addition and reduction, it is estimated that each business unit will need to add 223 staff in 2021 (186 from staffing addition and 37 from staffing reduction). According to the specific number of additional staff and the urgency of addition, the distribution analysis of new staff in 2021 is conducted. The analysis results show that in 2021, 9 new staff members should be added to Dingshu Business Office, 1 to Gaoping Business Office, Heqiao Business Office, Huankouyuan Business Office, Kaifaqu Business Office, Xushe Business Office, and Zhangzhu Business Office, totaling 9. In addition, Yicheng Business Office is available for internal transfer of 10 agricultural power personnel.

Table 6. Comprehensive Analysis and Distribution Suggestions of Staff Configuration for Each Agricultural Power Company

No.	Department	Staffing Addition	Staff Reduction and Addition	Number of New Staff in 2021 Distribution
	Staffing Addition	Staffing Reduction	Should Be Added	Distribution of New Staff in 2021
1	Dingshu Business Office	38	4	42
2	Fangqiao Business Office	4	1	5
3	Gaoping Business Office	14	0	14
4	Guanlin Business Office	9	3	12
5	Heqiao Business Office	22	2	24
6	Hufu Business Office	8	-1	7
7	Huankouyuan Business Office	12	3	15
8	Kaifaqu Business Office	12	4	16
9	Taihua Business Office	4	3	7
10	Wanshi Business Office	10	2	12
11	Xizhu Business Office	7	1	8
12	Xinjian Business Office	2	0	2
13	Xinzhuang Business Office	6	1	7
14	Xushe Business Office	18	4	22
15	Yangxiang Business Office	5	2	7
16	Yicheng Business Office	-13	3	-10
17	Zhangzhu Business Office	19	4	23
18	Zhoutie Business Office	9	1	10
Total	186	37	223	9

Note 1: The number of new staff should be added = Staffing Addition + Staff Reduction and Addition.

Note 2: The distribution of new staff in 2021 = Department should be added / \sum Should Be Added * Total number of new staff, where the number of new staff should be 0 or negative, does not participate in the distribution of new staff in 2021.

Note 3: The total number of new staff in 2021 is "9", estimated based on the "2 out of 1" retirement (17 retirees in 2020), subject to the actual total number.

RESULT APPLICATION

Labor staffing management, as a fundamental aspect of management, plays an increasingly important role. With the rapid development of the company, the accuracy of staffing numbers has a more obvious impact on management decisions. According to the strategic positioning and layout of the provincial company, the personnel configuration model of Yixing Company has been optimized and updated, helping the company to stand at a macroscopic perspective, tilt limited resources to the most needed areas, and orderly achieve business organization focusing on the main business, supporting both wings of the business, effectively realizing the reasonable allocation of various business "staffing" and "quotas", optimizing resource allocation, enabling labor staffing management to support the improvement of human resource management level like an "invisible hand", and further improving the management level of Yixing Company.

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