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Exploration of Maintenance and Support Organization Flexibility Analysis Method

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As one part of the support system, Maintenance and support organization, whose own characteristic will also have some changes during the process of providing support services for support activities, and these change will affect the continued support capabilities of the support system. In order to maintain and improve the ability of the support system in the support process, it requires some further study of the factors that affect the ability of the support system, one of the important ways is to improve the support organization flexible. The higher flexibility of maintenance and support organization it has, the smaller changes of self-generated by the impact of changes in the external environment during the support process.
It means that maintenance and support organization support adaptability be enhanced. In this paper, the entropy theory evaluation to determine the degree of flexibility of the support organization, and introducing a indistinct element to fit two or more similar characteristics that for different elements which in the same level of protection organization structure, and thus make a more reasonable and flexible analysis of maintenance and support organization. Finally, according to the size comparison of the degree of flexibility in the fit around judgment and analysis to find a method to improve the supportability of the maintenance and support organization.

1. Maintenance and support organization

Organization structure is a mode that interacts with each other among the internal elements, and it is the organization's structure that executes management. Establish a reasonable and flexible maintenance and support organizational structure is the fundamental premise which guarantees to accomplish organizational tasks effectively. Maintenance and support organization as one of the three factors, which includes several varieties elements, the relationship that between operation and management process is complexity. The support sites which are divided by support level are the physical elements of the support organization. According to the support level, there are vertical links among the different levels of support site, and horizontal linkages exist between the same levels of support site, specifically as shown in Figure 1.
The geographic distribution of the support organization site, different resource types and quantities of site configuration, describes the different support organization of the state. In addition to the support organization site, the main content of the support organization manage the flow of information and protection of resources flow.
For the management of information flow is a top-down management, base-level site as the top-level management institutions in the protection of the organization, assumed an important role in coordinating relations between the other safeguards site. For resource information flows mainly including two types: 1) the flow of information from left to right protection resources; 2) fault parts repair information flow is from right to left. The maintenance shop at every level support sites consisted by using outfield, spare parts warehouse, tool shop, equipment shop, support sub site constitutes. So support Organization element refers to the protection site.

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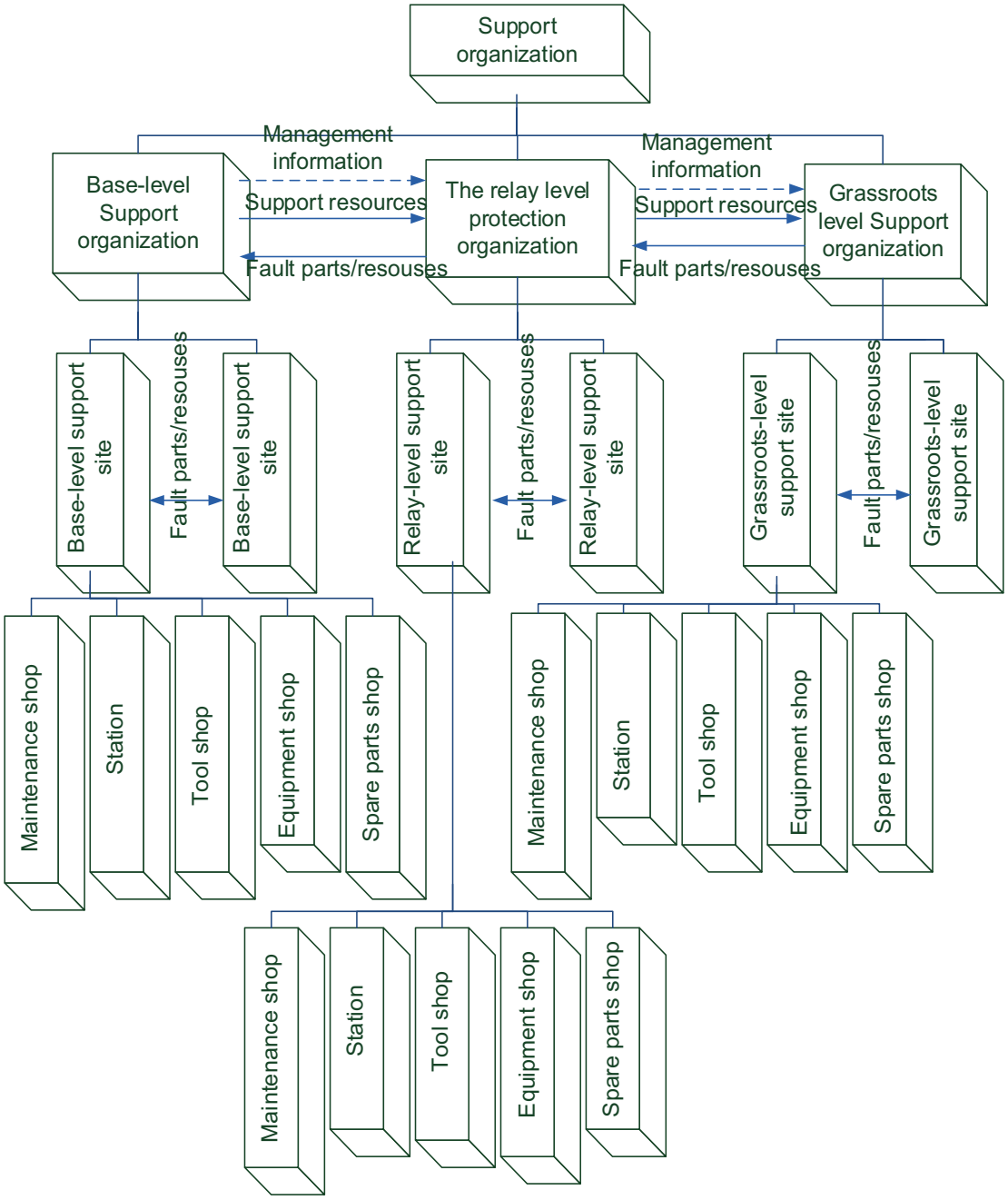

Figure 1: Maintenance and support organization chart

2. Support organizational structure flexible analysis method

2.1 Organization flexible degree

Flexible degree reflects the changes of the support organization which face the environmental and other external conditions adaptability in the performance, it has dynamic characteristics, while reflecting the local characteristics of the organization, organizational flexibility analysis is the analysis of organization protect the environment changes or the ability to organize information reconstruction process, that is, the organization adaptability to the changing environment. The entropy is a measure of the state of disorder of the system and is a measure of the random event uncertainty procedures. From this information and entropy complementary information is negative entropy. The entropy called information entropy or Shannon.

The definition of entropy:

$$H(x) = \sum p(x_i)h(x_i) = -\sum p(x_i)\log_2 p(x_i) \quad (1)$$

In it , $h(x_i) = -\log_2 p(x_i)$ It is said that at some point the system Xi the uncertainty quantity or amount of information contained in.
The entropy of the organizational elements as:

$$H_i = -p(x_i)\log_2 p(x_i) \quad (2)$$

Changes in organizational structure change in entropy:

$$H = \sum H_i = -\sum p(x_i)\log_2 p(x_i) \quad (3)$$

The biggest change in entropy:

$$H_m = \log_2 A \quad (4)$$

Flexible organizational structure R:

$$R = 1 - H / H_m \quad (5)$$

2.2 Support Organization flexible degree

The flexible degree of the support organization describes the ability that adapt to the new situations, new environment, and new task. Generally, improving the support organization flexible degree can enhance the organization's decision-making ability, respond and controlled capacity. The flexible of the support organization consist of varieties of ability that adapt to the organizational structure, decision-making process, and the communication process, it not only depends on the nature of the support system itself, but also on the basic elements of the system's organizational structure, staff and time closely.

The flexible of the support organization must have a object that to be contrasted, it is said that when considering the changes of the support organization, the changes of the support organization will be more rational than the other changes under the same conditions, and this organizational structure will be more flexible than before. In a certain sense that the transfer efficiency of resource information support organization is a standard that reflects the organization’s flexible. The higher flexible degree of support organization shows that support organization faces relative reaction faster make changes in the external environment.

A represents the number of delivery channel contact which is the result that due to the changes of the support organization resources in the external environment or maintenance support process, the contact between two individual elements of the coefficient is 1, the coefficient of internal linkages of the same unit is 1, the coefficient of the contact between the different units according between resource transfer is incremented by 1.

Assuming the support organization elements numbered 1, 2, 3..., organization change in the total number of microstates is A, the total number of microstates with fuzzy elements is A’.

The conditions of setting fuzzy element:

1) When we found the same feature elements in the same level of the support organization, we can fit these same or similar elements fit into one fuzzy element.

2) Fuzzy element in the support organization with circular frame, these fuzzy elements is indicated by dashed lines.

3) Numbing these fuzzy elements in order to avoid confusing these fuzzy elements and repeating the phenomenon logic computational workload increased.

Due to the maintenance and support of the support organization exist some uncertain relationship between subordinate elements of the same layer and directly under the element, we can introduce a virtual fuzzy element, using this fuzzy element to adjust the maintenance and support tissue into constituting the relationships between the elements. fitting these elements that have common nature of the work or has close ties with elements as one element, and thus analysis the maintenance and support organization to make more reasonable and get a high flexible.

Analysis of the elements of the support organization, according to carrying out the maintenance and support organization the same level elements in the relationship among support organization run protection organization uncertainty. Combined with the characteristics of support organization running proposed definition of entropy support organization and connotation, the use of the change of support organization entropy description of the operation of the support system as a whole, and on this basis to establish protection organization model, and establish a quantitative relationship between the degree of order of entropy and support organization. Flexible degree of protection organization as a safeguard organizational evaluation is an important indicator. The support organization example to verify the effectiveness of the organization flexible evaluation method based on entropy protection.

3. Instance application

3.1 protection organization original flexible degree calculation and has close ties elements transferred unified level

The support organization initial model analysis, combined with the sequence number of the elements of Figure 2 in the form of the protection within the organization, as shown in Figure 2.

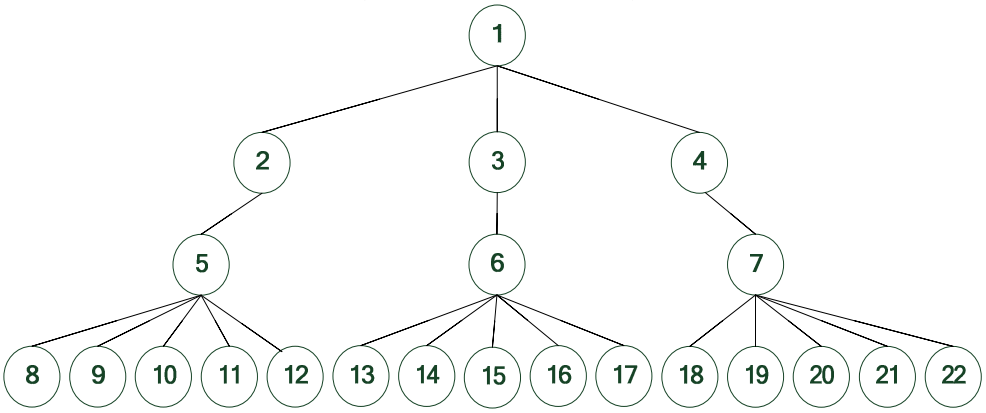

Figure 2: Maintenance support organization chart

According to the algorithm for calculating the entropy theory, it is calculated with the following results shown in Table 1. The degree of flexibility is calculated as follows:

Table 1: Flexible calculation of the maintenance and support organization

Contact length	The number of changes in contact	$P(ij)$	Contact label	Total Label	The number of changes in micro-state	The number of total micro-state
2	1	1/528	2-3,2-4,3-4,8-9,8-10, 8-11,8-12,9-10,9-11, 9-12,10-11,...21-22	33	33	66
4	3	3/528	5-6,5-7,6-7	3	9	12
6	5	5/528	8-13,8-14,8-15... 8-21,8-22,9-13..17-18,17-19,17-20...17-22	75	375	450
Total	$H_m = 9.0443$	$H = 5.4669$	$R = 0.3955$			A=528

3.2 Maintenance and support organization to improve flexibility analysis

In the maintenance and support organization, of the spare parts shop, tool shop, equipment shop, the three elements as the address of the storage, the function of them is similarity in some degree. Such as, in the maintenance task they are all storage which stockpile the resources and the execution time of the maintenance and support the organization's mission are close extremely. For example, when a certain type of aircraft engine failure, and maintenance it in the corresponding support site, some certain tools which come from tool shop or equipment shop will be used to do some test for the engine, if the failure part of the engine can't be repaired, we need to use the spare parts corresponding replace the failure parts. If the failure source is known, the test of the engine and getting spare parts are likely happen at the same time. If we combine the spare parts shop, tool shop with the equipment shop, we will have more dexterity on obtaining resources, and reduce the difficulty of resource scheduling in some degree and shorten the time of access to resources.
The combined Maintenance and support organization is shown in Figure 3.

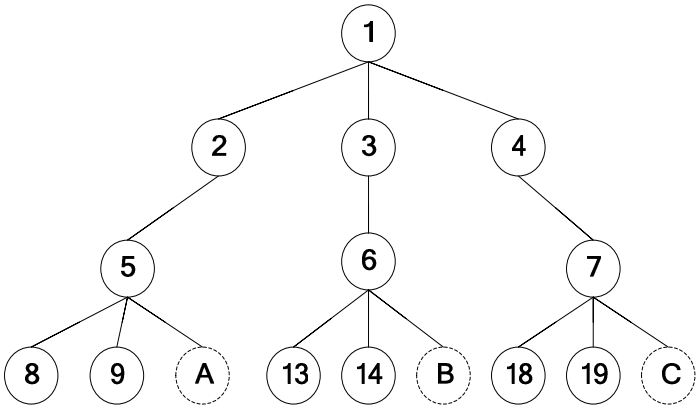

Figure 3: The combined Maintenance and support organization chart

Calculated according to the degree of flexibility of entropy theory to maintenance and support organization, the results are shown in Table 2:

Table 2: Flexible calculation of the maintenance and support organization

Contact length	The number of changes in contact	$P(ij)$	Contact label	Total Label	The number of changes in micro-state	The number of total micro-state
2	1	1/198	2-3,2-4,3-4,8-9,8-A, 9-A,13-14，13-B,14-B, 18-19，18-C,19-C	12	12	24
4	3	3/198	5-6,5-7,6-7	3	9	12
6	5	5/198	8-13,8-14,8-B...9-13.. .A-13，A-14,A-15... B-18，B-19，B-20	27	135	162
Total	$H_m'=7.6293$	$H'=4.3558$	$R=0.4291$			$A'=198$

4. Conclusion

According to the results of calculating, we found that the flexible degree increased after fitting some elements of the support organization, support organization flexible. Several conclusions can be drawn as followed: The less support site element in the bottom of the support organization, the higher flexible degree and the stronger supportability the organization have which to adapt to the uncertain environment. Site consolidation with the function of protection can improve support organization flexible. The lowest level of protection site of the merger may increase the difficulty in the management of support organization. Further analysis and research to find ways to reach the intersection of a win-win management and flexible degree need to be done in the future. But the merger of the underlying elements of the maintenance and support organization will lead to high demand of the quality requirements for the protection of staff and the capacity of using professional knowledge and logistics support knowledge to a certain extent. From the domestic level of technology and education development, the majority of the logistics support staff that already have a high standard of protection skills, and meet the requirement of the maintenance and support organization through training. In addition, By adding the number of support personnel to make up for the lack of maintenance and support organization and continue to improve the Support capabilities.

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