Discussion on Service Modular Division Method for Railway Logistics Agent Business

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Abstract: In order to improve the design efficiency of railway logistics agent business service, and reduce the design cost and meet the demand of railway logistics market, the modular design concept is introduced to explore the modular division method of railway logistics agent business service, which aimed at the lack of scientific basis and high allocation efficiency in the design of railway logistics agent business service. Firstly, the railway logistics operation links are analyzed from three aspects of service function, service flow and service resources, and comprehensive correlation degree is obtained. Secondly, the system clustering method is used to aggregate the operation links, and some railway logistics modular division schemes are obtained. Finally, the loose coupling, configuration and flexibility of the block are given. In order to evaluate the index, the hybrid fuzzy TOPSIS method is used to select the scheme, and the optimal modular division scheme is obtained. The results show that the method is effective and reasonable. It is in line with the actual railway logistics agent business process and provides a basis for solving the modular division problem of railway logistics total agent business service.

1. Introduction

Since the reform of the freight organization of China Railway, which in order to adapt to the demand of the market, and improve the railway logistics service ability, China Railway carried out the agent business of the railway logistics faced on the logistics service demand of the production and processing enterprises¹. The agent business of railway logistics refers to the logistics outsourcing business of the enterprise by participating in the public bidding, inviting bidding, competitive negotiation and so on by participating in the logistics outsourcing projects of the enterprises². The railway department establishes a customized logistics service plan for customers, providing logistics services including railway transportation, storage and distribution, insurance claims and information services. The design of railway logistics service scheme in China is mainly based on artificial experience, it is low efficiency and lack of scientific basis. At the same time, the railway logistics service involves many links, the customers’ logistics demand are different, which make the railway logistics service scheme more complex and diverse. In order to meet the different demand of railway logistics and reduce the cost of service plan design, the railway departments need to use some general modules to realize the modular design of railway logistics service. The existing modular division of railway logistics is summed up according to practical experience. It is difficult to realize the standard configuration of module.

Wang Danzhu³ takes the link between the railway logistics operation link and the functional characteristics as the evaluation index, and puts forward an improved fuzzy C mean clustering algorithm based on the operation link as the clustering object. Song Wenyan⁴ takes the product service
component as a cluster unit, and uses service function, service flow and service resource as evaluation index to determine the comprehensive association degree between service components, then uses fuzzy tree theory to modularize service components, and gets multiple modular schemes. Zhang Zaifang\(^5\) describes the relationship between product and service by U/C matrix. The fuzzy similarity matrix of product service coupling is obtained by Hamming Distance formula, and the dynamic clustering method is used to cluster the modules. Finally, the optimal modularization scheme is worth to the maximum adaptability in the module. Chen Xingyu\(^6\) proposes a division method of complex product module for product family. The optimization model of product functional module division is established by minimizing the coupling degree between modules, and the simulation solution of the model is realized by using an improved immune algorithm which fused the heuristic rules. On the basis of the research, the association between the operation links is considered from three aspects of service function, service flow and service resource, and the association matrix is established. The relationship between the operation links is reflected by the system clustering method and the hybrid fuzzy TOPSIS method is used to obtain the optimal scheme for modular division of railway logistics services.

2. The proposal of the problem

2.1 Description of the problem

The modular division of railway logistics agent business service refers to the cluster process of logistics service operation facing the railway agent business. The operation link \(i\) and the operation link \(j\) are the two operation links of the railway logistics service respectively, respectively using \(R^f_{ij}\), \(R^p_{ij}\) and \(R^s_{ij}\) to express the service function association degree, service flow association degree and service resource association degree of operation link \(i\) and \(j\), then take the comprehensive association degree as the aggregation evaluation index. Aggregate the railway logistics operation link into several modules. The correlation degree of the module is as large as possible, and the correlation between the modules is as small as possible. Because of the existence of several modular division schemes, we need to select the modular division scheme, and judge from three aspects of loose coupling, configurability and flexibility, and finally choose the optimal modular division scheme.

2.2 The modularization process of railway logistics service

(1) The relationship of the operation link. The relationship between operation links can be judged from three aspects, they are service function correlation degree, service flow correlation degree and service resource correlation degree. Then we can get the comprehensive correlation matrix between the operation links to show the relationship strength between the operation links.
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Modular division process of railway logistics service

Analysis of the relation of operation link

- Service function
- Service flow
- Service resources
- Comprehensive association degree

Modular division process of railway logistics service

Selection of modular division scheme for railway logistics service

- Loose coupling
- Configurability
- Flexibility
- Optimal scheme

Start
Analysis of the relation of operation link

End

Figuer.1 The flow chart of railway logistics service modularization

2) Modular division of railway logistics service. The system clustering method is used to polymerize the operation link, and the clustering index is used to improve the clustering granularity, until all the operation links are aggregated into one module, and the clustering tree is finally output.

3) The evaluation of the modular division scheme of railway logistics service. Each scheme is judged from three aspects, they are loose coupling, configurability and flexibility of module. The hybrid fuzzy TOPSIS method is used to evaluate each scheme, and a modular division scheme is finally obtained. The best scheme is the best comprehensive score.

3. Modular division process of railway logistics service

3.1 The relation of operation link

Through the analysis of railway freight service and railway logistics service status, and combining the same or similar operation links, then removing some unnecessary specific links, we can sort out and summarize the 106 common operational links of railway logistics services in Table 1.

| Number | Operation link                      |
|--------|-------------------------------------|
| No.1   | Release capacity                    |
| No.2   | Transportation resource query       |
| No.3   | Fill in the order                   |
| No.4   | Verification of real goods          |
| ...    | ...                                 |
| No.106 | Logistics plan consultation         |

(1) Association of service function

Association of service function refers to the degree of collaboration and association of some functions between operation links. The operation link that can realize the same service function is gathered together to form a module to facilitate the function independence of the module. Using \{0, 0.2, 0.4, 0.6, 0.8, 1\} to indicate the intensity of functional correlation between operation links. 0 indicates that there is no correlation between the operation links, and 1 indicates that the relationship between the operation links is strong, and the following two correlation degrees are judged in the same way.

(2) Association of service process
Association of service process refers to the degree of association between operation processes. The process Association of service is mainly embodied in the material flow, information flow, and the transfer and transmission of the knowledge and skills between the operations, and the operation links form a service process flow according to the relation of the operation process sequence.

(3) Association of service resources

Association of service resources refers to the degree of association that is generated by sharing some resources between the operational links. If the same service resources are shared among different operation links, there is a service resource association between the two links. Service resources mainly include tangible resources such as personnel, equipment and other tangible resources, such as time, space, information and other intangible resources.

(4) Association of comprehensive degree

The association of comprehensive degree is the index of the comprehensive evaluation of the relationship between the operation links, and it is the synthesis of the correlation degree of the evaluation index. If the comprehensive correlation degree is high, the link between the operation links is close, and conversely, the relationship is relatively loose. In order to express the comprehensive association degree between the operation links, the formula of the comprehensive association degree is calculated in formula (1).

\[
R_{ij} = \begin{cases} 
W_f R_i^f + W_p R_p^f + W_s R_s^f, & i = j \\
1, & i \neq j 
\end{cases} \quad (1)
\]

Among them, \(i, j = \{1, 2, \ldots, n\}\), \(n\) are the number of job links, and \(W_f\), \(W_p\), \(W_s\) represents the weight of service function correlation degree, service process association degree weight and service resource association degree weight respectively, and \(W_f + W_p + W_s = 1\) The comprehensive association degree matrix \(R = [R_{ij}]_{n \times n}\) between the operation links can be obtained, and the matrix element \(R_{ij}\) is the degree of association between the operation link \(i\) and the operation link \(j\).

By using the fuzzy analytic hierarchy process\(^6\), the weight of the evaluation index of three operation links is \(w_r = (0.400, 0.319, 0.281)\), and the evaluation value and the comprehensive correlation degree of the operation link are shown as table 2.

| No.1  | No.2  | No.3  | No.4  | \(\ldots\) | No.106 |
|-------|-------|-------|-------|------------|---------|
| (1,1,1) | (1,1,1) | (1,0.8,1,0.936) | (1,0.8,0.8,0.880) | \(\ldots\) | (0.6,0,1,0.521) |
| (1,1,1) | (1,1,1) | (1,1,1) | (1,0.8,0.8,0.880) | \(\ldots\) | (0.6,0,1,0.521) |
| (1,0.8,10.936) | (1,1,1) | (1,1,1) | (1,0.8,0.944) | \(\ldots\) | (0.6,0,1,0.521) |
| (1,0.8,0.8,0.880) | (1,0.8,0.8,0.880) | (1,1,0.8,0.944) | (1,1,1) | \(\ldots\) | (0.6,0,0.8,0.456) |
| \(\ldots\) | \(\ldots\) | \(\ldots\) | \(\ldots\) | \(\ldots\) | \(\ldots\) |
| No.106 | (0.6,0,1,0.521) | (0.6,0,1,0.521) | (0.6,0,1,0.521) | (0.6,0,0.8,0.465) | \(\ldots\) | (1,1,1) |

3.2 Modular division of railway logistics service

The operation link is aggregated by the system clustering method\(^7\), which makes \(l_{ij}\) express the distance between the operation link \(i\) and the operation link \(j\), and \(l_{ij} = 1 - R_{ij}, i, j = \{1, 2, \ldots, n\}\), the initial distance matrix \(L_0 = [L_{ij}]_{n \times n}\) of the operation link can be obtained, such as table 3. Set up \(G_p\) and \(G_q\) respectively to represent the set of two operation links, which contain \(n_p\), \(n_q\) operation links respectively. The distance between \(G_p\) and \(G_q\) is recorded as \(l_{pq}\), and the shortest distance between the operation links included in the set of job links is the distance between the \(G_p\) and \(G_q\), that is, \(l_{pq} = \min \{l_{ij}\}, i \in G_p, j \in G_q\).

| No.1  | No.2  | No.3  | \(\ldots\) | No.106 |
|-------|-------|-------|------------|---------|
| 0      | 0      | 0.064 | \(\ldots\) | 0.479 |
| 0      | 0      | 0      | \(\ldots\) | 0.479 |
The minimum element on the non diagonal line in the initial distance matrix $L_0$ is selected and the lines and columns corresponding to $G_p$ and $G_q$ are eliminated in $L_0$, and composes a new set $G_\tau$, $G_\tau = G_p \cup G_q$, and the minimum distance between the remaining set is added to form a new $n-1$ order matrix $L_1$. It is so repeated until the $n$ operation link is aggregated into a set, and the clustering tree is shown as shown in Figure 2.

Figure 2 The cluster tree graph of operation link

The distance between each set is expressed by the threshold $\lambda$, and the different threshold $\lambda$ corresponds to the different modular division scheme of railway logistics service, and a total of 13 different modules of railway logistics service modularization can be obtained.

4. Selection of modular division scheme for railway logistics service

4.1 Determination of evaluation index

(1) Loose coupling
Loose coupling is an indicator of the independence of the module. The loose coupling of modules is generally influenced by the dependence of the interdependence and the close dependence between modules. If the interdependence between the modules in the modules is closer, the interdependence between modules is not obvious, the loose coupling of the modules is good, and the vice versa is worse.

(2) Configurability
Configurability is an indicator of the diversity of the configuration of a scheme. The configurability is generally related to the number of modules. The more modules, the more kinds of services can be
obtained, but too many modules will also cause the complexity of the scheme configuration.

(3) Flexibility degree

Flexibility refers to the ability to meet different needs through the selection of modules. The modules with high flexibility can meet the needs of customers through a simple combination. The modules with low flexibility are often unable to cope with the changes in customer needs. Only by redesigning the modules can the new requirements be met, which will lead to the increase in the cost of service design.

(4) Quantifying the evaluation index

In the evaluation of railway logistics service modular division scheme, the result of decision experts’ evaluation of qualitative indicators is multi granularity and multi semantics according to their knowledge and experience. Because of the fuzziness and uncertainty in the evaluation process, the quantification of qualitative indexes is often difficult. The existing methods are based on the evaluation semantics and convert them into the corresponding fuzzy numbers. Language evaluation terms are "VH", "H", "F", "L", and "VL" corresponding to the interval number, triangular fuzzy number, intuitionistic fuzzy number, as shown in Table 4.

### Table 4 The relationship between the evaluation language and the fuzzy set

| Evaluation semantics | Interval number | Trigonometric fuzzy number | Intuitionistic fuzzy number |
|----------------------|-----------------|-----------------------------|----------------------------|
| VH                   | [90, 95]        | (0.8, 0.9, 1.0)             | <0.90, 0.05>               |
| H                    | [70, 75]        | (0.6, 0.7, 0.8)             | <0.75, 0.20>               |
| F                    | [50, 55]        | (0.4, 0.5, 0.6)             | <0.50, 0.40>               |
| L                    | [20, 25]        | (0.2, 0.3, 0.4)             | <0.25, 0.60>               |
| VL                   | [0, 5]          | (0.0, 0.1, 0.3)             | <0.10, 0.80>               |

The weights of evaluation indexes are \( w_m = (0.290, 0.333, 0.377) \) respectively by fuzzy analytic hierarchy process, and 4 experts are invited to evaluate the combination assignment with interval number, triangular fuzzy number and intuitionistic fuzzy number respectively, and the initial matrix, as shown in Table 5.

### Table 5 The initial matrix of railway logistics service modularization scheme

| Expert | Program | Loose coupling | Configurability | Flexibility | Program | Loose coupling | Configurability | Flexibility |
|--------|---------|----------------|-----------------|-------------|---------|----------------|-----------------|-------------|
| A1     | [60, 65]| (0.8, 0.9, 1)| <0.2, 0.7>     | A3         | [60, 65]| (0.6, 0.7, 0.8)| <0.2, 0.6>     |
| 1      | [60, 65]| (0.8, 0.9, 1)| <0.2, 0.5>     | 2          | [60, 65]| (0.6, 0.7, 0.8)| <0.3, 0.6>     |
| 2      | [60, 65]| (0.8, 0.9, 1)| <0.2, 0.7>     | ...        | ...      | ...            | ...            |
| ...    | ...     | ...            | ...             | ...        | ...      | ...            | ...            |
| ...    | ...     | ...            | ...             | ...        | ...      | ...            | ...            |
| 13     | [90, 95]| (0.0, 1.0, 0.3)| <0.2, 0.7>     | 13         | [85, 90]| (0.0, 1.0, 0.3)| <0.2, 0.6>     |
| 1      | [50, 55]| (0.8, 0.9, 1)| <0.3, 0.7>     | 1          | [60, 65]| (0.8, 0.9, 1)| <0.3, 0.5>     |
| A2     | [50, 55]| (0.8, 0.9, 1)| <0.3, 0.6>     | 2          | [60, 65]| (0.8, 0.9, 1)| <0.3, 0.3>     |
| 2      | [50, 55]| (0.8, 0.9, 1)| <0.3, 0.6>     | ...        | ...      | ...            | ...            |
| ...    | ...     | ...            | ...             | ...        | ...      | ...            | ...            |
| ...    | ...     | ...            | ...             | ...        | ...      | ...            | ...            |
| 13     | [90, 95]| (0.0, 1.0, 0.3)| <0.3, 0.6>     | 13         | [85, 90]| (0.2, 0.3, 0.4)| <0.3, 0.6>     |

4.2 The scheme evaluation method based on hybrid fuzzy TOPSIS

The hybrid fuzzy TOPSIS method can quantify the uncertain fuzzy semantics, consider the positive and negative ideal solutions, and introduce the relative closeness degree to measure the distance between the alternatives and the positive and negative ideal solutions, so it can be used to measure the advantages and disadvantages of each alternative, and the concrete steps are as follows\(^8\):

1. Calculate the hybrid fuzzy matrix. The normalization of evaluation index matrix is carried out, and the normalization of interval number, triangular fuzzy number and intuitionistic fuzzy number is calculated as formula (2).
In the formula, $\left[f_{ij}, g_{ij}\right]$ and $\left[f_{ij}, g_{ij}\right]$ are the evaluation data of the interval number before and after standardization respectively; $m_{ij}$ and $m_{ij}$ are the evaluation data before and after the standardization of the triangular fuzzy numbers, respectively. $u_{ij}$ and $v_{ij}$ are the membership degree and non membership degree of the intuitionistic fuzzy evaluation data respectively, and the intuitionistic fuzzy number does not have the dimension shadow in the quantitative process, so there is no change before and after the normalization. The normalized matrix element is multiplied by the weight of each evaluation index, and the weighted mixed fuzzy matrix

$$R_p=[r_{ij}^{p}]_{N \times M},$$

as shown in Table 6.

**Table 6** The modular weighted mixed fuzzy matrix

| Expert Progr | Program | Loose coupling | Configurability | Flexibility | Expert Progr | Program | Loose coupling | Configurability | Flexibility |
|--------------|---------|---------------|-----------------|-------------|--------------|---------|---------------|----------------|-------------|
| A1 1         | (0.18,0.20) | (0.27,0.30,0.33) | (0.08,0.06) | (0.08,0.19) |
| 2            | (0.18,0.20) | (0.27,0.30,0.33) | (0.08,0.06) | (0.08,0.19) |
| A3 13        | (0.28,0.29) | (0.00,0.03,0.10) | (0.08,0.06) | (0.08,0.19) |
| 2            | (0.15,0.17) | (0.27,0.30,0.33) | (0.11,0.26) | (0.08,0.19) |
| A4 13        | (0.28,0.29) | (0.00,0.03,0.10) | (0.11,0.27) | (0.08,0.19) |
| 2            | (0.15,0.17) | (0.27,0.30,0.33) | (0.11,0.27) | (0.08,0.19) |

(2) Calculate the positive and negative ideal solutions. $r^+=[r^+_1, r^+_2, \ldots, r^+_N]$ and $r^-=[r^-_1, r^-_2, \ldots, r^-_N]$ are used to express the positive and negative ideal solutions of each scheme, then the interval number $r^+_i=[f^+_i, g^+_i]$ and $r^-_i=[f^-_i, g^-_i]$ are calculated as formula (3).

$$f^+_i = \max_{\forall N, p \in Q} \{f_{p,i}\}, g^+_i = \max_{\forall N, p \in Q} \{g_{p,i}\}$$

$$f^-_i = \min_{\forall N, p \in Q} \{f_{p,i}\}, g^-_i = \min_{\forall N, p \in Q} \{g_{p,i}\}$$

(3)

In the formula, $f_{p,i}$ and $g_{p,i}$ are the lower and upper limits of the $j$ evaluation data of the $i$ scheme by $p$ experts, respectively. For triangular fuzzy numbers, $r^+_i=(d^+_{i1}, d^+_{i2}, d^+_{i3})$ and $r^-_i=(d^-_{i1}, d^-_{i2}, d^-_{i3})$ calculate the following formula (4).

$$d^+_{ij} = \max_{\forall N, p \in Q} \{d^+_{p,ij}\}$$

$$d^-_{ij} = \min_{\forall N, p \in Q} \{d^-_{p,ij}\}$$

(4)

In the formula, $d_{p,ij}$ is the triangle fuzzy evaluation data of the expert $p$ case $i$ on the index $j$. For intuitionistic fuzzy numbers $r^+_i=<u^+_i, v^+_i>$ and $r^-_i=<u^-_i, v^-_i>$ calculate the following formula (5).
\[
\begin{align*}
    u^*_j &= \max_{i \in N, p \in Q} \{u_{p,j}\}, 
    v^*_j &= \min_{i \in N, p \in Q} \{v_{p,j}\} \\
    u^-_j &= \min_{i \in N, p \in Q} \{u_{p,j}\}, 
    v^-_j &= \max_{i \in N, p \in Q} \{v_{p,j}\}
\end{align*}
\]

(5)

In the formula, \(u_{p,j}\) and \(v_{p,j}\) are the membership degree and non-membership degree of the data from the expert \(p\) case \(i\) respectively on the index \(j\).

3) Calculate the distance between the positive and negative ideal solutions of each scheme. The distance between the evaluation data of each project to the ideal solution is the formula (6).

\[
    D^+_p = \sum_{j=1}^{n} \left[ \frac{1}{2}((u_{p,j} - u^*_j)^2 + (v_{p,j} - v^*_j)^2) + \frac{1}{3} \sum_{k=1}^{m} (d_{p,jk} - d^-_{j,k})^2 + \frac{1}{2}((f_{p,j} - f^+_j)^2 + (g_{p,j} - g^-_{j})^2) \right]
\]

(6)

In the formula, \(\pi^+_j = 1 - u^*_j - v^*_j\). In the same way, the distance between the evaluation data of each project to the negative ideal solution is the formula (7).

\[
    D^-_p = \sum_{j=1}^{n} \left[ \frac{1}{2}((u_{p,j} - u^-_j)^2 + (v_{p,j} - v^-_j)^2) + (\pi_{p,j} - \pi^+_j)^2 + \frac{1}{3} \sum_{k=1}^{m} (d_{p,jk} - d^+_{j,k})^2 + \frac{1}{2}((f_{p,j} - f^-_j)^2 + (g_{p,j} - g^+_{j})^2) \right]
\]

(7)

In the formula, \(\pi^-_j = 1 - u^-_j - v^-_j\).

4) Calculate the relative closeness of each scheme. The relative closeness of the alternatives is calculated by the experts for example (8).

\[
    R_{p,i} = \frac{D^+_{p,j}}{D^+_p + D^-_p}
\]

(8)

5) Calculate the comprehensive relative closeness of each scheme. The comprehensive relative proximity \(R_{i,j}\) indicates the distance from the ideal scheme to the scheme, and the formula (9) is calculated.

\[
    R_{i,j} = \sum_{p=1}^{Q} R_{p,i}
\]

(9)

The scheme sort is given according to the \(R_{i,j}\) value, as shown in Table 8, the larger the \(R_{i,j}\) value is, the better the scheme is. Obviously, the program 7 is the best in Table 7.

4.3 Results
The optimal scheme of railway logistics service modularization is scheme 7, the granularity \(\lambda = 0.272\) and is divided into 21 modules, and the modules are named according to the functional characteristics of each module, and the results of modular division of railway logistics services as shown in Table 8 are obtained. The result of the modular division of the railway logistics service reflects the whole service process of the whole railway logistics package, which is in line with the actual railway logistics operation process division, and has the effectiveness and feasibility.

5. Conclusion
The basic purpose of the modular division of railway logistics service is to serve the following railway logistics service configuration and provide the basis and premise support for the scheme allocation. Through the clustering of the railway logistics operation link, some modular division schemes are obtained, and the hybrid fuzzy TOPSIS method is used to evaluate the modularization scheme, and the optimal scheme is obtained. It can be seen from the results that the modularization of railway logistics service can induce and merge the link of railway logistics operation, which is in line with the actual operation process of the railway logistics, and is convenient for the process management. It provides a reference for the railway department to realize the modular division for railway logistics agent.
Table 7 The evaluation and sorting of railway logistics service modularization scheme

| Program | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---------|---|---|---|---|---|---|---|---|---|----|----|----|----|
| Comprehensiveness degree | 2.35 | 2.52 | 2.51 | 1.94 | 2.32 | 2.42 | 3.16 | 3.05 | 2.93 | 2.07 | 1.17 | 0.65 | 0.48 |
| Sort    | 6 | 1 | 9 | 1 | 4 | 5 | 2 | 5 | 4 | 2 | 9 | 8 | 6 |

Table 8 The result of the modularization of railway logistics service

| Module number | Module name | Operation link serial number |
|---------------|-------------|-----------------------------|
| M01           | Service management module | 1.2.3.4.5.6 |
| M02           | Scheme consulting module | 102.103.104.105.106 |
| M03           | After-sale service module | 87.88.89.90.91.92 |
| M04           | Proxy service module | 75.76.77.78.79.80.81.82.83 |
| M05           | Rental service module | 93.94.95.96.97 |
| M06           | Information service module | 98.99.100.101 |
| M07           | Hair station fetching module | 7.8 |
| M08           | Hair station delivery of goods | 9.10.11.12.13 |
| M09           | Hair station handling module | 14.15.21.22.16.23 |
| M10           | Hair station storage module | 17.18.19 |
| M11           | Hair station circulation processing module | 20 |
| M12           | Railway transport module | 24.25.26.27.28.29.30.31.32.47.48.49.50.51.52.85.86 |
| M13           | Transfer station delivery of goods | 40.41.33.34.35.42 |
| M14           | Transfer station handling module | 36.37.38 |
| M15           | Transfer station storage module | 43.44.45.46 |
| M16           | Transfer station circulation processing module | 39 |
| M17           | Destination station delivery of goods | 53.54.55.56 |
| M18           | Destination station handling module | 59.66.57.58.64.65 |
| M19           | Destination station storage module | 60.61.62 |
| M20           | Destination station circulation processing module | 63 |
| M21           | Destination station distribution module | 67.68.69.70.71.72.73.74 |

References

[1] Ju Bei. Accelerate the logistics general package business to promote the transformation and development of railway freight transport [J]. railway procurement and logistics, 2016 (6):48-49.
[2] Wang Danzhu, Liu Qigang, Xi Jiang Yue, et al. Research on the statistical index system and evaluation of railway logistics general package business [J]. railway freight, 2017 (12): 6-11.
[3] Wang Danzhu. Research on modular design of railway logistics service products [D]. Beijing Jiaotong University, 2015.
[4] SONG Wenyan. Study on Methods and Technologies for Customer Requirement-Oriented Design of Product-Service Concept [D]. Shanghai Jiao Tong University, 2014
[5] Chen Xingyu. Research on the theory and method of modular product design for product family [D]. HeFei University of Technology, 2009.
[6] Guo Yan, Han Jinghai. Using fuzzy analytic hierarchy process (FAHP) to determine the weight of customer demand in QFD [J]. mechanical management development, 2007 (6): 112-113.
[7] Gao Xian Ming, Hong Jun, Liu Ruiping, et al. Research on the division method of multi criteria numerical control machine tool module pedigree clustering [J]. Journal of Xi'an Jiao Tong University, 2011, 45 (5): 131-136.
[8] Li Yupeng, Lian Xiao Zhen, Lucheng, et al. Evaluation of complex product module partition scheme based on mixed fuzzy multiple attribute decision [J]. Journal of Shanghai Jiao Tong University, 2017, 51 (11): 1374-1382.