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Flexible modular management of logistics based on intelligence

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Abstract: Based on the development trend of flexible modularization in logistics enterprises, this paper discusses the application possibility and application path of intelligent technology. This paper analyzes the demand of intelligent flexible supply chain, and puts forward the urgency and necessity of intelligent demand. Aiming at the design and modular application of intelligent flexible supply chain, this paper analyzes the economics, and analyzes the technical path pleasantly.

1. Introduction

At present, modularity is the use of intelligent concepts to achieve better flexibility. Flexible modules can better adapt to the internal and external changes of the logistics management system. The pace of change in modern supply chains has accelerated again. The flexibility of logistics service is the key for enterprise clusters to adapt to the change of external environment. The rapid logistics service is the future development trend of the international maritime industry. The fast logistics service can be divided into two kinds, one is the fast fixed supply chain, and the other is the fast flexible supply chain. The general industry believes that the fast fixed supply chain is a problem of efficiency, and the fast flexible supply chain is a problem of intelligence. Intelligent management technology plays a key role in the management of flexible supply chain.[1]

2. Intelligent demand analysis of flexible supply chain

2.1 Analysis of construction process of flexible supply chain

The environment of flexible supply chain is complex and changeable. The flexibility of supply chain is reflected in the rapidity and adaptability of construction. Building a supply chain quickly requires accurate tracking and fast tracking of targets. The matching relationship between supply chain and changing environment is called following relationship by the author. This kind of follow-up relationship needs to be established by using adaptive theory. Adaptive follower relationships require extensive data collection and analysis. This kind of data collection and analysis requires intelligent analysis methods. Intelligent data analysis methods can provide accurate and effective information. This kind of effective information is explicit and instructive.[2] The basic decision making and command dispatching business can be completed by this intelligent data processing system. This intelligent data processing system has the characteristics of followability,

adaptability, flexibility and robustness. These advantages are the core capabilities of intelligent data processing systems.[3]

The core difficulty of building a flexible supply chain is to establish a high-quality intelligent data processing system. The core of supply chain management is the response management to the external environment. The intelligent information processing ability between the common node enterprise and the core enterprise needs a certain matching. This kind of intelligent data processing between enterprises involves the basic ability of informatization and intelligence of enterprises. There is still a big gap between the information base of logistics enterprises and the requirements of intelligence. The information level of most logistics enterprises is low and stays in the information stage of process management. For the inter-enterprise information management, many enterprises do not pay attention to. Intelligent management among enterprises is still in its infancy. The modular intelligent interface between enterprises needs to be strengthened. Flexible management between modules involves data fusion. Data fusion between modules requires intelligent guidance. Flexible supply chains are based on modular intelligent data processing. Flexible supply chain management has high requirements for data acquisition in external environment. The main difficulty is how to quickly discover the data collection point. After quickly determining the data collection point, the method and strategy of data collection is the core content of intelligent management. If the amount of data collection is too large, a large number of invalid data will be generated, which will interfere with the extraction and application of effective data. This requires setting prior guidelines on the scope and magnitude of data acquisition. This guidance should be intelligent and flexible, and will adapt and adjust to changes in the external environment.[4]

2.2 Necessity analysis of flexible supply chain construction

The advantage of flexible supply chain is that enterprise cluster has adaptability to complex and changeable environment. Ordinary supply chain management lacks good adaptability to the rapidly changing external environment. The rapid reorganization of enterprise clusters at the supply chain level requires sufficient decision support information. A large amount of information requires a good intelligent learning mechanism and decision support system. Otherwise, massive information may cause information interference. The function of big data is widely used, which requires a good data collection and processing system. Theoretically, it has the characteristics of long self-learning time and lack of intelligent self-learning ability. The information processing of ordinary supply chain is characterized by rigid rules.[5]

3. Intelligent application design of flexible supply chain

3.1 Economic analysis of flexible supply chain design

There are many technical paths for flexible supply chain design. Moreover, with the development of The Times and technological progress, the choice and planning of technological paths are also more uncertain. The design of supply chain is the result of technical and economic considerations. The priority of technology is a necessary requirement in the short term, and the long-term assessment of economy is the premise of the sustainable operation of enterprises. The sustainable business concept of the enterprise can be matched with the sustainable business concept of the flexible supply chain. The sustainable operation of flexible supply chain is not the permanent fixed of supply chain members, but the permanent existence of flexible supply chain learning ability and self-renewal ability. Self-optimization and self-combination of flexible supply chain are the basic characteristics of flexible supply chain. These basic characteristics determine the fuzziness of the economy of flexible supply chain. This kind of economy has the characteristics of migration and

dynamic. Therefore, the economic measurement of this flexible supply chain is very difficult. It is mainly reflected in the uncertainty of target effect. In addition, it is difficult to use agreed measurement methods for the efficiency of flexible supply chains. The efficiency of flexible supply chain can be divided into two directions: operation efficiency and reorganization efficiency. Operation efficiency is a short-term evaluation index, and reorganization efficiency is a long-term evaluation index. The short-term index is simple and easy to operate in the assessment. Long-term indicators are more difficult to assess. This dynamic and intangible evaluation mechanism has important guiding significance for the construction of flexible supply chain. The primary function of this mechanism is to measure the economics of flexible supply chain. At present, economic measurement has begun to change from results-oriented to efficiency-oriented. Due to the continuity and dynamic nature of flexible supply chain, it is difficult to determine the exact stage of economic evaluation. Without an exact time period, accurate measurement is difficult to achieve. This reflects the dynamic fuzziness of economic measurement. This dynamic and fuzziness can only be measured qualitatively. Qualitative measurement will introduce more subjective judgment. This kind of subjective judgment generally comes from the experience of experts or operators. This judgment of ecchymosis is dynamic. It includes two dynamic aspects, one is the dynamic of the time span, and the other is the dynamic of the judgment standard. This dynamic nature is characterized by fuzziness in mathematical description. The economics of flexible supply chain can be studied by means of fuzzy mathematics and fuzzy evaluation.

3.2 Technical analysis of flexible supply chain design

The design of flexible supply chain should consider the possibility and sufficiency of supply chain design. A sentence of flexible supply chain design is the overall consideration of technology and economy. The technical feasibility is generally compatible with advanced technology and management ideas. The development of trap technology is the driving force, and the corresponding economic analysis is mainly considered from the perspective of constraints. The application of technology also has two basic elements, that is, the advanced nature and stability of technology. Stable technologies are relatively mature, and advanced technologies often lack adequate testing. The advanced nature of technology does not equal the advanced experiment. Advanced technology basically needs to be tested or tested, but the technology that passes the test does not necessarily have real advanced nature. Then the advanced nature of technology is mainly reflected in the efficiency and effect of the supply chain. Advanced technology will bring higher efficiency and better results to the flexible supply chain.

The technology of flexible supply chain is mainly embodied in the two fields of supply chain organization technology and coordination technology. Compared with these two technologies, it is more difficult to coordinate the technology. Coordination technology more embodies the effect of flexible supply chain. The advantage of flexible supply chain lies in the adaptability of supply chain module. The adaptability of this supply chain module is the technical coordination. This kind of coordination includes the coordination between modules and the coordination within modules. This may well be the soul of flexible supply chains. The technical coordination between modules directly reflects the effect of flexible supply chain.

The organization technology of flexible supply chain basically adopts the traditional supply chain management method. In general, the modular management theory is used to optimize the enterprise nodes. At this time, the flexible management is mainly reflected in the flexibility of the module. The flexibility of the module is mainly based on the management method and level of the node enterprise. Due to the different management level of the elder brother enterprises in the supply chain, there is a possibility that the flexibility ability of the node enterprises will not match. This

mismatch in management level requires the use of flexible methods to solve. The flexible supply chain management method has better fault tolerance and robustness.

4. Process analysis of the implementation of intelligent logistics flexible module

4.1 Intelligent flexible module implementation stage division

The implementation process of intelligent flexible modules can generally be divided into four stages. The first stage is the analysis of supply and demand balance based on supply chain. This stage is the logical starting point for the entire business process. All management activities should be based on the actual situation of the supply and demand sides. All management activities are in service of this real relationship. The second stage is the convergence stage of supply chain enterprise management activities. The management activities of each enterprise in the supply chain have their own characteristics. Each enterprise has its own management system and habits for the management of business processes. This stage is to link up the specific management activities of the enterprise. The third stage is the upgrading and application of enterprise management information system in supply chain management. Every enterprise used to have its own management information system. Now? There is a need to unify the management standards of information management infrastructure among enterprises. The fourth stage is the integration stage of intelligent module management. This stage is the implementation stage of intelligent logistics. This is also the stage where modular management plays an important role in the flexible supply chain. Modularity is particularly suitable for intelligent management in supply chain management. The intelligent management of supply chain changes the management object from enterprise to module. This changes from concrete enterprises to abstract modules. Modular management plays a fundamental role in intelligent management. The flexibility of the enterprise is also transformed into the flexibility of the module. This series of changes is gradually completed through the guidance of intelligent management. These four stages make intelligent logistics management a reality. These four stages are completed gradually and cause and effect each other. These four stages can be carried out sequentially, or they can overlap in local areas. In general, the four stages of management are gradually transitioning from low level to high level.

4.2 Construction dimension of intelligent logistics flexible module

The construction dimension of flexible module is the basis of process reengineering for intelligent logistics. There is a direct correspondence between the construction dimension of flexible module and the management dimension of intelligent logistics. This correspondence is not necessarily a one-to-one correspondence, but there are rough and fuzzy correspondence. The construction dimension of flexible module can be divided into two aspects: physical dimension and capability dimension. The physical dimension of modules mainly refers to the management standard of modular interface technology based on enterprise resources. Module capability dimension do not refer to. Scheduling and balancing based on capabilities between enterprises. The division of these two dimensions is very important for the construction and operation of intelligent logistics. The capability dimension of the module directly reflects the operation purpose of intelligent logistics. The physical model of the module directly reflects the basis of intelligent logistics construction. This also reflects two aspects of the enterprise's core competitiveness, which is based on resources, and the other is based on competence. These two kinds of enterprise core competence have different requirements for the construction process. The physical dimension of the module reflects the basic ability of modular management, focuses on the standardization of the enterprise modular transformation, and is also the basic stage of modular management. The inner

dimension of the module reflects the ultimate goal of modular management, focuses on the coordination ability of the supply chain after modular transformation, and is the advanced stage of modular management. These two dimensions are parallel in the process of intelligent logistics management.

4.3 Analysis of difficulties in flexible management of intelligent logistics

Once the flexible management of intelligent logistics is realized, the management efficiency of supply chain can be greatly improved. But there are also administrative issues. When intelligent logistics realizes flexible management, the intelligence and automation of management will quickly replace the independent management of enterprises, leading to the independent decision-making power of some enterprises in listing management. The human element of enterprise self-management will be greatly reduced. Companies will react in different ways. Some other enterprise management has reduced human interference factors, which is considered to be a good thing. Some enterprises think that their own decision-making ability is not respected, yes, this is not a good thing. How to balance the interests of various enterprises has also become a difficult point for enterprises to realize intelligent and flexible management. This involves the principal-agent problem of management. At this time, there is also a practical problem, that is, the right of intervention of supply chain member enterprises. It is when enterprises have the power to intervene in the intelligent management process of the entire supply chain, and to what extent they can intervene. This is not only related to the management efficiency of the supply chain, but also to the management autonomy of the enterprise. In the process of intelligent management and flexible management of supply chain, the whole management may not be completely fair and just for all enterprises in the supply chain. Because automated management can't do that yet. How to ensure that supply chain enterprise members enjoy fair and just rights in the process of intelligent management is a new problem in the process of intelligent management. In the case that enterprises encounter their own inequity, how to realize intelligent supply chain management error correction is a difficult difficulty to solve at present. This practical difficulty is likely to become the focus of intelligent management among supply chain enterprise members. When this difficulty can not be well solved, it is difficult to reach an agreement between members of the marriage enterprise. This is the difficulty of intelligent logistics management. A new interactive management mechanism between enterprises and intelligent systems becomes a possibility to solve the problem. This interactive management mechanism, this mechanism includes intelligent management system interrupt mechanism and work intervention mechanism. When the entire logistics system is considered to have incorrect management in the process of operation, the entire automated management system is temporarily interrupted. When the supply chain member enterprises think that manual management needs to replace the intelligent management system, this year's traditional manual management coordination mechanism plays a role. This will not allow the intelligent management system to continue to manage the entire flexible logistics system in the case of errors. The supply chain enterprise retains the final management decision-making right. Under the current management technology and rule of law conditions, it has practical significance. The supply chain member enterprises can partially accept intelligent logistics management. In the stage where enterprises partially accept intelligent management, today's intelligent management capabilities have been gradually improved. This makes automated logistics a possibility in the process of enterprise supply chain management.

5. Conclusion

The application process of flexible modularization of logistics has many difficulties in matching

management time with intelligent technology. These difficulties will be gradually solved with the development of intelligent technology. Artificial intelligence technology will optimize the efficiency and effect of flexible supply chain.

References

[1] Jihai Jiang, Yong Long. Research on the Mechanism of value Network networking based on Modularization and dynamic capability. [J]. Science and Technology Management Research 2009 (1) P136.

[2] Zhidong Zhang, Kang Han. Modularization: system structure and competitive advantage. [J]. China Industrial economy 2006 (3) P92.

[3] Song Li, Yanmei Wang. Analysis of efficiency Boundary of Virtual Logistics Enterprise based on transaction cost Theory. [J]. Railway Transportation and economy 2006 (6) P20 ≤ 22.

[4] An Chen, Lu Liu. Research status and challenges of supply chain Management [J] .Journal of system Engineering 2002 (2).

[5] Jinglin Hu; Xiuxia Sun; Shuguang Liu; Lei He.Adaptive finite-time formation tracking control for multiple nonholonomic UAV system with uncertainties and quantized input [J]. International Journal of Adaptive Control and Signal Processing, 2019.