Construction of Logistics Information Platforms for Coal Enterprises using Supply Chains

Changhui Yang * Ruixia Yang

School of Business
Zhengzhou University
Zhengzhou, Henan, China, 450001
* Corresponding authors: yangchanghui@zzu.edu.cn

Abstract - Information technology is widely used in supply chain management. In this paper, information is used to build coal enterprise logistics information platform based on supply chains. After reviewing related research, a supply chain structure for coal enterprises is proposed, and a logistics network system is developed. The functional requirements of coal enterprise logistics information platform are detailed and, using construction principles and objectives, a framework is put forward. The platform includes core enterprise, upstream enterprise and downstream enterprise subsystems. By means of this platform, every node of the coal enterprise in the supply chain can: i) share information, ii) reduce "bullwhip effect", iii) increase supply chain operating efficiency, iv) realize the maximum supply chain profit, v) enhance the core competitiveness, and v) reduce cost.

Keywords - Coal Enterprise, Supply Chain Management, Logistics Information Platform, System Framework.

I. INTRODUCTION

Occupying the absolute advantage in the Chinese energy production and consumption. Coal is to provide a reliable guarantee for the sustainable development of the national economy for a long time. After the financial crisis based on the reducing demand, competing market and impacting of foreign coal as well as increasingly serious energy saving and environmental protection pressure, the traditional management and logistics mode has faded the advantage, coal enterprise are forced to "the third profit source" for getting more benefits. Therefore, optimizing the coal enterprise supply chain system is an important direction of progress by means of using advanced information technology, building coal enterprise logistics information platform is to become the development trend of coal enterprise logistics information. The construction of logistics information platform in coal enterprise, can be shared and instantaneous transmission information of the supply chain of coal enterprise, improve the efficiency of the supply chain, enhance the supply chain enterprise competitiveness, obtain good economic and social benefits.

II. LITERATURE REVIEW

Many scholars have researched this problem, R. J. Ormerod have proposed "coal chain" expansion possessing constraint mechanism, coal production, acquisition and delivery to consumers is the logistics and economic issues, the development of new technology is help to eliminate some constraints [1]. R. D. Miles and K. C. Sinha points out that coal enterprise should integrate logistics resources, the establishment of regional logistics system, to achieve the maximum overall efficiency of the coal logistics resources, reduce logistics cost [2]. S. J. Ratick and J. P. Oslee established coal logistics system, using the mixed integer programming model, providing information for traffic infrastructure planning, that is help to improve the USA coal export [3]. Oslee believed that through the optimization to improve distribution, storage capacity of coal logistics system of comprehensive the very complex, in order to enhance the operational efficiency of the coal logistics. Bahar [4]. Y proposed the establishment of professional coal transportation sector is to contribute to the coal logistics system, improve logistics efficiency and reduce coal transportation risk, decrease logistics cost by using of GIS technology [5].

N. Prindezis and C. T. Kiranoudis put forward logistics management system to coordinate and disseminate tasks and related information based on internet, to solve a chain of small business network heterogeneous vehicle routing problem, and focus on the Athens central food market demand and detailed road network [6]. Laureano Jimeneza and Raul Munozb introduced the development of integrated application architecture and e-commerce integration, is the enterprise internal and external business process oriented enterprise application integration [7]. J. C. Q. Dias etc proposed portunities and challenges for the current new manufacturing and logistics system automation and control system, and pointed out RFID, ICT, MAS technology is to become the biggest advantage of cooperation of intelligent logistics system in supply chain management, production and sales through the logistics platform, can realize the
Visualization management of inventory [8]. Jose Santa etc have built a remote information processing platform by means of GPS, ICT and RFID technology, successfully develop the hardware and software prototype system and tested and applied in southeastern Spain transport of agricultural products [9]. Domenico Gattuso and Gian Carla Cassone presented an analysis of logistics platform operation based on microscopic simulation model of random, dynamic discrete event, the model has been realized by Witness software, and applied to the "Kuehne+Nagel" logistics platform to analyze its operability [10]. Egils Ginters and Jorge Martin-Gutierrez thought using RFID is to increase the performance of logistics project identification, and using the 3D visual inspection items is to reduce the number of potential errors, and studies the application of Augmented Reality in the warehouse project visualization [11]. John D. Nelson and Corinne Mulley comparative analyzed Europe and Australia's Intelligent Transport System, and pay attention to the collection methods of use and the Australian Department of public traffic application, discussed the problems to improve the passenger experience, operational effectiveness, compared to Europe, Australia Department of public traffic ITS use efficiency is low [12].

To sum up, coal enterprise logistics information platform has made some achievements, but there is still big research space. In view of this, this article attempts from the perspective of the supply chain, taking coal enterprise logistics information as the core, focusing on the main structure of coal enterprise logistics information platform and network structure model.

III. ANALYSIS OF COAL ENTERPRISE SUPPLY CHAIN LOGISTICS NETWORK SYSTEM

A) Coal Enterprise Supply Chain Structure

Supply chain can be understood as the sum in the whole industry, collaborative relationship with raw material suppliers, manufacturers, and distributors, logistics service and after sale service center. Node of coal enterprise supply chain include: coal suppliers of raw materials (such as mechanical, electric, upstream supply enterprise), coal and coal producers (including coal mining, coal transportation, coal production, coal sales) of coal products, transportation and coal consumers. That formatted the main clue of logistics, framework of coal enterprise supply chain including the relationship between input and output of information flow and capital flow, as showed in figure 1.

![Figure 1. Coal Enterprise Supply Chain Framework](image)

The coal enterprise supply chain management information platform, mainly refers to the materials and equipment needed for coal production procurement, storage, coal mining, transportation and customer service related information to management. The node information of coal enterprise in the supply chain is mainly composed of coal materials and equipment suppliers, coal mining, coal transportation and marketing business (logistics companies), coal, coal users or agents coal consumers arising from the information. Information sharing can make a series of activities in coal enterprise supply chain more efficient.

Information sharing, process synchronization, mutual cooperation, delivery on time, quick response and satisfactory service are the characteristics of coal enterprise supply chain management. Coal logistics information flow under supply chain environment is obviously increased, information transmission of demand and passing feedback information is network, supply chain market and supply and demand information through the EDI/ Internet rapid transfer to the node enterprise of the supply chain.

B) Coal Enterprise Logistics Network System based on Supply Chain

From the perspective of the supply chain, coal enterprise logistics system includes coal production logistics, production logistics and distribution logistics of coal.

1. Coal production logistics: Coal production logistics is to refer to the whole process of coal from the working face to the outside, including the main production of two part logistics and production
logistics. The main characteristics of the coal production logistics including coal logistics is almost useless semi-finished products, coal logistics single, continuous high, the product size, weight and logistics capacity.

2. Coal production supply logistics: Coal production supply logistics mainly include coal mining required raw materials, fuel, equipment and tools, supply logistics center is mainly refers to the supply of coal enterprise, coal group and logistics supply company. The principal features of the coal production and supply logistics, production of coal required raw materials do not form part of the product entity, the supply company, production base far apart, internal material line long. Therefore, enterprise should strengthen the recycling logistics management, and through the total warehouse distribution to each demand point to improve logistics efficiency.

3. Coal distribution logistics: The coal distribution logistics is to refer to the coal from the coal transport to the customer of the whole process. Among them, the logistics information intensive, the user releases the wide area is the main feature of the coal distribution logistics. Generally speaking, the coal enterprise will be set up throughout the country, many distributors, coal orders, refined coal transportation, customer management, product information release and other related information processing a series of coal distribution activities still rely mainly on the telephone, fax, express mail and direct to the traditional way.

The main elements, object elements and carry communication constitute the elements of the coal logistics network. The network system structure of coal logistics model as illustrated in Figure 2, integrating the network of interrelated organizations, facilities and equipment, lines and place, logistics information and service elements. As can be seen from the graph, the coal distribution, transport and distribution center are three important logistics node, is the soul of the coal logistics network and the central nervous system.

C) Analysis of information and function requirements of coal enterprise supply chain

1. Characteristics of information demand of coal enterprise supply chain: Internal and external dependence of coal enterprise supply chain logistics system: Every node enterprise of coal supply chain has very strong dependence on public logistics infrastructure, transportation network and external information, which requires the existence of public information platform, in order to improve the logistics information access efficiency and reduce the cost of information.

Difference of coal enterprise supply chain logistics information needs: Coal enterprise, each enterprise in supply chain, the use of logistics customers and government departments to demand of logistics information is different, the difference is mainly reflected in: the time differences, differences in the contents and degree of difference.

Complexity of coal enterprise supply chain logistics information exchange: A plurality of management main body integrated logistics service to customers, the main economic relations, diversity, technology, corporate culture and information system, leading to the complexity of logistics information exchange. Data exchange in different management systems, different enterprise, different operation mode in different systems, each system data structure, storage format and interface protocol is not the same, the node enterprise of supply chain logistics data of coal enterprise and logistics resources integration difficult.

Limited of coal enterprise supply chain logistics data sharing: The partial coal enterprise supply chain node enterprise is run by a closed system to a particular user. Logistics internal information and external shared scope is very limited, which leads to limited data sharing.

![Figure 2. Network Framework Model of Coal Logistics](image-url)
logistics management informatization consciousness is not strong, so that the coal enterprise logistics information current collection, transfer, exchange, the link sharing and processing are lagging behind, which affects the efficiency of coal enterprise in the supply chain, but also increased the cost of logistics. Therefore, establish an open character and satisfy the coal enterprise logistics information platform of supply chain become the best choice based on the internal demand of the enterprise platform. This platform can be very useful to complete the coal logistics information collection, transfer, exchange, sharing and processing process, as each enterprise in supply chain management decision making.

Coal enterprise logistics information platform based on supply chain is help to reduce the transmission level and flow of logistics information, improve the logistics information utilization, the normal operation of the logistics system in the most short process, the fastest speed and minimum cost to realize, can effectively reduce the logistics cost, the optimization of logistics system operation.

### 3. Functional requirements for platform of coal enterprise supply chain node enterprises

From perspective of the needs of Logistics Department of business process analysis, the relationship between recognition system users and information needs, consider the expected service and platform to provide comprehensive services, the relevant units of the requirements of the construction of information platform, thus to ultimately determine the basic information and function of information platform.

Many related enterprises in the coal enterprises supply chain, different enterprises for information requirements and contents of each are not identical, for different user information demand analysis, can better understand the logistics demand supply chain enterprises, eliminate the information asymmetry phenomenon, realize the sharing of real information. Node enterprises of coal enterprise supply chain demand for logistics information platform is mainly reflected in four aspects, such as showed in table 1.

#### Table 1. Requirement for logistics information platform of coal enterprise supply chain node enterprises

<table>
<thead>
<tr>
<th>Requirement Type</th>
<th>Requirement Contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Requirement for Government</td>
<td>Coal logistics government matters and approval requirements, coal logistics government</td>
</tr>
<tr>
<td>Resources</td>
<td>affairs consulting demand, coal logistics government information query demand.</td>
</tr>
<tr>
<td>Requirement for Related Resources</td>
<td>Coal industry information query (such as management, business, enterprise, infrastructure, policies and regulations, training, exhibition, data information), coal human resource exchanges / expert group consultation, learning coal knowledge resources, sharing logistics solutions.</td>
</tr>
<tr>
<td>Commerce requirement</td>
<td>Coal enterprise supply and demand, coal enterprise online shops, coal enterprise</td>
</tr>
<tr>
<td></td>
<td>customer resource mining, coal enterprise business Auxiliary tools demand, coal</td>
</tr>
<tr>
<td></td>
<td>enterprises online office demand.</td>
</tr>
<tr>
<td>Work Requirement</td>
<td>coal enterprise internal operation information, coal logistics vehicle and cargo tracking, customs clearance requirements of coal industry.</td>
</tr>
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</table>

In addition, the government can take the docking logistics information platform of e-government and the existing management system, realize the coal industry regulation. Specific performance are following, docking with the tax department of coal enterprises online declaration of tax, docking with the department of industry and commerce implementation supervision of coal enterprise transactions, docking with traffic and statistics departments realize coal supplies online information and data acquisition, and connect the existing government database realize the public and online data acquisition of coal enterprises. General user demand for logistics information platform of coal enterprise include: coal enterprise information query, coal production supply and demand information query, the development of the coal industry, the coal industry information related policies, laws and regulations, standard of coal industry and coal industry logistics service price information, coal industry issues.

### IV. CONSTRUCTION OF COAL ENTERPRISE LOGISTICS INFORMATION PLATFORM BASED ON SUPPLY CHAIN

#### A) Construction Principles and Objectives

The construction of coal enterprise logistics information platform based on supply chain is based on supply chain management theory as a guide, using information technology, breaking industry boundaries, boundaries and regional boundaries, to carry out a comprehensive plan for logistics, capital flow and information flow in the supply chain of coal enterprises, through the planning, organization, coordination and control means, between coal enterprises to establish each enterprise in supply chain partnerships and strategic alliances and the reasonable distribution mechanism, improve the operation efficiency and the benefit of the whole supply chain, to satisfy the customer value, reduce supply chain cost [13]. The construction principle and other information platform construction principle is similar to the logistics information platform in coal enterprise, some characteristics of coal enterprise supply chain and logistics problems in the
development process, focus on 7 principles and as shown in table 2, construction target includes 6 aspects and as showed in table 3.

### Table 2. Construction Principles of Coal Enterprise Logistics Information Platform

<table>
<thead>
<tr>
<th>Construction Principles</th>
<th>Explain</th>
</tr>
</thead>
<tbody>
<tr>
<td>comprehensiveness</td>
<td>Considering the relationship between the actual demand of each node enterprise coal supply chain on the platform of logistics information and the mutual.</td>
</tr>
<tr>
<td>Standard</td>
<td>In accordance with the coal industry standard, country specific requirements of platform construction and standardization, standardization of information acquisition.</td>
</tr>
<tr>
<td>Openness</td>
<td>Capable of docking with other related information platform and information system, the mutual exchange of data.</td>
</tr>
<tr>
<td>Augmentability</td>
<td>To adjust and change and adapt to new markets and demand situation, for the future development of the platform there are enough space.</td>
</tr>
<tr>
<td>Safety</td>
<td>Safety of platform user authentication information of the logistics, information exchange for user security and transaction security.</td>
</tr>
<tr>
<td>Reliability</td>
<td>Stably running of the system, not the process of information transmission were stolen or leaked.</td>
</tr>
<tr>
<td>Easily Operation</td>
<td>Platform and system has the advantages of simple operation, providing online help and for the user to solve the problem in time.</td>
</tr>
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### Table 3. Construction Objectives of Coal Enterprise Logistics Information Platform

<table>
<thead>
<tr>
<th>Construction Objectives</th>
<th>Explain</th>
</tr>
</thead>
<tbody>
<tr>
<td>One-stop service</td>
<td>Providing one-stop services, to realize the supply chain upstream and downstream communication, business operation and coordination.</td>
</tr>
<tr>
<td>Electronic activities</td>
<td>Mobile communication, electronic data exchange of goods, GPS tracking, SMS platform payment collection of real-time query technology, electronic logistics activities of coal enterprises.</td>
</tr>
<tr>
<td>Decision support</td>
<td>Getting the development change rule of the coal logistics of information processing and processing, realize the analysis and decision on purchasing, inventory management, vehicle scheduling, transportation process design and other enterprises.</td>
</tr>
<tr>
<td>E-Commerce</td>
<td>Electronic trading, integrating logistics, information flow, storage, transportation, customs clearance and financial settlement and other functions.</td>
</tr>
<tr>
<td>Membership</td>
<td>Have different levels of membership function, and according to the membership privileges to provide information index directory, membership information management, data storage and analysis of service customization.</td>
</tr>
<tr>
<td>Intelligent logistics</td>
<td>According to the data provided by the node enterprises, coal logistics solutions, operations research, statistics tracking methods and technology to develop the best.</td>
</tr>
</tbody>
</table>

**B) System Framework of Coal Enterprise Logistics Information Platform Based on Supply Chain**

Coal enterprise logistics information platform based on supply chain is related to logistics, information flow and capital flow each node of the supply chain. Logistics activities are to transfer regional and cross enterprise. The main function modules of the platform includes basic services, application services and value-added services [14-16]. Among them, the basic service function modules including data storage, data exchange and query statistics; application service modules including service, resource allocation, scheduling, inventory management, financial services and other value-added service; function module including decision support, electronic commerce, supply chain management, customer relationship management, financial management, office automation and external docking etc..

Architecture of coal enterprise logistics information platform based on supply chain can be divided into infrastructure layer, supply chain business layer, supply chain management level, supply chain decision-making layer and gateway layer. The system structure of the general logistics information platform reference state regulations, combined with the actual characteristics of coal enterprise, based on the architecture of logistics information platform of coal enterprise supply chain as showed in Fig. 3. Among them:

- Infrastructure layer: Mainly includes firewall, data storage device, information collection system, information input and output devices, data processing center and network facilities.
- Supply chain business layer: Including purchasing management, order processing, distribution, warehousing, transport digital coal transportation scheduling and financial management.
- Supply chain management level: Good docking of supply chain management layer helps among node enterprises in the supply chain, to realize the centralized management of coal enterprise supply chain.
- Supply chain decision layer: Through the collection of customer information, market information, providing decision support for the formulation of supply chain strategic planning.
- Gateway layer: Gateway layer to achieve good communication, information of each node enterprise
supply chain to share and feedback, so as to better serve customers, enhance market sensitivity.

C) Analysis of Network Structure of Coal Enterprise Logistics Information Platform based on Supply Chain

Network structure model of coal enterprise logistics information platform based on supply chain is as shown in Figure 4, including the core enterprise subsystem, the upstream enterprises and downstream enterprises subsystem.

(1)Core enterprise subsystem: When coal enterprise will build supply chain information platform, followed by the original system and the principle of separate, system design should break the functional

Figure 3. Coal Enterprise Logistics Information Plat Architecture Based on Supply Chain

Figure 4. Network Architecture of Coal Enterprise Logistics Information Plat Based on Supply Chain
departments of the original structure of Pyramid structure, establish a business oriented function as the basic unit, divided into flat structure of different business logic module and the service module. Through the sharing of Intranet coal enterprise internal business processing, coordination office and information, and real-time exchange of external information. The architecture of the system to store and manage all kinds of data and information to the database server, provide browsing and querying web office, material, equipment, production and other information online as the web server, providing information processing services to financial, decision support, production and marketing services to application server.

(2) Upstream enterprises subsystem: By means of Internet coal enterprise can best grasp of coal supply information, reduce procurement costs and expenses, shorten the inventory cycle, improve the stock utilization, accelerate capital turnover. The platform will coal materials suppliers, coal production enterprises together, help to realize supply chain information and resource sharing, improve the competitiveness of the entire supply chain.

(3) Downstream enterprises subsystem subsystem: By means of the platform coal enterprise can understand the needs of the coal market, and sales forecast, and then according to their own production capacity, production scheduling and scheduling of production plan, production to meet the needs of users of products, realize the profit maximization.

Coal enterprise logistics information platform based on supply chain is a complex system engineering, is the current logistics information system, distributed, heterogeneous into account, the application of information technology will be a series of hardware, software together, realize the integration of various application services. The three subsystem platforms can be integrated through the network portal technology. Through combining with Internet/Intranet, a set production, supply, marketing as one of the portals, the core subsystem to coal enterprise supply chain and upstream and downstream systems together, achieve the global supply chain management, realize the sharing of information between supply chain nodes. Through the establishment of the portal and identity authentication system, each user of coal enterprise supply chain to chain information query, feedback and communication.

V. CONCLUSION

By means of information technology constructing coal enterprise logistics information platform based on supply chain, using advanced data method and statistical technologies to comprehensively treatment, storage and utilization of information, to provide decision support and information service for the supply chain node enterprises, can realize each node of the supply chain information sharing, and will be helpful to reduce "bullwhip effect", increase supply chain operating efficiency and profit, enhance the core competitiveness of each enterprise, reduce the cost.

REFERENCES