

Research on the Innovation Strategy of Coal Supply-Chain

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Abstract: This paper analyzes the disadvantage of the coal supply chain in the traditional business environment, propose the optimum approach for innovation of coal supply chain is e-business, establishes a strategic model for the supply chain members involved in coal e-business with the cost/benefit analysis of the coal e-business, and draws the conclusion that a collaborative e-business system be set up by the coal mining enterprises, coal washing and processing enterprises and coal user enterprises.

Keywords: Supply chain, Innovation, E-business

I. The Disadvantage of the Coal Supply Chain

The coal supply chain members in the traditional business environment are: coal mining enterprises, coal washing and processing enterprises, coal distribution companies and coal users. In the traditional business model of coal, the coal mining enterprises will sell the coal that is mined out (some under the coordination of the Mining Bureau) to the coal washing and processing enterprises. After the conduct of the coal is washed and processed by the coal washing and processing enterprises, the majority of the product is sold by the coal distribution companies to the coal users. In this seemingly simple supply chain, the coal distribution companies and other companies reselling coal for the purpose of obtaining benefits are involved in, who wring out most of the profits in the coal price, making the price of coal departed of the true value. This has increased the burden on the coal users and coal production enterprises and undermined the interests of them.

II. E-business is the Optimum Approach for Innovation of Coal Supply Chain

After the implementation of coal e-business, the structure of coal supply chain will be changed, as information flow and cash flow change, the coal distribution companies will be transformed into a real coal "transport" company, or be completely withdrawn from coal supply chain, and the relationship between the supply chain members will also be changed and optimized. In the e-business environment, due to the support from coal users and coal production enterprises, and no need for the participation of distribution companies and other intermediaries, the middle part is cancelled, and the coal-user enterprises directly send purchase request to coal production enterprises through the

network according to their needs, production enterprises use e-business systems to make dialogues directly with users, complete the programs such as the confirmation of online orders, online certification and online payments through other processes of e-business and complete the transaction. This will completely abolish intermediate links, enabling coal production enterprises to make a reasonable price, and lowering the purchase costs of coal-user enterprises. The transportation of coal is undertaken by coal mining enterprises, or third-party logistics companies selected by coal washing and processing enterprises, the coal distribution companies no longer have the role of middlemen.

III. Development Strategy of E-business between Coal Supply Chain Members

E-business between coal supply chain members, can be understood at different levels. According to the classic categories of e-business, coal e-business can be divided into three levels.

Coal Enterprises Static Websites

Coal enterprises initially carry out e-business, build a coal marketing site of information dissemination category, use the Internet to publish information of coal products, collect customer information, achieve network marketing, using the Internet platform to promote coal enterprise culture and expand enterprise visibility, and get more market share for enterprises. In terms of coal enterprises, although the functions that this solution supplies are quite limited, but it is low-cost, has relatively small overhead, and is also convenient and effective, which could allow enterprises to enter the e-business market as soon as possible.

Independent Coal Trading Platforms

The second level has further development compared to the first level, in which the coal washing and processing enterprises begin to use the Internet for trading, coal trading platform consists of two parts, one is coal trading platform, the other is the raw material trading platform, and these two platforms are relatively independent. Coal company's sales systems and production scheduling systems provide coal raw materials purchase information to the coal trading platform, and the sales system also accept feedback and transaction information on the trading platform; purchasing system and inventory system provide raw materials procurement

information to raw materials trading platform, procurement system also accept the procurement information and feedback information of raw materials trading platform for; financial control system is responsible for the settlement for orders with e-business trading platform.

At present, enterprises engaged in the coal industry e-business such as Shanghai coal trading network, China's coal enterprises online, China Coal Information Network, China's coal sales network, Chinese coal digital market, are all coal e-business trading platforms, which are primarily engaged in coal trading, and do not support the raw material trading.

Integrated Coal Trading Systems

Refer to that coal mining enterprises, coal washing and processing enterprises, coal-user enterprises carrying out collaborative e-business, fully realizing networking of information flow, capital flow, logistics. Take coal mining companies and coal washing and processing business e-business system as basis, e-business system between coal washing and processing enterprises and large coal-user enterprises to as a key, link the two business processes together and become an integrated comprehensive coal trading system. Because of the special nature of the coal industry, if it is not a mine-based coal preparation plant, coal mining enterprises and coal washing and processing enterprises often do not belong to the same interest group and management system, part of which still need to mediate the relationship between the Mining Bureau. In the direct sales of coal to coal-user enterprises, coal washing and processing enterprises on the one hand need to coordinate coal distribution agreement with the transport department, on the one hand coordinate the relationship with coal mining companies, therefore, the original simple business becomes complicated, E-business has also lost its original meaning. Similarly, the coal mining enterprises also need to coordinate the relationship with the coal washing and processing enterprises and the transport department, so that the efficiency of the entire process is not different from before the implementation of e-business, which is to the contradictory of e-business' purpose of streamlining business processes, and maximizing the cost reduction. As a result, an independent coal trading platform loses its original meaning and attraction, and there is no much effect of the competitiveness in increasing enterprises. Its implementation only reduces the intermediate link of the coal distribution companies, does not organically integrate the entire business processes together, therefore, also need to develop an integrated coal trading system, to also integrate the business processes of coal mining enterprises and coal production enterprises together, take coal washing and processing enterprises as a coal mining companies' downstream businesses. After integration, whether in logistics, or in capital flows, it will bring with high economic returns to both parties. From coal product design R & D, manufacturing, product delivery, logistics and distribution,

financial processing, and even the final outcome evaluation, all through e-business to make operations of all parties of the transaction synchronize. At this level of coal e-business, the coal enterprises not only can design online catalog and receive online orders, but also can make corresponding transaction processing and daily operations to the online orders. This program provides not only the receptionist customer service functions to guide customers for information query and order in this enterprise web site, but also provides the appropriate background processing functions, so that combines corporate on-line catalog management, order processing and enterprise inside database operations together, automatically processes and completes settlement, tax calculation, statistical analysis and other integrated treatment of transaction information.

IV. Cost/benefit Analysis of the E-business between Coal Supply Chain Members

Coal e-business system constructions need to purchase computer hardware and software devices, network equipment, and there are bound to be cost issues in conducting system testing and training. Compared with other trading methods, the cost of e-business activity has early stage characteristics in input: before e-business activity is carried out, need to invest substantial resources to prepare for in advance, such as training personnel, purchasing or developing software, installing hardware, and so on, are all put in before operation of e-business, and it accounts for a considerable proportion in the total cost of e-business; the cost of e-business system is easy to quantify, such as personnel training costs, software purchase expenses, communication costs, research and development expenses. However, in addition to the direct benefits available from quantitative analysis, the benefits of e-business systems have some indirect benefits which are difficult to estimate in quantitative methods. They in general can only be obtained through a subjective analysis and comparison, and can not be estimated completely accurate as calculated costs.

The cost of coal e-business systems, same as e-business projects in other industries, consists of the following cost items: hardware costs, including computers and related equipment, etc.; software costs, generally consists of two parts: the initial software development costs or purchase costs and the software improvement and maintenance costs in the using process, the size of software costs depends on the application level of coal e-business systems, the higher is the application level, the higher is expenditure on software costs; electronic charges, referred to the cost for which companies use credit cards and electronic checks, the second and third level of coal enterprise e-business applications will result in cost of this item; communication costs, refer to the costs of electronic communications and transmission between mining companies and coal washing and processing

enterprises, coal washing and processing enterprises and coal customers, including network access charges and network service charges; training costs, in the implementation of e-business need system application training to enterprise personnel and customer enterprise personnel, so the training costs is bound to happen; labor costs, the implementation of e-business, need to input e-business professionals, when calculating the project costs, expenditure required for hiring e-business professionals need to be included in labor costs; external support costs, coal enterprises' implementation of e-business, need to hire consultants to assist in determining the strategy of e-business development, consulting fees are necessary costs to build e-business systems.

The economic benefits of coal e-business systems, include two kinds, direct benefits and indirect benefits: direct benefits are the monetary value obtained through e-business activities, which can be dealt with quantitative analysis, and are mainly reflected through the decrease to various operating costs of companies, from the measurement method aspect, comparisons can be carried out between the various indicators before and after the enterprises adopt e-business, according to statistics data, including the reduction of management costs, reduction of inventory costs, reduction of purchasing cost, reduction of transaction costs, reduction of sales expansion and time cost. Indirect benefits refer to an enterprise's benefits, or reduction of the adverse factors in a broader sense, such as better customer relationship management, promoting the development of the information economy and the value-addition of the entire society, the formation of corporate culture and so on.

V. Strategic Model for the Supply Chain Members involved in Coal E-business

According to the analysis above, establish a set of coal e-business participants $N=\{1, 2, 3\}$, 1 stands for coal mining enterprises, two stands for coal washing and processing enterprises, and 3 stands for the coal-user enterprises; participants have the same strategy set

$S_1=S_2=S_3=\{A, B, C\}$, A stands for only creating static website, B stands for building an independent coal trading platform, C stands for building an integrated coal trading system; for the strategy combination $s=(s_1, s_2, s_3)$,

If $s_1=A$, enterprise e-business benefits are only indirect benefits, the cost is only a static website construction cost, enterprise e-business revenue = Benefit - Cost ≈ 0

If $s_1=B$, enterprise e-business benefits are direct benefits, denoted as M_i , business e-business cost is the cost of building and managing an independent trading platform for the coal, denoted as C_i , enterprise e-business revenue =

$M_i - C_i$; for coal washing and processing enterprises, if only building a coal mining - coal procurement trading platform, then $0 < \text{washing and processing enterprise e-business benefits} < M_i$, for which this article takes value $M_i/2$. As the fixed investment of building a separate raw coal procurement platform and building a coal sales platform can be reused, the cost of building the platform is still valued for C_i , washing and processing enterprises e-business revenue = $M_i/2 - C_i$

If $s_1=C$, E-business benefits are direct benefits, denoted as M'_i , and the enterprise e-business cost is the cost of building and managing an integrated trading platform for coal, denoted as C'_i , the enterprise e-business revenue = $M'_i - C'_i$; according to analysis of this paper,

$M'_i - C'_i > M_i - C_i$; for coal washing and processing enterprises, if only coal mining enterprises or coal-user enterprises are upgraded to integrated coal trading platform, $0 < \text{washing and processing enterprise e-business benefits} < M'_i$, for which this article values $M'_i/2 + M_i/2$, the cost of building a platform is still valued for C'_i , washing and processing enterprises e-business revenue =

$M'_i/2 + M_i/2 - C'_i$
Strategic model for the supply chain members involved in coal e-business:

$$G = \langle N, S_1, S_2, S_3, u_1, u_2 \rangle \tag{1}$$

u_1 is the revenue function of coal mining establishment enterprise:

$$u_1(s_1, s_2, s_3) = \begin{cases} 0 & s_1 = A, s_2 \in S, s_3 \in S \\ -C_1 & s_1 = B, s_2 = A, s_3 \in S \\ M_i - C_i & s_1 = B, s_2 = B, s_3 \in S \\ M_i - C_i & s_1 = B, s_2 = C, s_3 \in S \\ -C_1 & s_1 = C, s_2 = A, s_3 \in S \\ M_i - C'_i & s_1 = C, s_2 = B, s_3 \in S \\ M_i - C'_i & s_1 = C, s_2 = C, s_3 \neq C \\ M'_i - C'_i & s_1 = C, s_2 = C, s_3 = C \end{cases}$$

u_2 is the revenue function of coal washing and rocessing enterprises:

$$u_2(s_1, s_2, s_3) =$$

0	$s_1 \in S, s_2 = A, s_3 \in S$
$-C_2$	$s_1 = A, s_2 = B, s_3 = A$
$M_2/2 - C_2$	$s_1 = A, s_2 = B, s_3 \neq A$
$M_2/2 - C_2$	$s_1 \neq A, s_2 = B, s_3 = A$
$M_2 - C_2$	$s_1 = B, s_2 = B, s_3 \neq A$
$M_2 - C_2$	$s_1 = C, s_2 = B, s_3 = B$
$M_2 - C_2$	$s_1 = C, s_2 = B, s_3 = C$
$-C_2'$	$s_1 = A, s_2 = C, s_3 = A$
$M_2/2 - C_2'$	$s_1 = A, s_2 = C, s_3 = B$
$M_2'/2 - C_2'$	$s_1 = A, s_2 = C, s_3 = C$
$M_2/2 - C_2'$	$s_1 = B, s_2 = C, s_3 = A$
$M_2 - C_2'$	$s_1 = B, s_2 = C, s_3 = B$
$M_2/2 + M_2'/2 - C_2'$	$s_1 = B, s_2 = C, s_3 = C$
$M_2/2 - C_2'$	$s_1 = C, s_2 = C, s_3 = A$
$M_2/2 + M_2'/2 - C_2'$	$s_1 = C, s_2 = C, s_3 = B$
$M_2' - C_2'$	$s_1 = C, s_2 = C, s_3 = C$

The Conclusion

Nash equilibrium of

$$G = \langle N, S_1, S_2, S_3, u_1, u_2 \rangle \quad (2)$$

is

$$s_i^* \in \max_{s_i \in S_i} u_i(s_i, s_{-i}) \quad (3)$$

Here s_i stands for the participants strategy combination apart from participant.

From coal mining business e-business revenue function u_1 and coal washing and processing enterprises revenue function u_2 ,

Get $\{C, C, C\} =$

$$\max_{s_i \in S_i} u_1(s_1, s_2, s_3) \cap \max_{s_i \in S_i} u_2(s_1, s_2, s_3) \quad (4)$$

The solution process of Nash equilibrium of $G = \langle N, S_1, S_2, S_3, u_1, u_2 \rangle$ shows that:

In order to achieve the maximum revenue of coal e-business, that is, $\max u_1$ 、 $\max u_2$, where does not to discuss the user enterprises e-business revenue (e-business user enterprises revenue cost-benefits involved in features of different industries, which this article does not discuss), must achieve the strategy (C, C, C), this strategy is the Nash equilibrium solution of the game model between coal mining enterprises, coal washing and processing enterprises, and users enterprises, which requires the establishment of the enterprises alliance of coal mining enterprises - coal washing and processing enterprises - coal users enterprise, take the first B2B (between coal mining enterprises and coal processing enterprises) as a basis, take the second B2B (coal washing and processing enterprises and large-scale coal-user enterprises, such as iron and steel enterprises) as the focus, link up the two business processes and become a new model

after being integrated. Jump out of the logistics approach of Producers - Coal Transportation and Marketing Corporation (or other intermediaries) – Coal-user enterprise, directly deliver the coal into the hands of coal users, make merchants directly face to merchants, reducing unnecessary intermediate links, and thus regain most of the profits of coal products that are wringed out in intermediate links, new business alliance will must have the interests distribution issue and alliances risks, which will be discussed in the follow-up studies.

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