Establishing Business Collaboration between Contractors and Developers Based on Management Information System

ETABLISSEMENT DE LA COLLABORATION COMMERCIALE ENTRE LES ENTREPRENEURS ET LES EXPLOITANTS SUR LA BASE DU SYSTEME D'INFORMATION DE MANAGEMENT

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Abstract: The relationship between developers and contractors can change to a strategic business collaboration based on Management Information System (MIS). The purpose of this paper is to show how to establish this strategic collaboration through an efficient information circulating mode based on MIS. The paper interprets the extent and the importance of information in projects, and puts forward a collaboration mode of information circulating. This mode is feasible taking into consideration both the technological and economic aspects. The strategic business collaboration could help contractors and developers reduce project costs and increase competence. As a result of the study, the conceptual model of the collaboration mode through Internet and MIS is presented.
Key words: business collaboration, construction industry, Management Information System (MIS)

Résumé: La relation entre les exploitants et entrepreneurs peut se changer en collaboration commerciale stratégique basée sur le Système d'Information de Management(SIM). Cet essai vise à démontrer comment établir cette collaboration stratégique par un mode de circulation efficace des informations fondé sur le SIM. L'article interprère l'ampleur et l'importance des informations dans les projets, et met en avance un mode de collaboration de la circulation des informations. Prenant en considération les aspects technologique et économique, ce mode est faisable. La collaboration commerciale stratégique pourrait aider les entrepreneurs et exploitants à réduire le coût du projet et élever la compétence. Comme le résultat de l'étude, le modèle de conception du mode de collaboration par Internet et SIM est présenté.
Mots-Clés: collaboration commerciale, industrie de construction, Système d'Information de Management (SIM)

1. INTRODUCTION

Since the 1980s, many scholars have concentrated on the study of how to apply information technology in project management as a tool in order to improve the coordination and the management of projects. The aim of their researches is to make projects more efficient and achieve better quality, through integrating data sharing, decision making, and specialist knowledge.

Based on these researches, this paper focuses on how to establish the collaboration mode of exchanging information and sharing data based on Management Information System (MIS) between developers and contractors, in order to build strategic business collaboration.

First of all, the various kinds of information needed in project management are listed and the importance of information management is shown through results of an investigation. Secondly, the traditional mode and the new mode of information circulating are illustrated, followed by the collaboration mode based on MIS which is suggested by this paper. Then the strategic business collaboration based on this mode is interpreted.

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As a result, a conceptual model of the collaboration mode is established. In the discussion part challenges for domestic developers and contractors are presented and solutions are given.

2. INFORMATION IN PROJECT MANAGEMENT

2.1 Information in project management

Information plays an important role in project management. It can be divided into two classifications: (1) spatial data information, such as locations of buildings and underground line layouts, (2) attribute data information corresponding to the spatial data, such as structure types of buildings, contracts and costs. The attribute data information includes four subcategories: (1) information about construction status, (2) information about the construction process, (3) data analyses, (4) orders and decisions, and (5) other relevant information, such as the market, climate, and policy.

Another useful kind of information is data from past projects. These data may be stored in the database and are very helpful in project planning, control, feedback and decision making.

2.2 The importance of project information management

In an investigation of BRICSNET, over the past ten years, 3%-5% of construction costs were due to information faults, with 80% faults coming from using wrong or expired construction drawings. The investigation showed that express mail costs were about 500,000,000 dollars each year in America for sending only documents and drawings of engineering projects. Daily printing, copying and faxing accounted for 1%-2% of the total project costs.

The investigation showed that 35% of paperwork for both contractors and developers was useless paperwork when the project was completed.

The above investigation results proved that the developers and the contractors should make good use of information technology in project information management because of the huge increase in the amount of information. They should pay special attention to their information circulating modes, in order to cut down project costs.

3. BUSINESS COLLABORATION BASED ON EFFICIENT INFORMATION CURCULATING

This section is divided into two parts. In the first part an efficient information circulating mode is suggested. In the second part the business collaboration between developers and contractors, based on this efficient information circulating mode, is interpreted.

3.1 Information circulating modes

A project involves various cooperators. There are developers, contractors, architecture design institutes, suppliers and customers. Enormous information needs to be exchanged and shared among them on a timely basis and accurately. Otherwise, the project would not be completed on schedule and costs would rise beyond the budget.

Nowadays, there are many enterprises still following the traditional mode, and some are beginning to use the new mode based on the information technology (IT) and the World Wide Web (WWW).

3.1.1 The traditional mode

In the traditional mode, there is a lot of information exchanged by telephone or by fax as people exchanged information twenty years ago. Although some data are stored in computers, data formats have to be transformed according to the users' needs when using them. This mode would possibly lead to distortion and loss of information.

3.1.2 The new mode based on IT and WWW

R. E. Johnson investigated the applications of information technology, such as the Internet and other new technologies related to the Internet, in project information transmission. It was found that information technology could help enterprises solve problems arising in the traditional mode. He mentioned several solutions including e-mail, databases, the Internet and the Local Area Network (LAN).

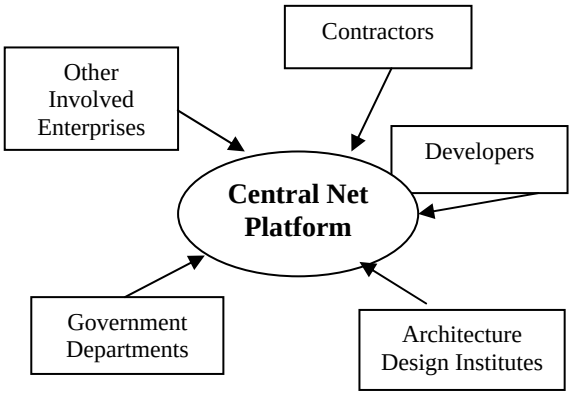

Figure 1: The New Mode Based on IT and WWW

In Figure 1, the new mode based on IT and WWW is illustrated. Here the Central Net Platform means the Internet or the intranet. This mode can be established through different technologies and permits enterprises to choose different systems. The common characteristic

of them is that the Internet, or the intranet, functions in a platform-like way through which project control data and information are exchanged.

Compared with the traditional mode, the new mode could improve the efficiency of information exchange, and promote the project information management.

3.1.3 The collaboration mode based on MIS

This mode may be taken as an improvement to the new mode mentioned above, and internet technology is applied in both of them. The difference between these two modes is that the collaboration mode emphasizes a long-term relationship of information circulating and data sharing between developers and contractors.

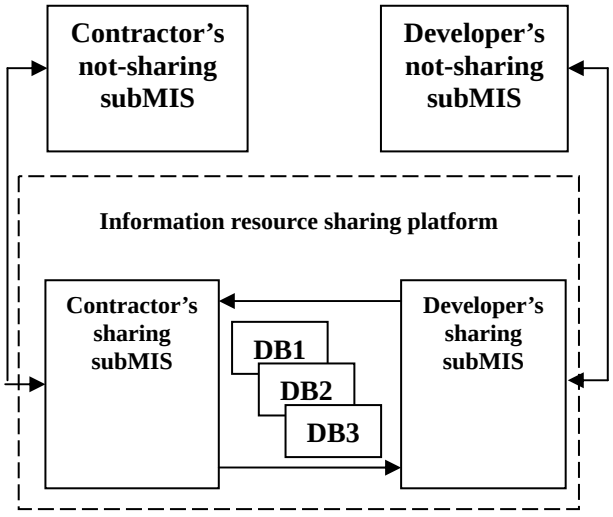

Figure 2: The Collaboration Mode Based on MIS

Developers and contractors are closely linked with each other in the supply chain of the construction industry. It is hard for developers and contractors to become strategic cooperators. However, the collaboration mode of information sharing would help them establish a strategic relationship.

In Figure 2, the collaboration mode is illustrated. Contractors and developers share several databases, and connect some of their management information subsystems to an information resource sharing platform. This platform supports queries and allows access to various kinds of databases.

This collaboration mode will not only use information technology to bring different participators of a project into an efficient information exchange environment, but also enable participators to improve their co-operation. That is a great advantage of the collaboration mode over the new mode. This is mainly because the new mode emphasizes real time information exchange, while the collaboration mode makes full use of information sharing to promote project management.

A. 3.2 Business collaboration between developers and contractors

The collaboration mode based on MIS does not only mean an improved mode for exchanging information and sharing data, but also a solution to establishing a strategic collaboration.

Today, global competition is changing from competition between companies to competition between supply chains. Companies need to choose their strategic cooperators, who may be their suppliers or customers. In the construction industry, developers and contractors could establish their strategic relationship more efficiently through this information sharing mode. This mode facilitates a long-term cooperation, and promotes on-time project management.

4. FEASIBILITY AND THE CONCEPTUAL MODEL

4.1 Feasibility of the collaboration mode

4.1.1 Technology aspect

There are three advantages to the establishment of the collaboration mode.

(1) The speed of computer hardware technology builds a solid hardware foundation. The hardware configurations may include network integration servers, system management servers, PC workstations, high speed exchangers, multiprotocol routers, coaxial cables and the shield twisted pair.

(2) The computer software systems are being increasingly perfected. This provides stable functioning for support platform with an operating system such as WINDOWSNT, NETWARE4.1, UNIX, or OS/2.

(3) The computer network technology, which takes the Internet and the intranet as the developmental direction, creates a good application environment. The wiring system could adopt the structure cable system combining fast Ethernet with switched network.

Because of these advantages, the collaboration mode based on MIS is feasible.

4.1.2 Economic aspect

The evaluation of the economic feasibility needs to analyse the investment and the return, from both the short-term run and the long-term run.

(1) The short-term advantages

The collaboration mode could help contractors reduce their database costs, and bidding fees if they establish a strategic relationship with developers. On-time communication with developers may cut down the reworking costs of the project.

For the developers, the collaboration mode could help them inspect the whole project process and the material purchase on-time, which means project costs could be reduced and fraud could be almost avoided.

(2) The long-term advantages

The collaboration between developers and contractors could increase their bargaining power in the supply chain of the construction industry, and enhance their competitive advantage.

4.2 Successful examples

There are lots of successful applications all over the world. For example, in Japan, there is the construction CALS/EC. CA (Continuous Acquisition) = Continuously Improving Process of Acquisition. LS (Lifecycle Support) = Lifecycle Support with Information. EC= Electronic Commerce. All the information in the project lifecycle is stored in databases, shared and reused. This meets the requirements of cost reduction, quality increase and competence promotion.

In Hong Kong, there are general-purpose standardized digital information infrastructures, which facilitate the communication of enterprises in the construction industry digitally. Enterprises use the Internet and computers to collect and exchange projects data. The management of engineering drawings, data and blueprint inspection is done electronically. Other successful applications include using digital cameras to realize dynamic management at construction sites and cameras allow green card certification for personnel management at construction sites.

4.3 The conceptual model of the collaboration mode

The collaboration mode requires both developers and contractors to have an open network integrated management information system. There are two main lines for their MIS.

(1) The project resource control system. This emphasizes the construction project process, including computer-aided design (CAD), project cost and budget, project management, construction plan management, operation management, project cost accounting, construction material management, quality management and safety management.

(2) The management control system. This emphasizes enterprise integrated information management, including aided decision support, office management, office automation, computerized accounting system, personnel management and construction technical data management.

4.3.1 The conceptual model of contractors' MIS

Besides the system type and the basic structure mentioned above, one of the key elements to consider in the model design is the subsystems division.

In the conceptual model, contractors' MIS includes ten subsystems, and they are divided into two groups: sharing and not-sharing (Table 1).

The other key element is the system structure. The contractors' MIS should include four application platforms.

(1) Information resources management platform. It uses Intranet/Web technology, Browser/Server application software, and has a completely open dynamic multimedia system as the basic structure. This platform connects to developers' MIS.

(2) Transaction processing platform. It uses Client/Server structure, has powerful word and data processing function, supports distribution information processing, and has many kinds of prediction analysis and aided decision functions.

(3) Communication, transmission and workflow management platform. It is an information transmission service system, which integrates e-mails, work reports, and sharing documents. It issues information, tracks information flow and collects feedback.

(4) Network application supporting platform. It has the TCP/IP as the network communication protocol and is built up by network servers and communication equipment.

The four platforms above form the MIS of contractors.

Table 1: Subsystems of contractors' MIS

Sharing	• CAD system • Project management system • Construction material management system • Construction data management system
Not-Sharing	• Cost and budget system • Cost management system • Aided decision and administration management system • Accounting system • Personnel management system • Computer network management service system

4.3.2 The conceptual model of developers' MIS

Developers have the same type of system as contractors, and the same main lines of MIS mentioned in the earlier parts of this section.

The subsystems of developers' MIS are divided into two groups, as shown in Table 2.

Developers' MIS includes databases storing various useful kinds of project data, which are listed in section 2. Contractors are able to access to the databases with proper authorization through a customer interface service system.

Table 2: Subsystems of developers' MIS

Sharing	• Project management system • Quality control system • Processing control system
Not-Sharing	• Investment control system • Contract management system • Document management system • Decision supporting system • Operation information processing system

The sharing subsystems of developers' MIS and contractors' MIS together form the information resource sharing platform, as shown in Figure 2.

After presenting the conceptual model of the collaboration mode establishment, the next section will discuss the challenges facing Chinese enterprises and suggest some solutions.

5. CHALLENGES AND SOLUTIONS

5.1 The current situation of IT application in contractors and developers in China

First of all, computers and software tools are used in a certain range, mainly to improve efficiency. They are applied in calculating operations and auxiliary management, such as the office automation system, the bidding system, the engineering calculating system, and the project management system.

Secondly, auto-control technology based on IT has been applied and popularized, which had a satisfying result. There are mass concrete construction quality control, high-rise buildings verticality control, and ready-mixed concrete loading auto-control. The technology is applied in the production of the curtain wall, building subsidence observation, engineering measurement, and construction materials testing data collection.

In brief, the overall level of IT application in Chinese contractors and developers is not high and there exist conspicuous limitations and deficiencies. This can be seen from the following observations:

(1) The range of IT application is limited, and is found mainly in the early phase of a project, such as the bidding, the construction costs budgeting, and the construction organization design. There are a few applications in the construction process, such as schedule control, quality control and costs control.

(2) Unconnected PC version software is more popular than network version. This leads to poor information sharing and low efficiency.

(3) Many enterprises have not made full use of the Internet. The online materials procurement, online bidding, and e-business have not boomed yet.

5.2 Solutions to establish the collaboration mode based on MIS

Establishing the collaboration mode needs efforts from various parties and companies.

5.2.1 Merging small contractors together or with big contractors

In China, only big contractors have their MIS. There are many small contractors who never consider MIS. In order to collect adequate data during the process of a project, it requires both the general contractor and the subcontractors to have their own MIS or Enterprise Resource Planning (ERP). It is not easy for small contractors to complete this goal. Therefore, amalgamating small contractors with big ones is the basic condition needed to establish the collaboration mode based on MIS.

5.2.2 Popularizing MIS based on the Internet in the entire project process

The collaboration mode means that the information sharing platforms and office automation systems, which are based on the Internet, are applied throughout the entire process of projects.

A project has various participants. Sometimes projects even involve foreign companies. This situation requires those participants such as the architect design institutes, developers, contractors and construction material suppliers to all have office automation systems at least, and MIS based on the Internet for better communication. This would promote data collecting and information circulating.

5.2.3 Developing auxiliary systems

Developing auxiliary systems means developing computer aided project management and process control software. They mainly concentrate on the three control elements in project management, which are the process, quality and cost.

6. CONCLUSIONS

Concluding from the above sections, the following can be stated:

— Developers and contractors could establish a strategic business collaboration based on MIS in order to enhance their competence.

— The collaboration mode of information circulating is feasible considering both the technological aspect and the economic aspect.

— Domestic enterprises have realized the importance of MIS application and applied computer

aided management, but still there is much room for improvement.

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