An Approach of One-item-multiple-code for Logistics Management in International Power Generation EPC Projects

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ABSTRACT

Engineering-Procurement-Construction project type is widely used in the industry of power generation development, and logistics management has been playing an important role in the execution of especially international power generation projects. Logistics in the area of power generation industry can be a very complicated system, typically involving many subcontractors related to logistical activities, requiring countless operations to be completed as well as deals with numerous interfaces between neighboring operations. With the objective of efficient and effective management and control of the whole logistics process, the paper proposes a "one-item-multiple-code" approach to realize the transparency and traceability of logistics management.

1. INTRODUCTION

EPC (Engineering-Procurement-Construction) contract type is a widely used in the field of construction, civil engineering, plant engineering. In EPC projects, an EPC contractor has sole responsibility for project cost, quality and schedule [1]. In a deepening economic globalization where power generation EPC project business expands across the globe, it is necessary for an EPC contractor to take full advantage of goods and resources over a global scale concerning cost, quality and schedule. Thus, a highly efficient logistics system is a prerequisite for the success of an EPC project, as the movement of materials and engineered equipment to the right place, on time, in good condition and with verifiable information is critical for the project progress, cost as well as quality. As such, a special attention is given to logistics aspect of EPC projects as an EPC contractor is essentially playing a decisive role in coordinating various involved subcontractors which provide services and supervising over freight transport with continuous consideration of project objectives which are cost, schedule and quality in general[2].

Generally speaking, logistics activities in the scope of EPC contractors' duties start from workshops through to on-site fields, which include picking, receiving, load & unload, transportation, inspection, warehousing, inventory, stocktaking, stock-in/out and so forth. The objective is to transport and deliver, by sea, by air or by truck or by means of any two or three of which, a huge volume of commodities and equipment to the destination where the project is built or any place designated by the receiving contractor in support of agreed project schedule. Meanwhile, the process is accompanied by creation and maintenance of accurate information with regard to logistics operations and associated documentations for imports/exports use. The whole logistics process typically involves many a subcontractor, requires countless operations to be completed as well as deals with numerous interfaces between contiguous operations, hence, it is necessary for an EPC contractor to monitor each operation of all parts of the system in real time to ensure the track and trace of shipment status. As such, the paper aims to propose a "one-item-multiple-code" approach for logistics management in international power generation EPC projects which are built throughout the world.

2. ORIGINS OF ONE-ITEM-MULTIPLE-CODE APPROACH

It is assumed that the vivid impression of the relation between "item" and "code" mostly comes from that of "goods" and "barcode" in shopping malls or supermarkets. By scanning barcodes through an optical scanner

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machine, it is possible to access and trace detailed information regarding a specific product item, including price, origin and component etc. In this way, it provides a basis for the system of "one-item-single-code" which is a commodity product corresponding to a barcode in an identification coding system.

Similarly, the proposed "one-item-multiple-code" is referred to as one item to which various codes have been assigned. Nevertheless, these codes are not equal in ranking or attributes: some codes (numbers) are used for a global scope in terms of overall logistics process while others are simply for a local scope. It must be emphasized that despite a lot of codes assigned to one item, one code is unique and fundamental, that is KKS code (plant identification system code).

To plan, set up and operate power plants, KKS (the abbreviation of Kraftwerk-Kennzeichensystem) code was established in Germany in 1970s and 4th edition was published in 1995 as a common language to all sectors of power plants, such as engineering, construction, operation and maintenance[3]. It is a standardized identification system used to identify all systems, subsystems, components and structures of power plants with a permutation and combination of numbers and alphabets according to designation rules. With KKS application, it forms a uniform designation database to describe power plants on the same angle for the effective management (classification, search, query, statistics, *etc.*). KKS is by far the most successful and widely-used equipment numbering system and is adopted by an increasing number of power plant clients, and its application is even made mandatory.

To adopt KKS code as a basis of identification system for items, all modules of various disciplines from all aspects of power plant system have a unified link throughout stages from design, procurement, manufacture, inspection, transportation, installation, testing, commissioning till operation, even the warranty period where spare parts are used. Whatever aspect of one item is searched at whatever stage, KKS code should emerge as a core number at fundamental level.

It can be said that KKS code serves as an ID number of items. The relationship of KKS between other codes is that of personal ID between certificate numbers. Analogically, each person will obtain papers of all kinds in societal activities, such as diplomas stating a complete study of one course in school, passports certifying the holder's identity and citizenship while going abroad, a driving license after passing the driving test, a company ID card when joining a company. Each paper will surely bear an individual number through which one can find and access detailed information as to the content the paper specifies. All these seemingly discrete numbers in various code formats, however, have one thing in common, that is personal ID as a core element to which these numbers are unexceptionally connected.

3. ADVANTAGES OF ONE-ITEM-MULTIPLE-CODE

The advantage of implementation of one-item-single-code is to condense and simplify the item information, whereas the biggest drawback is not suitable to carry out actual operations in the area of as complex as international power plant projects. The overall process of international power generation project is so complicated that it involves numerous operations conducted by participating operators from different subcontractors concerned, such as material and equipment suppliers, dock agencies, freight forwarders, logistics companies, customs brokers as well as project clients[4]. The focuses of these involved parties differ from one and another. They each need a code with which they are familiar within their specialty to finish their work. Therefore, it would be unnecessary to present all the information, by the use of one-item-single-code approach, to all parties, which would very likely cause tremendous difficulty in finding useful information, thereby resulting in a decrease in the efficiency of work and performance.

In order to overcome the above-mentioned problems brought about by one-item-single-code approach, this paper proposes one-item-multiple code approach. The purpose of this approach is two-folded. One is to reduce the information density of item data which participating subcontractors are concerned with and held responsible for. The item data can usually be regulated and presented according to rules of pre-defined coding systems which are different from each other given different aspects of an EPC project. For example, designers focus on drawing numbers and KKS codes which are related to items on an engineering drawing. The logistics employees emphasize on shipment numbers, customs declaration numbers, and the on-site workers are concerned with packing list numbers, inventory numbers *etc*. Suppliers can create and define clarification number within the scope of their own business for the purpose of internal management. For instance, boiler plant or steam turbine plant has respectively plant-level numbering system for effective internal control. As far as an EPC contractor is concerned,

KKS is the only identification number to connect all the subcontractors to the project client and more importantly, it certainly falls in the sole responsibility of EPC to ensure the consistency and unification of relevant codes associated with KKS.

The second advantage of adopting "one-item-multiple-code" is to enhance the supervision of the operation interface. Logistics in the area of power generation industry typically involves many participants, requires countless operations to be completed as well as deals with numerous interfaces. The quality of each operation in the process relies heavily on two factors: (1) the current operation done by the responsible party, (2) the degree of completeness of operations done previously. Thus, to efficiently trace and distinctively identity specific operation along the logistics process, a code/number must be assigned to an operation which, to an EPC contractor's judgment, needs documented in view of its significance or the requirements of a contract. With this, it is then possible to keep track on every operation of every aspect without omission.

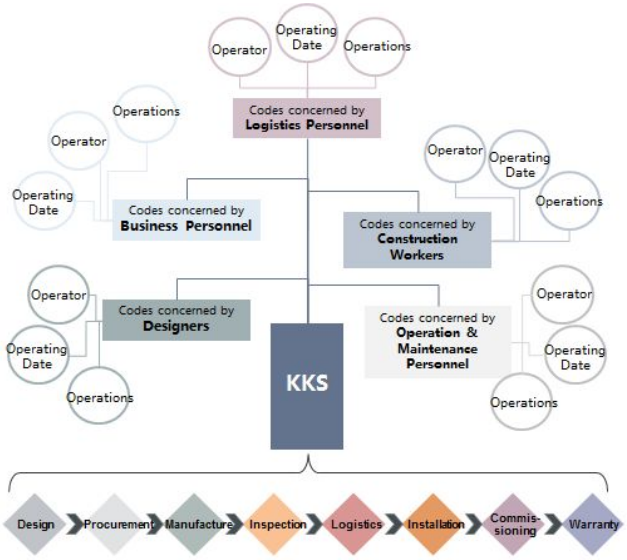


Figure 1. One-item-multiple-code & KKS in numbering system of power plant.

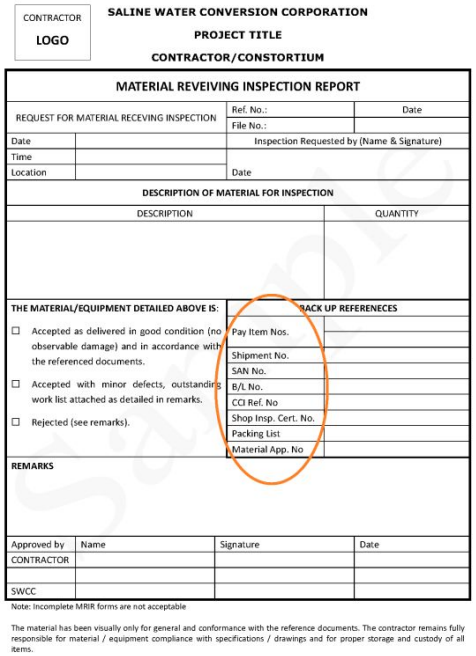
Figure 1 is a schematic diagram explaining the idea of "one-item-multiple-code" approach. As shown in the figure, KKS is linked to all stages of the flow of items in a project. On the basis of KKS, different codes derive from operations by different subcontractors. In addition, information on particular operation can be traced by using the codes (numbers).

4. Application and Forms

Logistics management in EPC projects includes an area of activities along the process covering from supply packaging to the inventory management on the project site. The "one-item-multiple-code" approach is to be embedded to each business interface and operation throughout all logistics activities. Consequently, the process and result of logistics operations reflects on the forms of various kinds which are designed and managed by EPC contractors. The management of EPC projects should be characterized by form-standardization to unify the general requirements of logistics operations at different levels. Using the project-oriented customized forms and filling notes, an EPC contractor is able to have a tool to ensure the timeliness and quality of delivery service, packing compliance, and operation procedures. The management of a project is manifested by the means of form so that an operation which is qualitative or hard to be quantified is made controllable [5].

In other words, what elements a form consist of and the way it is filled out depict the operational requirements imposed by EPC contractors on each and every operation to be conducted by a subcontractor concerned. It also ensures the overall coordination which is sole responsibility of an EPC contractor. The result of business operation, to a large extent, reflects on the quality and completeness of form fill-out. Meanwhile, each form has been designated to a corresponding reference number or code. A collection of various numbers included in the final

summary reflects the flow and storage of goods. On the other hand, specific information of a logistics operation can be tracked back by the use of a particular number. Thus, this realizes the logistics-process-oriented "one-item-multiple-code" approach.



CONTRACTOR LOGO

SALINE WATER CONVERSION CORPORATION

PROJECT TITLE

CONTRACTOR/CONSTORTIUM

MATERIAL REVEIVING INSPECTION REPORT

REQUEST FOR MATERIAL RECEVING INSPECTION		Ref. No.:	Date
		File No.:	
Date		Inspection Requested by (Name & Signature)	
Time			
Location		Date	

DESCRIPTION OF MATERIAL FOR INSPECTION

DESCRIPTION	QUANTITY

THE MATERIAL/EQUIPMENT DETAILED ABOVE IS:	BACK UP REFERENECES	
☐ Accepted as delivered in good condition (no observable damage) and in accordance with the referenced documents.	Pay Item Nos.	
	Shipment No.	
☐ Accepted with minor defects, outstanding work list attached as detailed in remarks.	SAN No.	
	B/L No.	
☐ Rejected (see remarks).	CCI Ref. No	
	Shop Insp. Cert. No.	
	Packing List	
	Material App. No	

REMARKS

Approved by	Name	Signature	Date
CONTRACTOR			
SWCC			

Note: Incomplete MRIR forms are not acceptable

The material has been visually only for general and conformance with the reference documents. The contractor remains fully responsible for material / equipment compliance with specifications / drawings and for proper storage and custody of all items.

Figure 2. Sample form of one-item-multiple-code.

Figure 2 shows a sample form "material receiving inspection table" used in a Middle East project which under the column of "BACK UP REFERENCES" constitutes eight entry numbers, namely, "Pay Item No.", "Shipment No.", "Packing List No." *etc.*, covering basically all aspects of the movements of items. More importantly, it describes the focal points an EPC contractor is in obligation to manage and control. The exhaustive set of entry numbers on the illustrated form implies that the complete path of the flow of items, and also the query on specific operational information can be tracked and traced by using codes. This indicates the basic idea of "one-item-multiple-code" for effective monitor and control of logistics activities.

5. USAGE OF IT PLATFORM

Nowadays, the obvious characteristic of international logistics management is maximization of information technology usage. The successful implementation of "one-item-multiple-code" has surely to rely on the information system. By establishing a unified system for international EPC project logistics management, an EPC contractor and all subcontractors related to logistics are able to conduct logistics operations under the same circumstances on the same platform. With different settings of the system managed by an EPC contractor, each subcontractor can be respectively granted clearance and access level. Meanwhile, operation procedures can be standardized and regulated, as can the information flow accompanied by operations be.

On the other hand, logistics information system serves as a container where the information created along the whole logistics process from the transportation, unload/load, warehousing, customs, and so forth can be saved and stored[6]. Logistics operations and document creation is to form a closed operational pattern, simply put, "operation incurs form, form is assigned with a code or number, with a code or number search is readily feasible, search with findings means traceable", which leads to the integration and utilization of information collected from all subcontractors by an EPC contractor. And it provides a powerful tool to improve the quality and efficiency of logistics management, and also lays a solid foundation of EPC authority in the sense that performance of product and service providers can be estimated.

6. CONCLUSION

Logistics management has a bearing on the successful implementation of an international EPC project. The proposed one-item-multiple-code approach is used to monitor and control of the overall logistics process from all aspects of a logistics system. The paper discusses the concept and characteristics of the approach and the way it is applied. Based on the approach, this paper also introduces an information system where logistics operations can be documented by electrical forms and stored in order that chain of evidence of the flow of items is preserved and secured in an organized manner for the purpose of the track and traceability of logistics operations.

However, the outcomes of applying the approach are not investigated in this paper. The future work can focus on the implications of "one-item-multiple-code" by conducting case study experiments with a quantitative analysis to better verify the proposed approach in terms of improvements on logistics management in international power generation EPC projects.

REFERENCES

[1] N. Ishii, Y. Takano and M. Muraki, "An order acceptance strategy under limited engineering man-hours for cost estimation in Engineering-Procurement-Construction projects", International Journal of Project Management, http://dx.doi.org/10.1016/j.ijproman.2013.07.009,2013.

[2] T. Chen, General Contract Project Logistics Management Development Status and Future Prospects (in Chinese), Logistics Engineering And Management, Vol.32, No.3, pp.40–42, 2010.

[3] An Overview of Full Form KKS Code in Baidu Wenku

[4] D. Kan, A Brief Discussion about International Power Plant Logistics Management in EPC Project (in Chinese), Logistics Sci-Tech, No.1, pp.101–103, 2013.

[5] Y. Li, Research on Operation Flows and Management Models of Logistics in International EPC Projects (in Chinese), Logistics Engineering And Management, Vol.33, No.2, pp.30–33, 2011.

[6] Z. Liu, Y. Yang, Analysis on International Logistics Information Development (in Chinese), Technology & Economy in Areas of Communications, No.3, pp.123–125,2011.