Modeling and Improving the Natural Resources Extraction Industry Supply Chain

The current supply chain modeling and evaluation approaches consider the raw material market as an infinite source. Therefore the supply of natural resources is more or less not included in existing models yet. An example is the well known Supply Chain Operations Reference (SCOR) model which can be considered as a quasi standard.

The limited access to natural resources and scarce resources will be an essential aspect when speaking about the reliability of supply chains. The task to guarantee a reliable access to natural resources will be a major success factor for every supply chain. This means that the early supply chain processes need to be considered in the supply chain modeling and evaluation approaches.

Available supply chain models do not cover the specific characteristics of the raw material market (e.g. SCOR: make to stock, make to order, engineer to order). Although Key Performance Indicators (KPIs) and best practices focusi on manufacturing branches, they do not on the early part of the supply chain (raw materials).

Research Problem

The natural resources extraction industry must be modeled and evaluated in each of its processes; the problem is to understand how the existing SCOR model can be extended for modeling and evaluating these processes. According to the literature, the SCOR model is focused on manufacturing industries considering the raw materials market as a black box of unlimited resources.
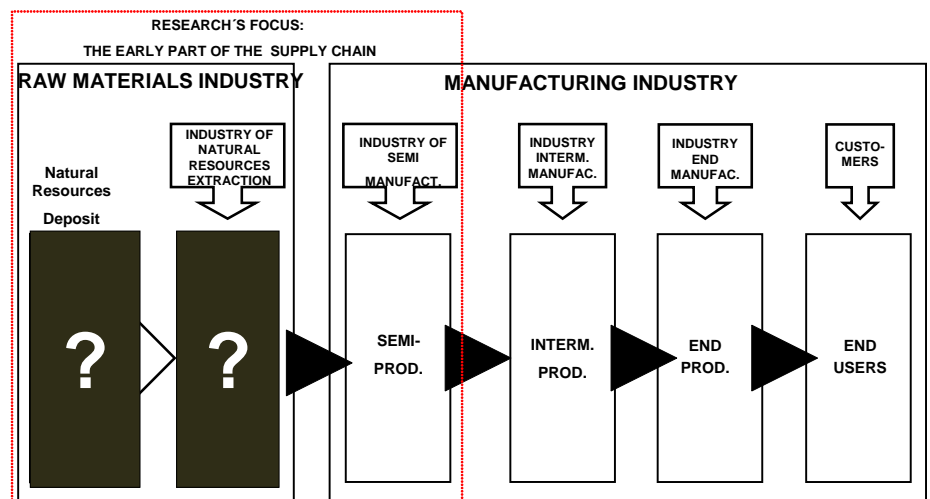

Figure 1: The Minerals Industry Supply Chain

Figure 1 depicts the whole minerals industry supply chain and shows the early part of the supply chain that will be studied in this research. The symbol "?" represents the main questions about the processes of the Natural Resources Extraction Industry.

The existing SCOR model does not capture the relevant performance issues regarding the first parts of the whole chain. Instead, it focuses on monitoring and controlling the supply of raw materials for the manufacturing industry against supporting process improvement for the natural resources extraction industry, promoting overall system optimization, and addressing the existing dynamics in this industry. Therefore, the SCOR model is not yet fully addressing the requirements of a performance measurement system for natural resources extraction industry.

The most important characteristics of the mineral raw materials market are related to the performance of the processes in the natural resources extraction industry. This industry is different from any other types of industries

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because the raw materials necessary for all following processes come from nature, instead of being purchased in the market. In consequence, the restrictions to the supply chain lie in the limitations of its natural resources. Also, the performance is restricted more by the natural resource itself rather than by market conditions. Therefore, the natural resources will change with production and will make the natural resources extraction industry's performance even more dynamic.

Figure 2 illustrates the processes of the natural resources extraction industry. As an example for these processes, the exploration process must be continuous and successful just to maintain existing production levels because the depletion is inherent in the exploitation of mineral deposits. In this way, the exploration is one of the essential processes for this industry and the entire supply chain to survive over time.

Even if the existing SCOR model does not meet all the characteristics of the processes in this industry, it has a better potential to be extended to this industry. This is because the SCOR model covers the supply chain from the supplier's supplier to the customer's customer. However, there is no research in literature on how the SCOR model can be extended to an early part of the supply chain to cover the specific characteristics of the processes in this industry. Therefore, the research problem is to identify how the SCOR model can be extended for modeling and evaluating the processes in the natural resources extraction industry.

Research Objective and Methodology

A process model as an extension of the SCOR model will be developed that describes the early supply chain processes on the raw materials supplier market (specific natural resources). The extension will cover: the process model, the performance metrics to evaluate the processes, and the best practices for the supply chain processes on raw material markets.

Methodology and procedure of this research are based on the following steps. First, different frameworks based on the SCOR model to improve the supply chain will be studied. Second, getting information about processes, metrics and best practices from the natural resources extraction industry. Third, identifying processes, performance metrics and best practices for modeling and evaluating this industry in the SCOR model. After that, the extension of the SCOR model for the early part of the supply chain will be developed. Finally, the evaluation of the extension of the SCOR model will be based on a case study (copper industry in Chile) in which the developed extended model will be applied.
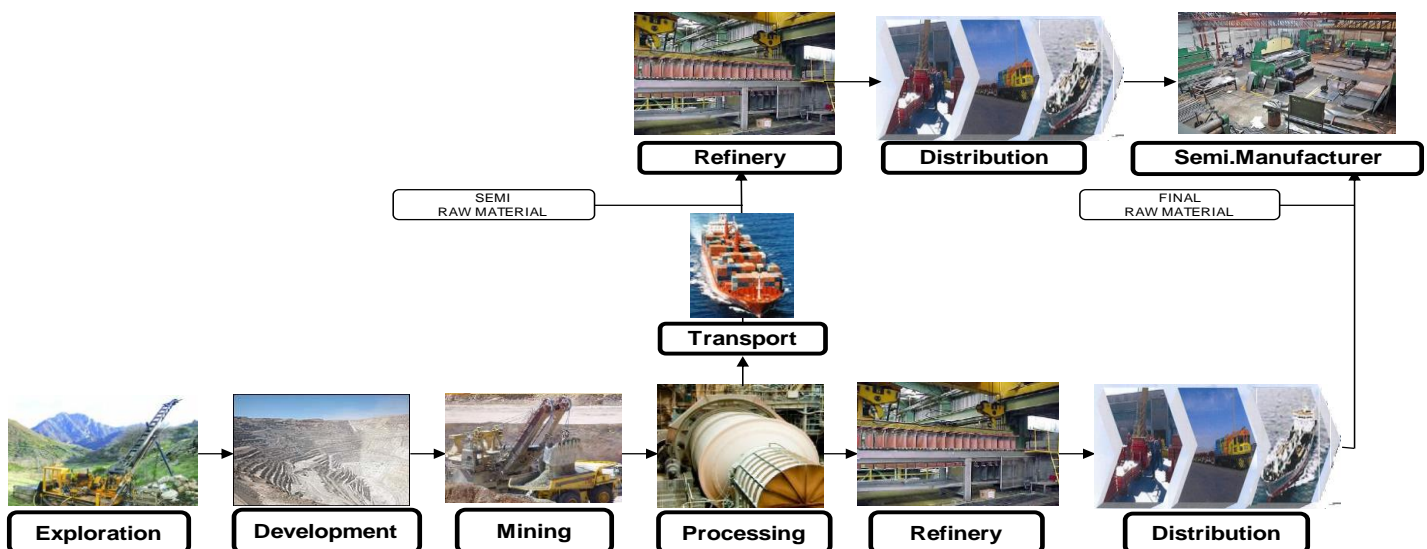

Figure 2: Processes of the Natural Resources Extraction Industry