International Journal of Mechanics and Thermodynamics.
ISSN 2278-361X Volume 4, Number 1 (2013), pp. 21-27

http://www.irphouse.com

# SCFCS: Supply Chain Factor Categorization Scheme

**Dheerendra Pratap[1] and Mr.Deepak Agrawal[2]**

*1. M.Tech (Production)*
*2. Sri Balaji College of Engg. & Technology, Benad Raod, Jaipur*

**Abstract:**

The performance of the material-procurement decisions is heavily dependent on the combination of the different alternatives associated with every phase of the materials management process and the factors or factors that influence the selection among the different alternatives for each particular decision. These factors need to be extracted on a regular basis as decisions related to material management are ever present in a construction project. The identification of factors is a task that requires more attention, since factors related to different areas, such as schedule, suppliers, among others, need to be considered. These factors can be acquired from different sources such as historical databases, the internet, and suppliers, among others. The recognition and extraction process for the factors could be tedious and time consuming because the decision maker could be extracting the information from unstructured records that contain vast amounts of data. This paper describes a framework/structured approach developed for factor categorization.

## INTRODUCTION

Currently, there is no structured model to categorize the factors that need to be considered on the supply chain decision making process particularly for small scale industry[3]. The small scale industry needs a structured database design that can allow decision makers to review and categorize these factors[5]. This categorization could facilitate the storage and categorization of the factor information for future extraction and use. As part of this research, a structured approach was defined for factor categorization only. For a more complete system design and model specification, a similar approach desires to be developed for alternatives and performance measures. This development could be the basis for future research.

Based on the information gathered through interviews with the electrical contracting industry personnel and through extensive literature reviews, a system for classifying factors for material supply chain was developed. SCFCS, an acronym for

Supply-Chain Factor Categorization Scheme, is a categorization structure for supply chain factors. The development of SCFCS begins with a hierarchical framework. This approach conforms to generally accepted methods of structured systems development. SCFCS will be the basis for future development of a relational database to share and organize factor information. In addition, the development of SCFCS could help industry in understanding how some of the particular database applications work. For example, SCFCS could give the firm an idea of how an Enterprise resource Planning (ERP) system was set up and the data that could be part of that system. In upcoming research efforts, this hierarchical framework could be developed into a relational database design[4].

For the development of SCFCS, the decision support systems (DSS) used in the materials management decision process are described as independent systems for each decision to be made. This means that each DSS extracts the information needed from a data source that contains the specific data required, in our case the SCFCS categories, to analyze that particular decision as described in Figure 1. The figure illustrates three of the decisions that are considered in the study.

The activities required for database development [1] are project identification and selection, project instigation and planning, psychoanalysis, logical design, physical design, implementation and maintenance. In the project identification and selection activity, the range and general contents of the organizational database are set. In the project initiation and planning activity, the scope of the data involved in the development project is outlined. In the analysis activity, a detailed data model is produced and all the information needed for the information system is identified. In the logical design activity, the conceptual data is transformed into relations by using ER diagrams [6].

The physical design activity involves disk allocations and physical allocations of the databases. The accomplishment activity involves testing the database with programs used by the company. The maintenance activity involves tuning the database to keep it up to date with information generated and fixing problems.

The information requirements for the application to be developed are defined, the contents of the overall database of factors are described within SCFCS, the overall data needs for the material supply chain process are defined and detailed models that identify the data needed for the decision support system are identified.

There are several points that need to be addressed with respect to the development of SCFCS and the model:

1. Decision models are never perfect and are always being updated and enhanced. The hierarchical definition of SCFCS allows updating the factor categorization and structure of the system easily.
2. The data requirements of a decision usually change when the decision model is changed. SCFCS allows extracting data to be used as inputs in accordance with the decision to be analyzed.

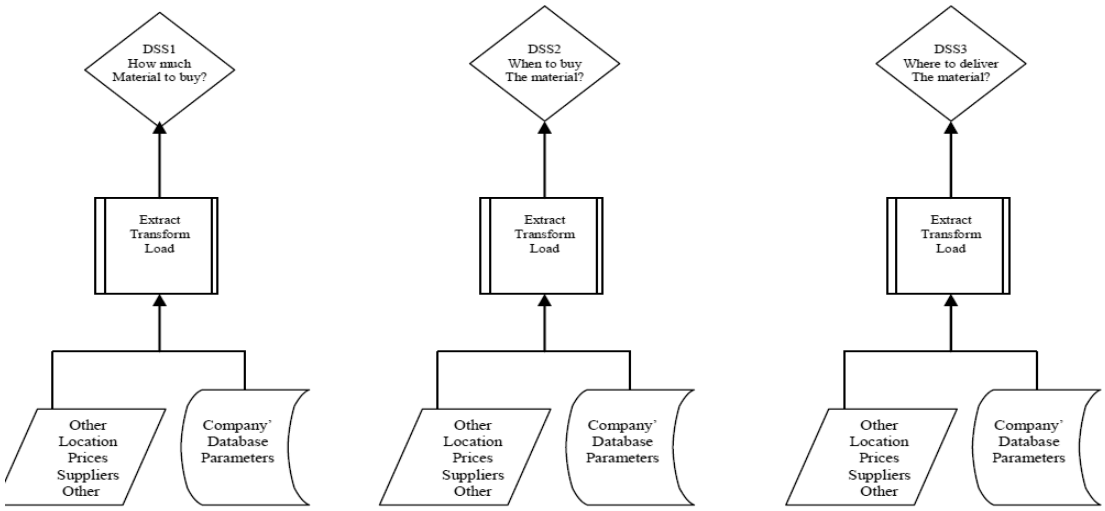


**Figure 1:** Description of Structure of the Decision Support Systems

3. Database design and data collection take a long time to complete.
4. The facts mentioned in points 1 to 3 imply that, in order to have the data available whenever a decision model is changed, the database must be built in anticipation of future decision-model developments. In other words, the database must be defined comprehensively with all possible decision models in mind. This is the approach taken in designing and investing in ERP systems and data warehouses.

## DEVELOPMENT OF SCFCS

SCFCS permits classifying and organizing supply chain related factor information into various categories. This categorization can be used as the structure to create the database that will store the factor information. Factors needed by the decision maker at any instant can then be extracted from the respective category in the database under the SCFCS categorization.

The first step in the development of the system was to gather information from interviews with companies and literature review. Once the information was gathered, the decision nodes for material supply chain were identified, and the data needed as inputs (i.e. factors) and the data generated as outputs (optimal decision variables and performance measures) for all the decision nodes were also identified. Once the data were identified, categories under which the factors could be classified were defined for each decision. Examples of the categories include cost, schedule and storage. Categories could also contain sub-categories. For example, the cost category can be subdivided into direct and indirect cost. The factors are then classified into the respective category and subcategory, if applicable. Each category is comprised of factors that can directly influence that category. For example, some factors that are included in the storage category are capacity, cost, etc.

It could be argued that ERP databases that are currently available were designed to address decision support in all aspects of a business enterprise. However, the development of SCFCS presents the following research contributions:

1. It defines the database that would be extracted from ERP databases or other company data sources in order to support specific decisions.
2. It defines data that may have to be extracted from different corporate entities and different corporate databases (general contractor, sub contractor, suppliers, and owner).
3. It assists in the development of small-scale decision support that a sub-contractor may utilize in the absence of an ERP system.

**Data Definition for SCFCS**

Figure 2 depicts the general structure of SCFCS. In a hierarchical diagram definition, this type of diagram could be referred to as a parent-child description. The entry point, or parent, is the decision to make. The categorization of the factors in SCFCS depends on this decision. Once the decision to be made is known, the next step is to identify the Category in which the factor fits. A Category is the main class used to classify a factor. Categories were selected based on the main information components that can be found in a typical construction project. Categories could contain Sub- categories that are used to further divide the Categories into components that could facilitate the categorization of the factors. For example, the Cost category can be further divided into two categories: Direct cost and indirect cost. The use of sub-categories allows classifying factors more specifically based on the cause that the factors could have on the overall decision system. For example, a contractor could easily identify that material not being available when needed creates an indirect cost associated to losses in productivity[8].

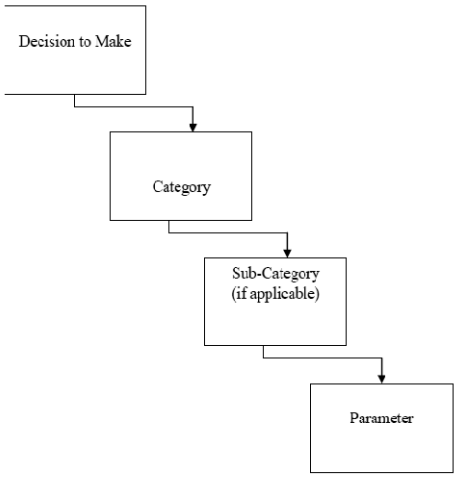


**Figure 2:** General Structure of the SCFCS System

The main categories identified are: Type of Material, Cost, Storage, Schedule, Supplier, Other and Plans and Specifications. Subcategories are used to further divide the Cost and Storage categories into direct or indirect cost and on-site or off-site storage. The factors are then classified into the appropriate category and subcategory. The factors needed for every decision to be analyzed are filtered from the SCFCS hierarchy.

## SCFCS FOR THE 'HOW MUCH TO BUY' DECISION

The main categories that apply to this decision are cost, storage, schedule, supplier and other.

The storage category comprises two options: on-site storage or off-site storage. The options for on-site storage are to store in "sea cans" or trucks, store in work areas or store in the lay down areas. The factors associated with the on-site storage are storage capacity, storage costs, storage location, security, theft, loss and damage. The alternatives associated with off-site storage are warehouse, rented space and subcontractor's yard. The factors associated with the off-site storage are storage capacity, storage costs (rent and transportation), storage location, security, theft, loss and damage. Another category associated with this decision is the schedule.

Factors under this category include progress of work, productivity, uncertainty in schedule, work to be done, when to use the material, planned vs. actual (i.e. extra work, changes), quantity to install, order to install or order to store. The other categories associated with this decision are supplier and other.

The total cost of materials includes direct costs and indirect costs. These are two subcategories under the Cost category. Direct costs are comprised by materials selling cost distribution, distributor's cost, transportation costs, and disposal. Indirect costs may include costs due to misplacement, damage, loss, cost of placing processing and paying of material, cost of receiving, storage, issuing, among others.

## SCFCS FOR THE 'WHAT MATERIAL TO BUY' DECISION

The type of material to use in a construction project is specified in the specifications and in the drawings. Consequently, it is expected that plans and specifications comprise one category for factors for this decision. For this decision, the main considerations are the brand of the material to buy and from which supplier to buy it. The main categories for this decision are Cost, Plans and specifications, Schedule and Supplier.

The total cost is comprised by direct and indirect cost. Direct costs include the purchasing cost, discounts, and ordering. Indirect costs include cost associate with backorders. The supplier category is important because the brand of the material to be used in a particular project could be specified in the contract documents. Some materials are only carried by specified suppliers; therefore this material needs to be acquired from those suppliers. If the material brand is not specified, the contractor can select the sourcing source either through bidding, negotiated contract or a blanket order.

## SCFCS FOR THE 'WHERE TO DELIVER' DECISION

The main categories that apply to this decision are: cost, schedule, storage and supplier. The contractor needs to consider the direct storage cost of each alternative before making a decision on where to send the material for storage. Moreover, the contractor needs to consider other indirect costs associated with each storage alternative such as damage while the material is stored, loss or theft.

Any of these factors can greatly affect the availability of material when needed, even more if the material being stored is a critical material. Absence of a critical material when needed affects the construction schedule greatly. The production and availability of a critical material requires long lead times, therefore it is very important to consider the storage location for such material.

The space available at each storage alternative is critical when making this decision. If there is available space and the material will be used in the near future, the contractor should consider storing the material at the jobsite. However, as seen from the SCFCS diagram, this decision is based on space availability, storage restrictions, storage fees, possibility of damages and loss.

## SCFCS FOR THE 'WHERE TO STORE ON SITE' DECISION

Often the available space for storage in the lay down areas is limited. The numbers of trades working at the same time influence the space available for storage in the lay down areas as well as the available space for storage in the building. In addition, the progress of the work and the number of trades working in the same area influence the number of times that material stored on the floor of the building needs to be moved around to free space for the other trades. These are some of the factors that affect the decision on where to store the material on the construction site.

The main categories for this decision are cost, schedule, storage and other. Under the other category, the possibility of material being damaged is encountered. The contractor needs to consider the possibility of material being damage when selecting a storage location. Quality is a very important aspect to achieve in a construction project. If material is damaged while stored and the contractor decides to store the damaged material not only re- work would have to be done, but, in addition, the contractor might not get future jobs due do this behavior. Therefore, the contractor should avoid damages and the cost associated with reordering material

## SCFCS FOR THE 'WHEN TO DELIVER' DECISION

The main categories for this decision are cost, storage, supplier, schedule and other. The performance of the supplier plays a critical role in this decision. If the supplier is a reliable source, the contractor could request deliveries the day before the material will be used. Otherwise, the contractor will have to order the material in advance and store it at the jobsite.

## SCFCS FOR THE 'WHEN TO BUY' DECISION

The main categories for this decision are type of material, cost, storage, schedule, supplier and other. As discussed earlier, the lead time for the material depends on the type of material to be bought.

The contractor should consider to buy material early if some discounts could be achieved by ordering such material early or if increases in material cost are expected in the near future. An example of material that could increase in cost is cable. Copper prices fluctuate and this affects the price of cable. However, the contractor should consider the storage cost of having this material early against the savings that could be achieved.

## CONCLUSION

The research presented in this document aimed at designing an integrated system of decision- support tools for material procurement for the small scale industry particularly an electrical industry. An integrated approach for material procurement provides better decisions on what to order, how much to order and where to deliver. Future research will be needed to develop a more complete framework integrating other decisions needed in areas such as supplier selection and preliminary material scheduling during the pre- fabrication phase. A fully integrated approach will better improve communication and minimize gaps in information flow among all the parties and departments involved.

## REFERENCES

[1] McFadden, F., Hoffer, J., Prescott, M., (1999), Modern Database Management, 5th Ed, Addison-Wesley publication.176-188.

[2] Kwan (2003), MINISIS Database Architecture,http://www.minisisinc.com/docs/architecture.pdf (May 2009).

[3] Sabbaghi,A.,N.Sabbaghi(2004)“Global supply-chain strategy & global competitiveness.”International Business & Economics Research Journal,3(7), pp 63-76.

[4] Wong, E., Norman, G., (2007) Economic evaluation of materials planning systems for construction, Construction Management and Economics, No.23, pp. 39-47.

[5] USSBA (2009). “Ecommerce: Small Business Venture Online.” US

[6] Small Business Admin illustration, July,09 www.sba.gov/library/ reportsroom.html.

[7] Tersing, Richard J., Campbell, John H. (2004) Modern Materials Management, 4th Ed, North-Holland Publishing Company, Amsterdam, The Netherlands, 277-284.

[8] Stukhart, G. (2007).Materials Management Approach for small Scale Sector, 2nd Ed Marcel Dekker Inc. New York. pp 24-40,198-218,256-270.