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# Decision-Making at the APOA Group: A Case Study

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## 1.0 Introduction

The companies parented by the Antimony Products of America Corporation (APOA) represent a fast growing group involved in manufacturing, marketing and distribution of non-ferrous metals, plastics and plastics additives. The group operates in a very volatile and impetuous environment which is best illustrated by the main line of the group's business - antimony trioxide whose primary use is as a flame-retardant additive to rubbers and plastics. The company's subsidiaries are involved in mining of antimony ores, production of concentrates, processing of concentrates and manufacturing of antimony trioxide and flame-retardant plastic additives.

The market of antimony metal and antimony based flame-retardant additives has several particular features such as: sudden and unpredictable price changes, a limited number of major producers and a great number of brokers, irregular supplies and inconsistent quality of the raw materials, and few large customers and many small ones. In addition, the market has seen a number of dramatic changes in the structure and geographical pattern of consumption, rise of consumers' quality requirements. One of the remarkable traits of this market is the fact that nearly all of the competing manufacturers are privately-owned companies and do not disclose their production and financial data.

The managers of APOA must make decisions in an fast-paced complex environment. This article is a case study of that decision environment. The company is attempting to mitigate the difficult nature of their decision environment through application of Information Technology (IT). A brief analysis of the IT requirements, application, and results to date are presented in the final section.

## 2.0 Decision Environment

The decision environment at APOA is divided into four major tasks. The first task involves the purchase of raw materials. The second task centers around the processing of the raw materials into finished product. In the third task, the finished product is sold to a variety of customers. Finally, each of these activities must be coordinated to achieve some degree of profitability. Each of these tasks is described in more detail below.

### 2.1 Purchase of Raw Materials

APOA employs a small number of brokers whose primary job is to seek out and arrange to purchase quantities of antimony metal and crude antimony trioxide. The price of antimony ore varies on a day-to-day basis. Unlike with some other metals, prices for antimony ores (concentrates) and metal are not set up by the world's commodity exchanges but rather "cited" based upon actual sale-purchase contracts. Antimony ore is mined and smelted (or roasted to produce crude antimony trioxide) in several places around the world, and the cost of transporting the raw materials must be factored into the price. Furthermore, the quality of the metal and the trioxide is highly variable. Not only does each mining region produce ore with varying characteristics, but each batch of ore from any specific mine may contain differing quantities of impurities from previous batches. Information regarding the assay of a batch of such produced metal/trioxide is usually incomplete or imperfect at the time of purchase and contracts often stipulate necessary payment adjustments upon arrival of shipments to the warehouses of the buyer and additional analyses.

### 2.2 Production of Finished Antimony Trioxide

The processing of antimony metal is a difficult task. The process itself is somewhat unpredictable. The quality of the product is dependent largely on the types and concentrations of various impurities in the raw

materials. Each combination of impurities produces a slightly different final product. Because the batches of metal (crude trioxide) are themselves so highly variable with respect to content, the final product must often be created by blending raw materials from different batches and/or sources.

The blending of metal (crude trioxide) is analogous to the process used by distillers of blended whiskey, in which alcohol is produced in large batches, and stored for many years. Distillers blend their final product from various batches to maintain a consistent quality and flavor over time. However, for APOA, a similar technology is not possible. Given the highly volatile pricing of antimony metal, and the highly variable and uncertain composition of each batch or raw material, the acquisition of sufficient stocks of metal (crude trioxide) necessary to implement a "distillers" strategy would entail a huge capitalization and consequent risk.

### 2.3 Sales Process

APOA sells about sixty percent of its processed antimony to a few large industrial accounts. The remaining sales go to a large number of small buyers. The large industrial buyers have rigid and fairly stable standards for quality and are often reluctant to pursue the lowest pricing for the sake of consistent quality and stability of the supply. Quality standards for small buyers are more variable and somewhat more flexible. This pattern is yet complicated by various payment terms and schedules the company and its customers employ.

Contracts for delivery of processed antimony specify penalties for substandard quality and missed deadlines. Penalties for substandard quality may include a reduction in the contract price or a return of the entire order. Returned orders are resold to other buyers or re-processed with addition of a "better" batch of raw material in order to "dilute" detrimental impurities.

### 2.4 Coordination

Dealing with all of the problems described above is a difficult task. Use of multiple suppliers shipping materials of variable quality as well as employment of a variety of financial instruments, add to the problems being faced by the company's managers on the daily basis.

The rapid horizontal and vertical expansion of the group has accentuated existing problems and brought in new ones, such as geographical distance and various time zones. At present, the managers and engineers at various locations are being flooded with a tremendous amount of data which is often not timely and poorly organized. Such particular traits as large number of suppliers of raw materials, their inhomogeneity causing the inhomogeneity of the finished and semi-finished products, a variety of small and single-purchase customers make the business akin to retail while the manufacturing supervisors face all the difficulties inherent in the mining, chemical and metallurgical industries.

In particular, there is a disparity in the typical time frames required to achieve the goals in the various company activities. The purchase and sales of antimony takes place on a day-to-day and sometimes hour-to-hour basis. However, the manufacturing processes take considerably more time and an interruption may cause enormous losses. This mismatch creates a tense and uneasy atmosphere for the managers involved.

## 3.0 IT Solutions

From the description of the decision environment above, it is clear that the situation faced by APOA management does not lend itself to traditional optimization methods. APOA management felt that many of the problems could be alleviated with better access and distribution of critical information. In response, APOA management has attempted to identify and resolve the most pressing information related issues. As usual, a number of the issues were found interrelated and, in some cases, only indicated the tip of an iceberg. For example, an attempt to establish an automated exchange of accounting and financial information between several sister-companies has displayed differences in their accounting practices. The following items appeared in the final list of priorities: selection of data; data acquisition scheduling and

procedures; classification of data and information; determining cross-functionality of information; design of information architecture; identification of information flows; determining the hierarchy of access to information; structure of information selection, storage and retrieval; data warehousing.

### 3.1 APOA's solution

The following items were identified as the most important elements of the planned decision-support system: up-to-date market information; manufacturing and sales planning and forecasting; following of incoming shipments underway; scheduling; tracking of raw material inventories through the warehouse; maintaining detailed quality reports readily available; optimization of blending; tracing of raw material costs; availability of quality reports on finished products; sortable up-to-date information by accounts; tracking of outgoing shipments; scheduling; variety of "red-hot" financial analysis information.

Each of the items above is only a generalized description of a number of types of information to be included therewith. Besides, one of the great problems is achievement of the uniformity of the information in- and output and possibility of superimposition of each type of information over another. Analyzing the situation it was understood that the company's management would expect the new IT system to be compatible with the accounting and manufacturing legacy software, allow for updating and retrieval of information from remote locations and be easily expandable into the other offices, branches and product lines. The system will have to feature a relatively simple and flexible interface in order to reduce the need of training for production, warehouse and sales personnel. In order to maintain minimal security the hardware and software should allow for a differentiated hierarchy of access to the information.

In short, the structure of data to be entered, processed and analyzed was described by its diversity, high frequency and complexity other than abundance as compared to a large retail chain. Another factor which had to be taken into account was that the company did not have MIS personnel on staff and maintenance of the network and decision-support system was expected to be done by managers themselves.

As of now, one of the most viable solutions is seen as establishment of an intranet, installation of an SQL database along with a multidimensional database and an on-line analytical processing (OLAP) tool with possible access through the HTML intranet server.

### 4.0 Conclusion

The APOA group is just in the process of designing and implementing a decision-support system. A brief analysis of the managers' requirements and the decision-making environment has shown that relatively simple single tasks create a high-pressure atmosphere when combined altogether and placed into a real-life manufacturing operation. It must be realized that the new IT system should help reduce the complexity of the environment, not add to it, and give the managers a powerful tool for making informed decisions. The company has recently introduced the Lotus Notes groupware at several facilities and is looking towards implementation of more sophisticated decision-support tools such as dynamic multidimensional databases.