BUSINESS INTELLIGENCE (BI):  
A CASE STUDY OF ACHIEVING OPERATIONAL EXCELLENCE  
IN CHEMICAL AND KAOLIN MANUFACTURING

Jason Maxwell  
Georgia College & State University  
and KaMin, LLC  
Plant Manager, Sandersville Plant  
530 Beck Boulevard  
Sandersville, GA 31082  
478-553-3508  
Jason.Maxwell@kaminllc.com

Patricia Layton  
KaMin, LLC  
Global Demand Planning Manager, Sandersville Plant  
530 Beck Boulevard  
Sandersville, GA 31082  
478-553-3509  
Patricia.Layton@kaminllc.com

Tanya Goette  
Georgia College & State University  
ITM Department  
CBX 12  
Milledgeville, GA 31061  
478-445-5721  
Tanya.Goette@gcsu.edu

ABSTRACT

This paper presents information on business intelligence (BI) and its use in industry. The specifics of BI in the chemical industry are discussed. A sample of a specific case where BI has been used through integration with an enterprise resource planning system is given. It is determined that having the key information and performance measures in place to evaluate business decisions is critical to the successful use of BI.

INTRODUCTION

Manufacturing industries throughout the United States of America are faced with a fierce battle to sustain market share within today’s global economy. Countries such as China, Indonesia, Thailand, and Mexico are weighing in as heavy players in the market as a result of vast improvements to information systems and technology enhancements that have allowed rapid transfer of products at low costs through e-commerce and other free trade channels. Most manufacturing corporations have adopted some type of business intelligence (BI) system which enables key decision makers to obtain real-time market data both internally and externally to their business. Key performance indicators (KPIs) are needed in order to understand how the business is performing externally in the market place (customer demand, revenues, complaints, etc.) and internally to achieve operational excellence (equipment efficiencies, identify specific projects to cut costs, etc.) [6]. The focus of this paper will be to discuss how a business intelligence...
system within a chemical manufacturing environment, with specific focus on the kaolin industry, can be integrated with process management, knowledge management, and enterprise resource planning (ERP) systems to transform the business into a competitive giant in its applicable markets.

KNOWLEDGE AND INTELLIGENCE

First, it is important to understand how intelligence and knowledge are critical to make proactive decisions that positively impact the bottom-line before the competition realizes what has hit them. The fundamental concept called “intelligence” is different from “information” [5, p. IT5]. Intelligence is actionable information that can be best described as data turned into knowledge that in turn is actually used for something. One definition is, “intelligence is knowledge and foreknowledge of the world that is the prelude to decision and action” [5, p. IT5]. History is a good example of how intelligence has changed as the world has evolved from long lead times to transmit critical information into real-time intelligence that is easily distributed to multiple key decision makers within corporations and/or government agencies throughout the world.

On July 4, 1776, the U.S. claimed its independence from Britain and Democracy was born. A superpower was instantly created within the world as many people across the seven continents heard of the “American Dream”. However, this critical information was not heard until months later. The victory and independence for the U.S. was founded on the industrious attitudes of people from the free-world that relentlessly defeated their opponent through critical intelligence. This intelligence was central to the U.S. (the battle occurred in the U.S.) and enabled key decision makers to act quickly and strike when it counted. On the other hand, the opponent of the U.S. lacked the critical intelligence needed to make key decisions due to the Atlantic Ocean separating the supreme leaders. At that time, intelligence messages could take up to a month before a decision was made to initiate action.

On the day that U.S. claimed its victory in the American Revolutionary War, King George III of England had no idea that American independence had been achieved. The battle was over, and it took a few weeks before the key leader was aware of his country’s defeat. With today’s modern technology, King George III would receive minute by minute intelligence that would enable him and his key military units to react according to their strengths. Given our modern culture and England’s strength as a country compared to the U.S. at that time, American independence could have easily turned out differently. This illustration is a prime example of how intelligence has evolved in the past 200 years. Receiving intelligence and acting quickly is critical before you become defeated by the opponent. In the case of today’s chemical companies, lack of intelligence will lead to a loss of market share and the eventual consolidation or shutdown of operations due to diminishing customer demand.

COMPETITIVE BUSINESS INTELLIGENCE

What most chemical companies really want is a competitive business intelligence system. This is defined as “the organizational means to systematically collect, analyze, and disseminate information as intelligence to users who can act on it” [5, p. IT5]. A key contributor to successful leverage efforts is a very simple one. Typically, whoever knows more in advance and responds to that knowledge quickly wins [5].

Understanding how a competitive business intelligence system functions is important as we move forward in this discussion. Operational raw data is usually stored in corporate databases. Specialized software is utilized to tie this data together into a data warehouse. The data warehouse is used to link tables of information allowing for extensive analysis. Business analytics tools are utilized to extract data from the data warehouse and manipulate it into reports, alerts, graphs, forecasts, or other data mining initiatives.
These reports are disseminated quickly to key decision makers to proactively and strategically move the business forward.

There are a few elements necessary to ensure a functional BI system within a chemical manufacturing environment. Business intelligence solutions allow companies to establish a performance management framework for targeting, reassuring, notifying, and adjusting their processes to comply with performance objectives [6]. The first step for a company is to define key performance indicators (KPIs) to turn strategic goals into measurable results. The latter really focuses on getting the right information needed to thrive and succeed in today’s fast-paced business environment. At all levels, employees need to be aware of the key business drivers and results related to their position in the company. More importantly, in order to better facilitate their specific task focus, employees need to know how these facts deviate from the planned or forecasted values.

Kulbeda and Hodge described the success formula for chemical companies as “external challenges, plus internal pressures, minus the company’s ability to manage product through the value chain equals a significant portion of chemical company’s operational success” [1, p.5]. Typically, external challenges drive a need for operational effectiveness. Products and brands are key to obtaining competitive differentiation, market share and demand. However, most strategies for long-term differentiation based on products, features or services are difficult to sustain. In other words, products and brands are important but not enough by themselves.

Market factors were overwhelmingly the top external challenge that accounted for 81% of CEO responses in a recent poll [1]. Although broad in scope, market factors can be interpreted as competitors, customers, and pricing. Other key external factors, such as globalization and regulation, do little to ensure chemical corporations maintain high prices or roomy margins. Long-term sustainability must come from business model innovation [1]. A perennial push to preserve margins revolves around reducing costs. Internal challenges drive a need to improve operational effectiveness by targeting the critical path of the product itself. That is, moving product from sourcing to distribution quickly, inexpensively, and effectively. Many chemical companies are utilizing lean manufacturing and six sigma methodologies to target non-value added activities in the value chain and eliminate the activity or improve the efficiency or variation that is generated by those functions.

**OTHER INDUSTRY USES OF BI**

The drug industry, as related to the chemical industry, found through BI that more was not always better [4]. They thought that high-throughput screening during the research process of new drugs was the key. After time, and with the help of a BI system, the industry realized that better screening (higher quality) is the number one priority to obtain more accurate hits on targets faster [4]. This was performed through improved information flow between discover research and clinical development.

**SIMPLE BI SOLUTIONS (EXCEL)**

Business intelligence is an essential component and needed for any manufacturing based company to stay competitive in the market place by delivering low cost products with excellent quality. One journal article described that today the most popular and inexpensive BI tool is Microsoft Excel [7]. Excel is not fancy, but business users are pretty comfortable with it because it allows them to aggregate data, quickly apply formulas, perform data analytics, and share results with other people. The latter is a result from Excel being easily installed on every business person’s PC (personal computer). Excel is a low automation solution but it works, and works without any help from IT departments [7].
CRITICAL USES OF BI IN THE CHEMICAL INDUSTRY

Product-intensive functions (procurement, manufacturing, and distribution) within a chemical company typically take the brunt of margin scrutiny and represent the biggest opportunity for improvement through business intelligence [1]. BI in procurement can be used to analyze raw material suppliers for quality, volume, and pricing. Typically, procurement managers can access data in pricing to secure long-term pricing contracts with vendors. In addition, discounts can be secured which in return generates costs savings for the company as well as minimizing potential scrap or rework that could be initiated by inferior raw materials [1]. BI in manufacturing can be used by plant management to understand the connection and relationship between performance measures and the detailed manufacturing components. In addition, operational data can be tracked more efficiently and linked with overhead costs to quickly understand how to maneuver the elements required in order to achieve financial success. Finally, BI in chemical distribution can be used to reduce inventory (working capital), improve order entry, and reduce delivery time. The latter is usually performed through business activities such as warehouse management, inventory management, order management, fleet management, etc. Distribution directly contributes to the overall chemical products cost structure and provides a critical link to the heart of a chemical company’s revenue: the customer. By improving business intelligence to procurement, manufacturing, and distribution, chemical companies can be more responsive with their business decisions and improve margins [1].

BI USES IN KAMIN LLC

As a specific case in the chemical industry, kaolin (clay) manufacturing will be discussed in order to further shed light on how business intelligence drastically impacts responsiveness to the market and the industry’s margins. About 40 years ago, kaolin mining and manufacturing was simply described as dirt that was extracted from mother-nature and brought into a plant through simple processes to remove elemental impurities in order to improve clay opacity (make the clay whiter and brighter). The polished product was finally placed in a bag or railcar for shipment to specific customers. During those years, kaolin reserves were abundant, and customers utilized kaolin as the primary contributor to their formulations. Typically, price was not as dynamic as it is today due to raw material costs (kaolin crude, chemicals, bags, etc.) and energy costs (natural gas, fuel oil, electricity, etc.) being fairly stable and predictable. Given the stability of the energy costs, kaolin prices were set at a rate that was favorable for both the producer and the consumer. This allowed for some level of predictability of the cost structure. Thus, enterprise resource systems were not as critical, and business intelligence was not as sophisticated.

As time progressed, natural resources diminished somewhat, raw material costs exponentially increased, and energy costs climbed to all time highs. Over the same period, technology drastically evolved through information systems, the Internet, and science. Kaolin customers are under the same scrutiny as other industries, and, thus, have found ways to cut costs by using less kaolin in formulations. In addition, rapid innovation of high technology equipment utilized to manufacture products cheaply and more efficiently have evolved in order to sustain competitiveness in the global economy with the likes of China, Mexico, and other third world countries who continue to discover ways to manufacture products at lower costs.

In order to control market share and sustain competitiveness, the kaolin industry has adopted strategies based on a BI system to procure large volumes of raw materials at low prices, manufacture products more cheaply through innovation and process improvements, and deliver products efficiently and on-time to its customers. Business intelligence systems were established to meet the demands of the market and have been synergized with process management, knowledge management, and ERP systems to quickly analyze and develop an informed decision on the basis of what is described by many as an avalanche of information [5, p. IT5]. Figure 1 illustrates how the BI system utilized by KaMin LLC ties into the ERP system (Oracle) to extract critical intelligence in a timely manner to decision makers [2].
**FIGURE 1: KaMin LLC ERP/BI Intelligence System**

**KPI (Key Process Inputs):**
- Production Data
- Shipping Data
- Quality Data

**Oracle ERP System**
Purpose: Houses all of the data inputted from various operations within the business and ties the supply chain and financials in with operations and customer demand.

**Sales Intelligence**
- Tons Shipped vs. Invoiced
- Revenue

**Manufacturing Intelligence**
- Plant Inventory
- Quality Specifications

**Order Management Intelligence**
- Shipping Information
- Order Entry Information

**Discoverer**
Purpose: Extracts information from Oracle and generates reports for various functions of the business.

**Transportation Intelligence**
- Freight Rating

**Manugistics Software**
- Analyze other critical information for supply chain planning.
- Shipped tons from Oracle to build forecast.
- System calculates forecast.

**Operational Efficiency and Intelligence**
- Reports generated through software to improve processes and identify key Six Sigma/productivity projects.

**Production**
- Operational data inputted into Oracle and other process control systems/software.
- Production Access Database

**Plant Planning**
- Integrate forecast data into the plant model to determine loading on equipment.

**Forecast**
- Forecast generated for each plant/business units.
Key process inputs from the manufacturing process are entered or scanned into the Oracle (ERP) system, which include production data (run-time, throughputs, chemical dose rates, etc.), shipping data (customer, location, quantity, volume, etc.), and quality data (customer specifications: brightness, rheology, particle size, etc.). The Oracle system houses all of the data from various operations within the business and bridges the gap between operations, supply chain, sales (customer demand), and finance. Oracle has the capabilities of tying different functions of the business together very quickly in order to generate key reporting and intelligence information.

Discoverer software is utilized for the purpose of extracting information/data from Oracle and generating reports for various business intelligence functions. Four critical intelligence reports are generated for key decision makers with responsibilities over different functions of the business. Sales intelligence reporting primarily focuses on tons of kaolin shipped and invoiced to specific customers, and the revenue associated with these shipments within given time periods. This information is essential to determine how the business is performing from a revenue and volume standpoint at any given time. The president, finance and sales team primarily utilize sales intelligence reporting report on a daily basis. Manufacturing intelligence reporting is utilized by operations leaders to determine plant inventories (working capital), and overall operational efficiencies. This information is essential to determine an attention focus on a daily, weekly, and monthly basis to ensure that overhead costs are minimized and products are produced effectively. Order management, transportation intelligence, and forecast reporting is heavily utilized by the supply chain department to determine order entry accuracies, precise freight ratings, and accurate shipping information [2].

In addition to BI systems, KaMin LLC utilizes demand planning and collaboration modules from Manugistics to extract other critical information necessary for supply chain planning. Shipped tons are pulled from Oracle and the software automatically calculates a forecast for a specific plant. The forecast is uploaded into a plant model (an intricate Excel spreadsheet) to determine plant loading over a given time period. Production is scheduled based on order entry through Oracle, and at the end of each month, forecasts are compared to actual production shipments to determine a percentage of accuracy.

Prior to the BI system at KaMin LLC, much of the activities during the first two weeks of the month involved gathering information about the previous month’s operational and financial performance through non-integrated systems [2]. Off-line spreadsheets captured critical information in typical silo fashion as these systems lacked integration or data linkage. Tracking performance monthly was the frequency allowed with existing manpower at the time. Due to the latter, upper management did not have access to the critical real-time information which is vital in making key business decisions to generate incremental wealth and propel past the competition [2].

BI has become an essential requirement to do business within the kaolin industry and to sustain a competitive edge by controlling costs on a real-time basis. KaMin currently uses the BI system to link costing, shipments, open orders, and production data. Snap-shot reports can be pulled throughout the month by upper management allowing them to make informed decisions. Another example of management’s pre-BI issues was the inaccuracy and lack of data when projecting expected volumes and revenues. Today, reports linking shipments, non-invoiced shipments, project gross margin, and standard costs can be easily pulled at any time [2]. In addition, once ERP and BI systems were fully implemented, fewer resources were necessary to operate and maintain system components and business reporting needs.

From a competitive perspective, KaMin is positioned well to gain intelligence on market conditions and consumer preferences. KaMin’s intelligence from the Vice President of Supply Chain, Mr. David Mayfield, confirms that “Engelhard (a competitor of KaMin LLC) was very good at data mining and utilizing data to generate meaningful reports on Sales and Operations data to feed their planning optimization software in order to validate plant models and confirm the decision making process.
KaMin’s advantage is a more integrated utilization of the Oracle system versus Engelhard’s use of their system. With the acquisition of Engelhard by BASF, and subsequent implementation of SAP, it is expected that there was an improvement in the accuracy of their ERP data. The advantage that KaMin had with regard to more accurate bill of materials, routings, etc. may have been lessened with the full implementation of SAP” [3]. In summary, Mr. Mayfield illustrates “that the more thorough use of the ERP system leads to a more thorough use of the BI system. There is a trust in the data and the system when there is use and accuracy in the system” [3].

KaMin LLC has been very effective in the market place by utilizing BI systems to make key decisions with accurate information. As a result, the entire efficiency of the organization has improved through a reduction of redundant transactional steps as compared prior years, and the manufacturing process can be more easily managed and controlled through process management and BI. Knowledge management is also utilized in other areas, especially in science and technology, for further process improvements. The Internet, combined with newly innovated product solutions from research and development, has yielded huge improvements to the KaMin’s bottom-line.

CONCLUSION

Chemical manufacturing, including the kaolin industry, will continue to be challenged by strong competition, both domestic and foreign. Business intelligence, ERP, process and knowledge management are all essential ingredients to build a dynasty that will withstand drastic shifts in the marketplace. Regardless of what type of BI system manufacturing companies utilize, the key is to have the right information and performance measures in place to properly evaluate business results. Finally, hiring the right people is essential in order to make tough decisions and lead the organization to the top. People still remain the greatest asset to building a well-rounded team and allowing for a functional/effective BI system.

REFERENCES


The primary customers are paper industries which utilize the product for coating applications, and industrial markets which utilize kaolin as a pigment for a variety of products, i.e. paint, insulation in wire and cable, tires, etc.