ABS – Business Excellence the Almatis Way!

Abstract

Standards for Business Excellence are set by the Almatis Business System (**ABS**). This business system is based on the management concepts of the leading Japanese automotive producer, Toyota, merged with Six Sigma principles. Its principles are:

- **Make to use**, not for inventory.
- **Eliminate** all non-value adding activities or **Waste.**
- **Success depends on** the **People** who do it.
- **Stable Operations** are essential.

Almatis has translated the ABS principles from automotive manufacturing to chemical processing. An overview of ABS and its application—the implementation process and key impacts for the manufacturing—are described using the example of Calcium Aluminate cements at Almatis' Rotterdam manufacturing facility. Consequences to Almatis' customer and supplier are presented and the overarching conclusion is that the approach to Business Excellence using ABS brings great benefits, not only to Almatis but also to its customers and suppliers, improves efficiency, eliminates Waste and drives success for all in a very competitive business environment.

Section 1 describes the underlying concepts of ABS. Section 2 explains the Framework of ABS and its subsystems, and section 3 illustrates the implementation of ABS in the Calcium Aluminate Cement Plant in Almatis BV., Rotterdam, The Netherlands.

1. The Almatis Business System

The Almatis Business system (ABS) is based on the Toyota Production System (TPS). Toyota is a leading Japanese automotive producer. ABS is a very structured system and companies applying the tools and concepts have achieved tremendous improvements in productivity, cost and quality—not only for themselves but also for their customers and suppliers. Productivity and efficiency are key words in today's business environment. Only those companies who are able to organize themselves to become more productive and more efficient than their competitors will "lead the race."

When ABS was introduced, many employees were asking how a "car assembling company's system" can be utilized in a chemical company. Intense hands-on training techniques with workshops and tutorials helped convince participants that this system has merits and that it can help even in a chemical company. Since its introduction in early 2000, the system has been successfully deployed on a global basis. The ABS system was implemented throughout the business from upper management to all levels in the plant. It has been seamlessly deployed throughout the organization in business processes as well as manufacturing processes. Almatis recently added Six Sigma tools to the ABS system and has deployed the combined system to a select group of participants who are agents of change. These individuals are helping to change the culture within the company by directly applying the tools and demonstrating their benefits.

The benefits of the ABS system have been demonstrated at all locations through lower inventories, lower cost, problem solving of repetitive issues, standardizing key processes to eliminate waste, unearthing of "Hidden Factories"* using the concept of stable operations and establishing vital linkage with key customers. By tapping into the intellectual capital of all personnel in the business, substantial improvements have been made in a relatively short period of time. These changes have translated to the bottom line of the business.

* The hidden factory is the extra useful, positive output that would theoretically be possible if the energy directed at creating waste were released and directed instead at making good quality items.

The intent of this article is to give the readers an introduction to ABS; it is by no means an attempt to cover all aspects of the system. An example of Almatis' implementation in the Rotterdam Calcium Aluminate Cement production facility is outlined.

Concepts and Principles

The ABS system utilizes various tools such as work balancing and leveling, pull systems, Just-In-Time manufacturing, problem solving, standardization, continuous improvement and stable operations using Six Sigma principles, etc. With the addition in 2005 of Six Sigma principles and stable operations to the ABS system, a large number of “Hidden Factories” have been discovered and eliminated, resulting in huge benefits to Almatis. The Almatis Business System has changed the way we do business from the top level of management down to the plant floor workers.

The Tenets of ABS are:

- ***Make to use*** – Production is based on making *what* the customers wants, *when* they want it and in the requested *quantity.* No extra material is produced for inventory storage.

  Make to use is best demonstrated by the application of one of the subsystems of ABS namely the “**Pull system,**” which is a scheduling system in which a Customer withdraws (pulls) products, and the Supplier replaces the product that has been used (pulled). The Pull system is best demonstrated with the **supermarket concept**: Customers take from the racks what they need and the consumed goods are replenished in a given period of time by vendors or by the supermarket. In a manufacturing environment, it could be the subsequent process that consumes goods or services and the preceding process that replenishes them.

- ***Eliminate waste*** – All processes eliminate any non-value adding activities, which means making *the perfect product every time* without *waste* generation (e.g., overtime, excess raw material, product movement, or defective products).

  Waste is defined as all non-value adding activity. The main categories of waste, which must be questioned continuously, are *overproduction, waiting, conveyance, processing, inventory, motion and correction*. Waste elimination at Almatis is performed by all employees who question the need for any non-value added process steps, the need to store products, the root causes for machine downtime, etc. This results in only spending energy in making what the customer wants, when they want it, how they want it and only in the quantity requested. The result is the highest degree of efficiency and the lowest cost to the business.

- ***People linchpin the system*** – Success in implementing a business structure depends on the people who do it. People are the heart of the system and none of the tenets of ABS can be achieved without people. Success in implementing ABS through the people who do it is achieved by training, education and personal respect. Examples of people-centered principles are: make work safety first, assure that everybody is an expert at what he/she does, listen to the people, continuously improve the processes, use simple visual methods for communication of information, provide a workplace where employees have a true sense of ownership and pride in their work, and create a production flow that becomes a system steered by orders (Pull system) and not by production for inventory (Push system).

  ABS is **not** an inventory reduction program. It improves productivity but its power lies in empowered knowledgeable employees who work on continuous improvement as a way of life. ABS is a highly visual system that highlights problems and allows people to intervene and solve them rapidly. (See section 3 for examples). All aspects of a business like safety, finance, human resources, purchasing, manufacturing, and maintenance are included in its deployment.

- ***Stable Operations*** – The general perception of **Six Sigma** principles is: More is Better, but at Almatis we preach "Stable is Better." Variation is the cause for a number of problems and Six Sigma principles attack variation at all levels of the business. When equipment, people and systems are pushed to their maximum limit, they reach a level of instability that takes away from productivity. So Stable is Better and is the Almatis Way!

2. ABS Framework and Subsystems

In order to successfully implement ABS, a company needs to have some basic conditions in place. Upper level management must be committed. All employees must be trained on the ABS concepts and allowed to participate in improvement activities. Motivation for change is facilitated with strong leadership and since this is a cultural transformation, road blocks have to be dealt with rapidly. The Almatis Business System Framework is illustrated in Figure 1.

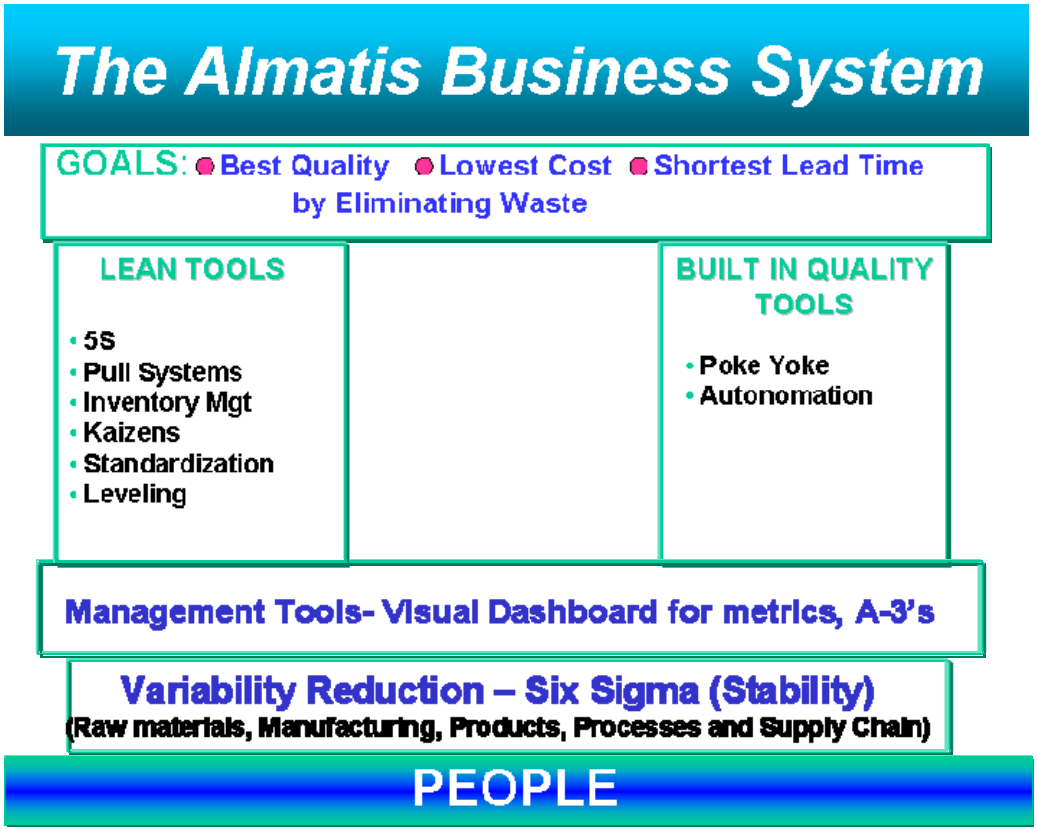

Figure 1: The Almatis Business System Framework

People are the **foundation** and in order to achieve the goals, mutual trust and respect between employees and management must exist..

To build on that foundation, a company needs to have **stability** (by means of stable suppliers, stable processes, and stable quality). Using Quality tools and Lean tools comprised of rapid problem solving, standardized work, Kaizen or continuous improvement, leveling and other ABS tools, the business goals of being the best in quality, lowest in cost and on-time in deliveries can be achieved. All of these are accomplished by eliminating waste.

On top of this solid foundation, two more building bricks support the ABS principles:

- **Lean** production, driven by pull systems, takt time and continuous flow.

- **Built-in Quality in processes,** meaning a self-supporting control in each process that ensures desired product quality is reached.

When these basic conditions are in place, the Almatis Business System enables our company to **increase productivity,** while customers receive **improved quality** and **timely deliveries.**

Before going into more detail of the subsystems, it is important to understand how a majority of companies work. Figure 2 illustrates the concept of batch processing in most manufacturing industries. Orders of the same kind are clustered, discounts for larger order quantities are offered, changeovers are minimized and the different process steps (see Figure 2 markings I - IV) all receive their own production schedule from a supervisor or by some other means. These production schedules may have monthly or weekly targets, but re-scheduling can occur several times per day. The objective of this type of a system is to maximize output of the individual sub-process steps while running “at capacity.”

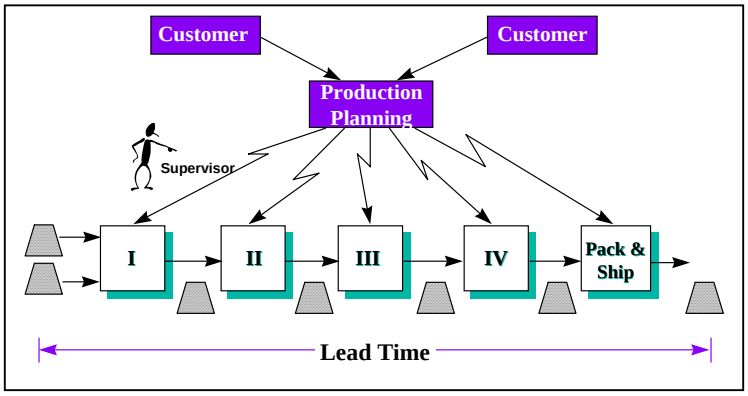

Figure 2: Conventional Industry (Push system)

This production system is called a “**Push system**”: the incoming raw material is virtually pushed though the individual process steps to finally reach the pack & ship area. Due to the goal of maximizing output of the individual process steps, inventory build up is common within the production line (indicated as piles between the processes in Figure 2). Such large excess of inventory ties up capital and fills up warehouses. Despite this large inventory, there is no guarantee of on-time delivery for all products and the supplier will require long production lead times. Flexibility in changing schedules is almost impossible.

2.1 Stability, Standardized Work, Continuous Improvement and Leveling

Stability

Before an organization embarks on improvements to productivity and quality, stability is needed. Stability is a basis on which one can start building. Stability means a stable customer demand, stable processes, reliable equipment, low levels of reject material, repeated work patterns, reliable suppliers etc. Basically, stability examples can be defined for the whole supply chain. The implementation of ABS and Six Sigma tools are a necessity for creating stability.

Standardized work

Standardized work is the framework for describing how to perform activities. The elements of standardized work are: setting of standards for activities that are repetitive in nature and determining the types of work for which elements are planned and which ones are unplanned. Most waste typically hides in the unplanned activities. Standardized work uses the concepts of time and motion and looks at all forms of waste. It is an excellent tool that provides step by step guidelines for activity analysis and exposes problems so they can be solved.

Continuous improvement
Another commonly used ABS tool is Kaizen which in Japanese means continuous improvement. By establishing standards, any deviations to standards present themselves as problems. Teams are encouraged to solve these problems rapidly and with the help of team leaders and supervisors. Most companies improve their processes on a continuous basis using problem solving tools, asking 5 why's to understand the root cause and eliminate problems. They also improve by using the above mentioned Standardized work to expose problems. Eliminating these problems result in continuous improvement as well.

Sometimes cross functional teams are set up to making rapid improvements. Teams use data and the current condition to find waste in the system and identify ways to reduce that waste. The team is empowered to make changes rapidly, experimenting and improving the current condition in a very short period of time (typically < 1 week).

Leveling
If a company wants to move to Just-In-Time production, leveling is an important ABS tool. Leveling is the smoothing of production, creating an even distribution of workload, resulting in a uniform burden for machinery, employees and material usage. Leveling can be done in many ways. For example, it can be set in the production requirement per day, per shift, per machine, but also per product type, etc.

Leveling can increase **changeovers** from one product to another product. Changeovers may involve physical changes as well as process adjustments and are a **necessary waste, but one that robs capacity**. Therefore, changeover time must be reduced as much as possible so that batch sizes can be reduced, which in turn will drive lower inventories. Changeover time reductions along with leveling are key enablers to achieving Just-In-Time manufacturing. More changeovers also mean that the **production of smaller batches** will take place. The full utilization of machinery is not the target; smooth flow in a supply chain is the goal. This means that equipment running at lower capacity will be, when looking at the whole supply chain, more productive than running large batches at full capacity.

Production capacity leveling by variety and product quantity is conducted using a **sales/order forecast**. Forecast information is used to define a rough-leveled production plan. The closer to the point of production, the more detailed the plan becomes. Last minute changes are incorporated and final adjustments are made. Once production is leveled, flexibility with respect to product changes increases. A perfectly leveled production plan can not always be realized, since there will always be changes to customer demand. ABS provides countermeasures to account for this in the form of a Pull system, which is described below.

2.2. Just-In-Time, Pull system, Takt Time and Continuous Flow

Just-In-Time
Figure 2, above, depicted the "Push system", where a company is manufacturing goods based on the sales forecast in large batches, regardless of whether there are actual customers waiting at the time the final product leaves the production line. Push manufacturing companies are typically inflexible to customer demand changes and are swimming in inventories.

The term "Just-In-Time" (JIT) defines a commonly known concept which means to manufacture only exactly **what** the customer wants, **when** the customer wants it and **in the right quantity** as much as the customer wants. The pull system is the designated system for Just-In-Time production.

Pull system
Figure 3 shows the concept of a "Pull system" where a company only manufactures goods when there is an actual customer order for the product. The manufacturing process installs

“supply chains” in which each process becomes a virtual customer for the preceding process, the preceding process functions as a supplier, and the individual pull loops are connected with one another.

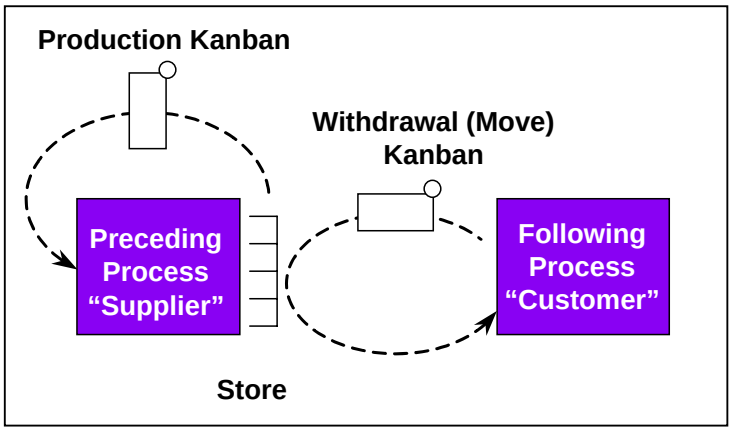

Figure 3: Pull system

The Pull system is a replenishment based system which only replenishes what the customer has consumed or “pulled.” Internally, the customer could be the preceding process and the supplier in this case would be the preceding process.

Pull systems are operated by means of “**Kanbans**,” which are signal cards for the production or for the movement of goods. All goods carry a Kanban that contains all the required information on the good (type, amount, place ...). When the goods move or are taken from the store, the Kanbans move back to the preceding process as an order for replenishment.

Takt time
The phrase “takt time” comes from the German word for metronome. Takt time sets the pace for the production to match the pace of the customer demand. It is calculated as the available production time divided by the product requirement. Takt time helps in defining if production is ahead or behind a schedule. Pull systems should be operated on takt time, so Kanban movements will also be made on takt time.

Continuous flow
Process steps should be linked to one another in continuous flow, resulting in lower inventory build-up between processes. By having lower inventories, problems surface faster and can be eliminated more easily. Production sequence that ends in single piece flow is the fastest way to convert raw materials into finished goods and is the ideal set up.

2.3 Build in Quality in Processes

ABS works under the premise that processes are set up to stop when problems occur. This prevents the production of defective material in the first place and eliminates defective material from getting passed on to the next process. When problems occur repetitively and are not solved to their root cause, waste can occur, which in turn drives up inventory and cost and takes up very precious resources. This results in the “Hidden Factory” where capacity is lost.

The total power of ABS can only be harnessed when problems are eliminated from recurring. When problems occur, the process should be stopped automatically by both machines and employees. This requires instilling in employees a need for analyzing and finding the root cause for problems and for solving them rapidly. This particular point changes the role of employees, since the whole organization needs to focus on problem solving. Six Sigma methodologies are also used to define root causes and improve the stability of processes.

2.3 Connections in the Framework

When **changeover** time is reduced, there will be **smaller batches**. Smaller batches **reduce the flow-time** of products in the line, resulting in **continuous flow**. Continuous flow will drive **leveling** and allow **Pull systems** to run. Pull systems will enable **Just-In-Time** delivery.

The concept of small batch production is exactly opposite of what is typically being done in the manufacturing environment (large product campaigns and high utilization rates of the equipment) and thus seemed illogical when ABS was first deployed. However, after implementation of ABS, small batches and fast changeovers were made and incoming customer orders began to be processed faster due to increased production flexibility. This resulted in production capacity increases and materials shipped on time. The old concept of having to wait until one large sales campaign was finished before the next one could be started was eliminated. Additionally, product inventories were kept at a low level resulting in less total capital. Inventory was used mainly to buffer sudden increases in order loads or as a countermeasure for unplanned machinery downtime.

3. ABS in the Calcium Aluminate Cement Plant in Rotterdam, The Netherlands

The implementation of ABS principles in the Almatis Rotterdam Calcium Aluminate Cement plant is described in this section.

3.1 Cement Production Process

Figure 4 shows the general process for the production of Calcined Alumina Cements. The raw materials lime (i.e. limestone and alumina) are co-ground and the raw mix is sintered in a rotary kiln to react to cement clinker. The clinker is milled in a ball mill to produce a final cement product. In the milling process, alumina and/or additives can be added depending on the required product properties. The final cement is bagged in paper bags, big bags or shipped in bulk.

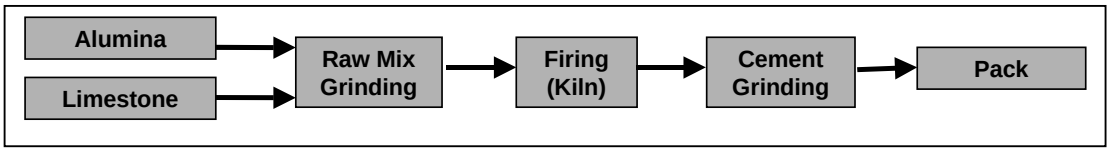

Figure 4: Cement Production Process

Before ABS was implemented, the Almatis cement plant in Rotterdam was based on a conventional set up and was running its production as a push system as shown in Figure 5. Major process steps received individual production planning, and changeovers took a long period of time, hence were kept to few in number. This resulted in big batch runs of the same cement type, which in turn meant long lead-times when products were not available or demand was rising at an unexpected level. Inventories resided as work-in-process materials in between process steps. Large inventory levels of the final product had to be kept to support and supply the customers.

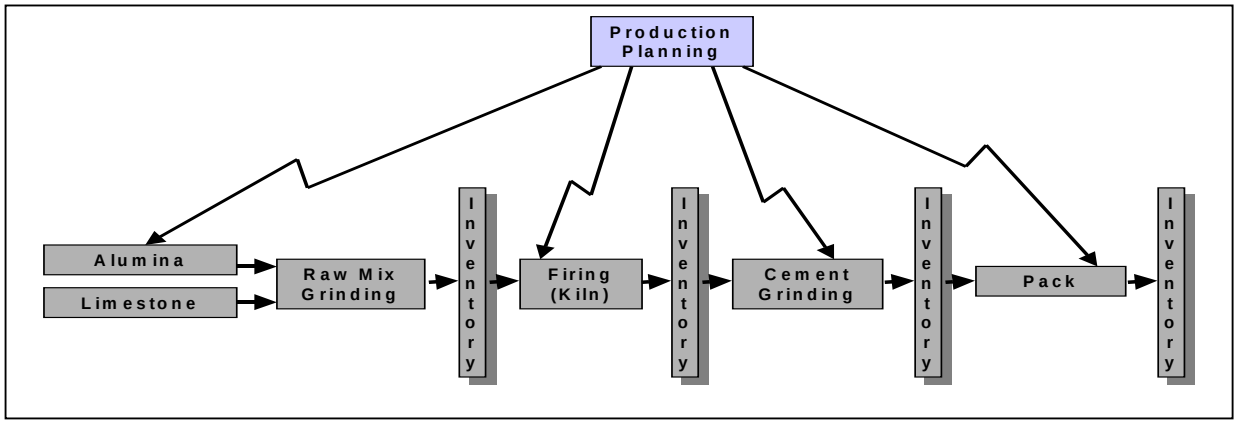

Figure 5: Cement Production Process without ABS

When ABS was first introduced in the Rotterdam cement production, the production model described in Figure 6 was set up to change from a Push to a Pull system.

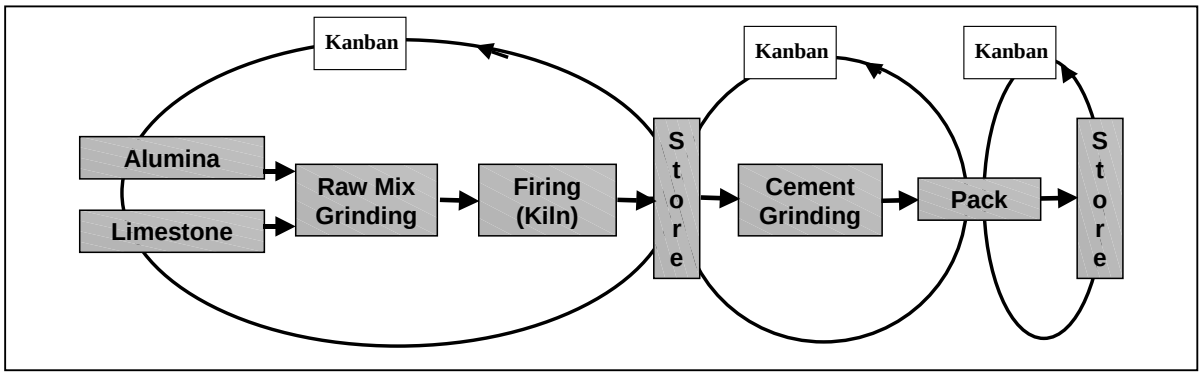

Figure 6: Cement Production Process with ABS

ABS was planned and deployed systematically. Since ABS is a highly visual system, implementing tools such as visual marking with fixed locations for material storage was done at the very beginning of the implementation. This was followed by leveling of production. Figure 7 and 8 show the reduction of inventories without (before) and with (after) ABS. Figure 8 also shows the marked storage areas created to limit the maximum cement storage amount.

Figure 7: Without ABS; Inventory final product

Figure 8: With ABS; Stores final product

The next step in implementation was the development of the loops for the pull system model. Each time a loop was developed, simulations of the loop were performed to test the model and to demonstrate that it could work before it was placed into production. Involving employees from the very beginning in making the changes to these systems was important as it allowed them to see the benefits of ABS and to develop ownership of the new processes. Such employee involvement is critical to a successful deployment of ABS. As various types of waste get eliminated, employees feel empowered about making positive contributions to the business.

To support the supply chain and its individual pull loops, Kanban stations were made to visualize the production flow and inventories. Figure 9 and 10 are examples that illustrate the last loop of the pull system illustrated in Figure 6 (from store to packaging).

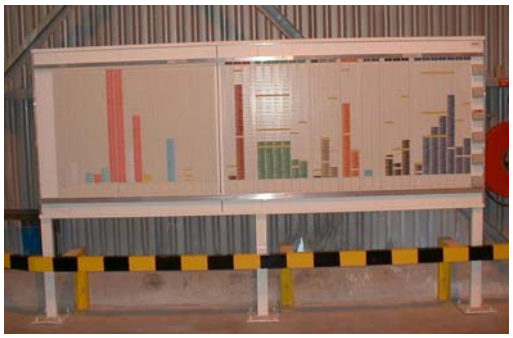

Figure 9: Kanban station board, visualizing actual inventory

Figure 10: Kanban station board, visualizing shipped inventory to be replenished

The Rotterdam cement plant uses forecast information to define a rough leveled production plan. Last minute information is used for the final adjustments. Actual customer shipments result in Kanban movements and drive the production. The order and shipment information is made visual (see Figure 11).

Figure 11: Order leveling

ABS has brought a lot of benefits: inventory levels have reduced substantially while our shipping performance has steadily increased. But more importantly, stability has increased and our employees have taken ownership as ABS enables them to do their best. We look into a challenging future knowing that the system never stands still and requires us, by definition, to continuously improve the productivity and quality.

4. Sharing ABS

The introduction of the ABS principles continues to enable us to improve our quality and productivity. We believe that the whole supply chain, from initial supplier to end customer, can benefit from ABS. In our experience, production improvements have brought stability to our suppliers as well as us. Customers who adopt the ABS principles also bring stability to their supply chain and increase their productivity. Working together, we can expose and eliminate waste, benefiting all parties and improving the linkages between the customer and the supplier.

ABS brings our suppliers and us much closer to our customer and end users. These partnerships are critical in today's highly competitive business environment.

IT'S ALL ABOUT THE CUSTOMER AND THAT'S THE ALMATIS WAY!