

# Use of Six Sigma Tools to Increase Ink Production and Delivery at TINTAS S.A.

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**Keywords:** Six Sigma, Oil-Based ink, Delivery.

## 1. Introduction

Tintas S.A is a chemical company located in Medellín, Colombia–South America, with leadership in both making and selling ink in the Andean market. Its share across the Andean Group has increased in recent years after acquiring important markets such as Flexo, Gravaure, Sheet Fed, Heat Set and Cold Set.

Tintas' infrastructure used to be just one factory, located in Medellín, dedicated to the production of water-based inks, oil-based inks and solvent-based inks, as well as few special products. A later fusion with another inks manufacturer, Sinclair S.A (with factory located in Cali, Colombia) resulted in new specialization assignments for the production of the two factories: Medellín's factory specialized in water and oil-based inks and special products and Cali's factory specialized in solvent-based inks only.

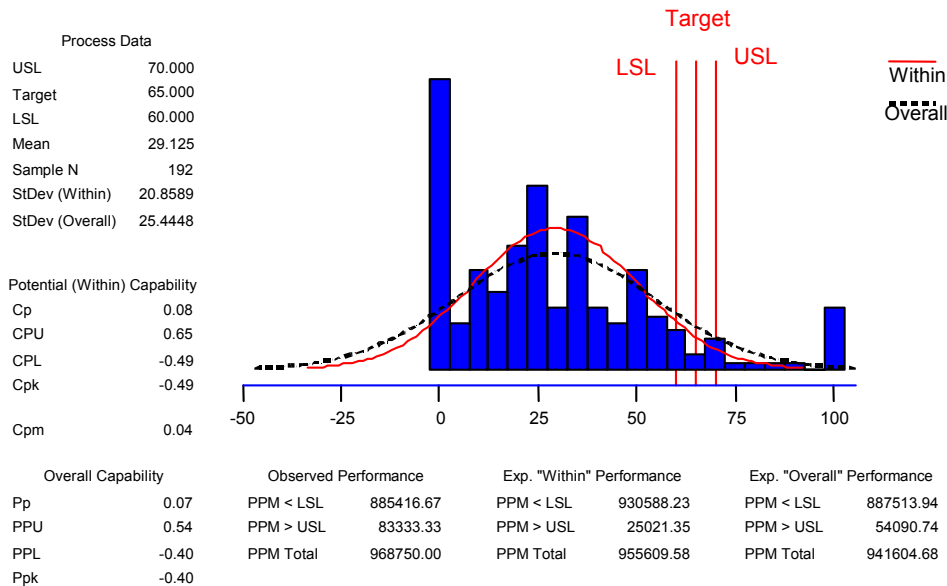
A new six sigma project was initiated with the purpose of improving the production capacity, efficiency, reliability and flexibility of both water and oil-based ink production plants at Medellín's factory, and expecting that a higher production capacity would result in higher sales. The goal was to increase sales profit in US\$ 70,000 and reduce management and production cost in US\$ 30,000 over a 1-year period. Such new project was linked to the on-going six sigma project "final-product stock-time reduction".

## 2. Project Motivation

It was first proposed to work on improving the reliability of oil-based ink production plant due to the following facts:

- Its batch operation was the process with the longest lead-time in the factory.
- Its maximum batch capacity was 450 kg, whereas other production plants had batch production capacities of up to 2000 kg. There was an obvious capacity limitation.
- The product delivery from this plant to the logistics department was had a fulfillment level of only 29% (see Figure 1).

## % Daily Fulfillment (before Six Sigma)

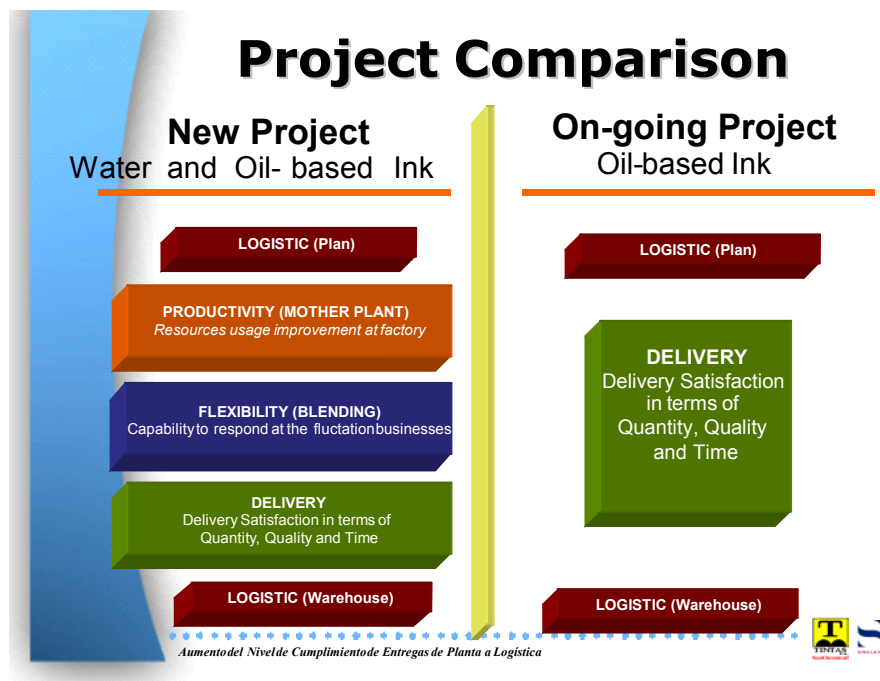


**Figure 1.** Percentage of daily fulfillment of product delivery from the oil-based ink production plant before six sigma project.

- The sales department argued that if oil-based ink production volume and reliability were increased, sales would respond with the same behavior.
- Production priorities were inconsistent due to frequent delays, resulting sometimes in the need for a high number of urgent batches in one single day.
- Product deliveries of approximately 30 tons (requiring about 10 production days) were due to the logistics department, which eventually ran out of Pareto final-product-stock for sale.
- The production plant had up to 90 product deliveries in process (requiring about seven production days), resulting in up to 40 of them being delayed.

### 3. Six Sigma Project Implementation

A comparison of the focus of the on-going project and the new six sigma project is presented in Figure 2.



**Figure 2.** Project comparison.

The new project started with the implementation of a delivery-on-time strategy that needed the collaboration from different departments as described below:

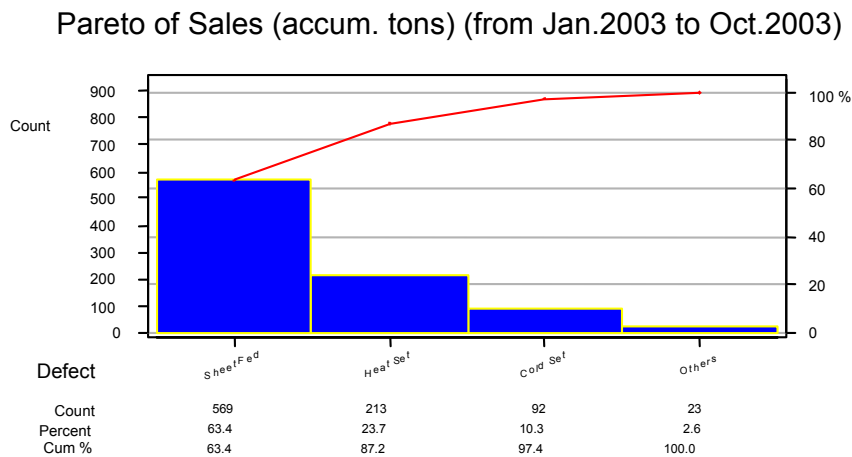
- **Logistics Department:** this department got involved with daily checking of production schedules and classification of those products that were required with more urgency than others. Furthermore, it started to adapt production schedules to plant capacity.
- **Technical Department:** they increased the number of quality control analysts from three to four, which helped reduce product quality approval time; they also updated product formulation standards, and started to work together with some suppliers, specially with Andercol, supplier of Barnizan varnish, in order to accelerate raw materials supply and approval process.
- **Production Department:** This department hired four new operators, helped analyze operation time, process and production capacities, gave thoughtful ideas on how to make improvements, took effective actions to organize and clean the factory and focused more on the relation between operators and the production process.
- **Sales Department:** They prioritized delivery orders, arranged periodic meetings and daily fulfillment evaluations.

The project considered the following three product lines for the Pareto analysis:

- **Sheet Fed:** Ink used for printing of books, magazines, post stamps and brochures. It is the most important from the Pareto and one of the most profitable products.
- **Heat Set:** Ink used for high quality printing of magazines. This product used to be imported, but it's now manufactured at Tintas S.A. It's sales margin was initially negative, but it's been increasing since July 2003 with better current investment returns.
- **Cold Set:** Ink used for printing of newspapers. It's produced in the factory with low sales margin.

These three product lines used to be manufactured at the same plant, with common equipment and unqualified operators. It was decided to start using separate and independent equipment and operators for each line.

Sales composition at the beginning of the project are shown by product line in Figure 3.



**Figure 3.** Sales composition by product family at the beginning of the project, from January to October 2003.

Sales behavior by product line during the first quarter of 2004 is presented in Figure 4. It shows a share growth in all lines, specially for Heat Set and Cold Set.

Pareto of Sales (accum. tons) (from Jan.2004. to Mar.2004)

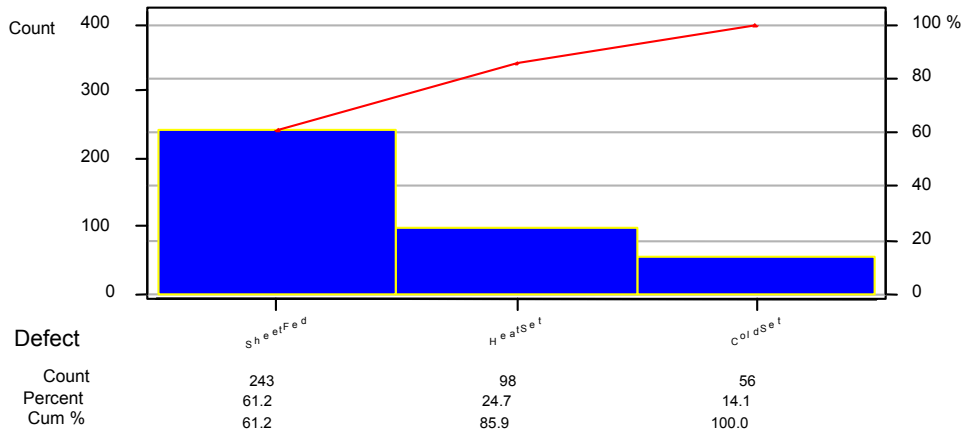


Figure 4. Sales behavior by product line during the first quarter of 2004.

#### 4. Results

Based on effective teamwork, the factory obtained the following results by April 2004:

- Delivery fulfillment level increased from 29% to 62%. (Initial goal was to reach 65%, see Figures 5 and 6).

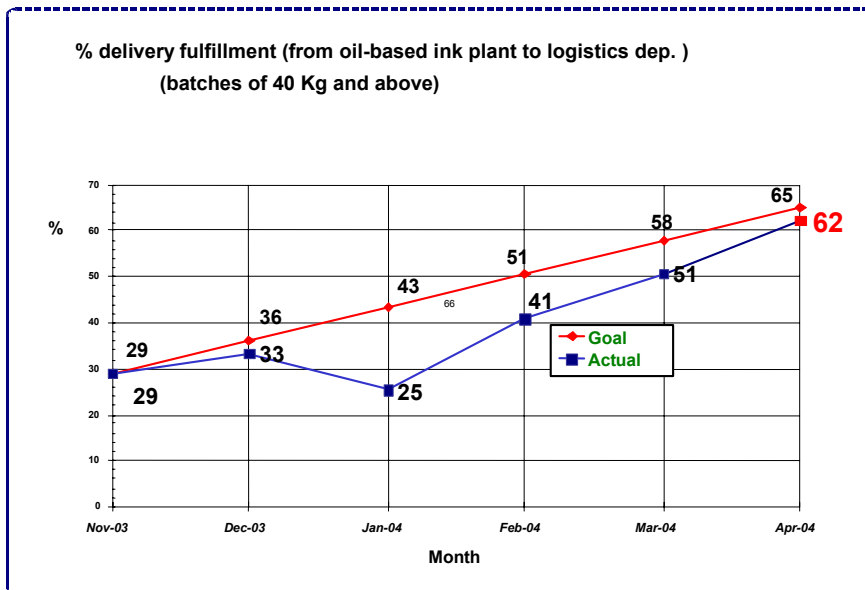
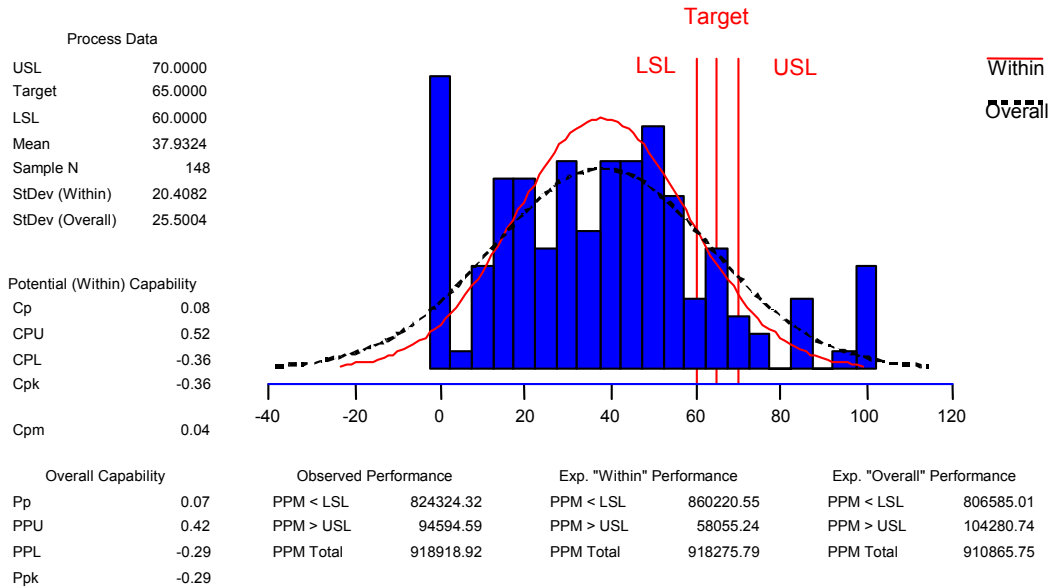


Figure 5. Percentage of fulfillment of product delivery from the oil-based ink production plant to logistics department.

## % Daily fulfillment (after Six Sigma)



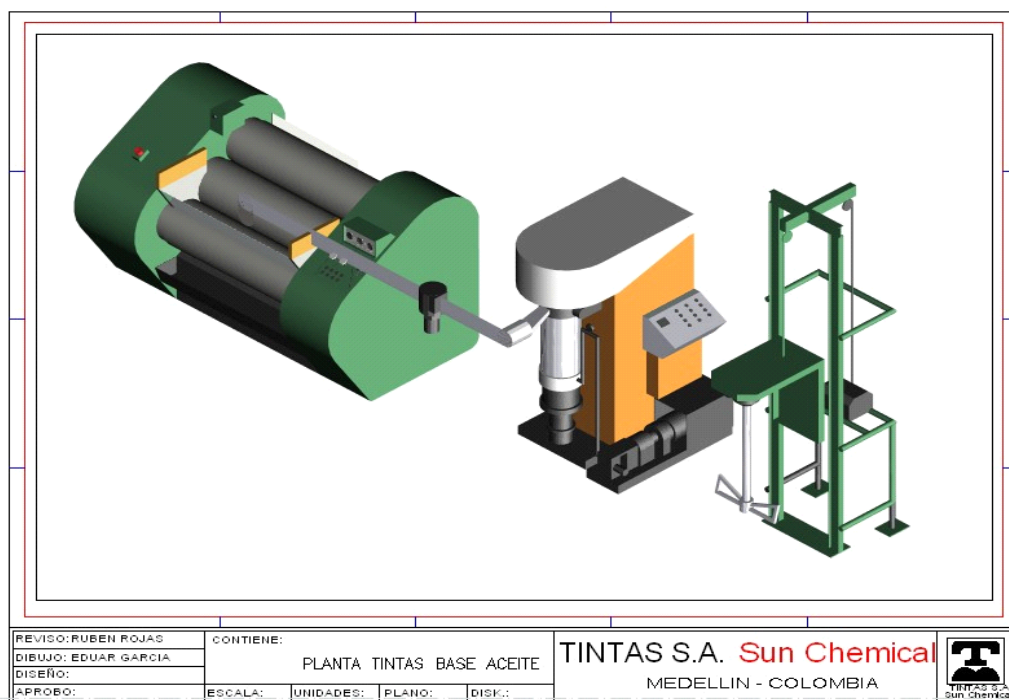
**Figure 6.** Percentage of daily fulfillment of product delivery from the oil-based ink production plant after Six Sigma project.

- The factory is up-to-date regarding delivery orders.
- Sales increased in 112 tons (39% increase) for the first quarter of the year, when compared 2004 vs 2003.
- Sales for the first quarter of 2004 were higher than expected in 51 tons (13%)
- Plant productivity improved from 25 kg/hr-operator (monthly average for 2003) to 27 kg/h-operator in 2004, corresponding to an 11% increase.
- The maximum production record was increased from 137 ton/month (Nov. 2003) to 152 ton/month in February and March 2004.
- The final-product-stock of the Pareto product lines was increased.
- Holidays and extra hours operator work was reduced.
- Plant capacity increased from 15 to 18 orders a day.
- Batch size was enlarged from 450 kg to 650 kg for some products.
- Diminution of order delays: only 10 out of 50 orders were delayed in 2004, compared to 40 out of 90 for 2003.
- Process lead-time was decreased.
- Designs of experiments were proposed to study plant operation and help standardize production process.
- Some measurement and evaluation methods were improved.

All the accomplishments mentioned above were achieved with small capital investment in equipment, tools and labor. It can be concluded that project goals were met after a better adaptation of ink production process to market demands.

## 5. Proposed Future Work:

- Keep working together with the logistics department in order to set attainable product-stock levels according to plant capacity and reliability.
- Production process standardization.
- Reduce the batch size for some products with lower demand in order to diminish their unnecessary final-product-stock and increase production capacity for products with higher demand.
- Implement a mother plant model by linking the pearls mill to the ink rolling mill (see Figure 7) as a way to improve plant efficiency.
- Improve plant layout.



**Figure 7.** Pearls and ink rolling mills join.

### Team Members

Ruben Dario Rojas  
Catalina Gómez.  
Juan Diego Gonzalez  
Rodrigo Posada P.  
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Production Manager – Sponsor.  
Oil – Based Assistant – Green Belt.  
Green Belt.  
Black Belt.  
Advisor.

## **Acknowledgments**

Luis Fernando Restrepo P

Gabriel Jaime Zapata

Luis Fernando Salas

Diego Felipe Rengifo

Robert Selke

Enrique Posada P.

Gustavo Mendoza

Six Sigma Advisors.

Tintas – SunChemical working team.

Oil-based production plant personnel.

Logistics Programming Manager.

Black Belt.

Accounting Manager.

Project Director.

Sun Chemical.

Mechanical Engineer – Advisor.

Tintas S.A. Process Engineer.