



THE COMPANY:



Companhia Siderúrgica Nacional Brazil

CSN is one of the largest and high-performing integrated steel companies in the world. With an annual production capacity of 5.8 million tonnes and around eight thousand employees, CSN is focused on steel, energy, cement production, mining, and logistics. The company has one of the most comprehensive lines of high added value flat steel on offer throughout the South American continent.

Currently, company assets consist of an integrated steel mill, five industrial units, one in the United States and one in Portugal, iron ore, limestone and dolomite mines, a major flat steel distributor, port terminals, as well as shares in railroads and in two hydroelectric plants.

CSN supplies a number of business segments both in Brazil and overseas, with the Automobile, Civil Construction, Packaging, Home Appliances and OEM segments deserving special mention.

The company sells its steel products to customers in Brazil and 71 other countries in North America, Europe and Asia through its sales force and distributors.



THE CHALLENGE:

While enjoying already one of the lowest production costs and highest EBITDA margins in the steel industry, visionary CSN has nevertheless decided to implement SCOOP (Steel Cost Optimization). SCOOP is a strategic decision support tool aimed at selecting the best combination of raw materials that match all quality and technical requirements of integrated operations in order to optimize the profitability of the entire steel making process.

Eneas Garcia Diniz, Executive Director of Steel, found out about SCOOP through a professional publication and, thrilled by the possibilities and advantages offered by the tool to optimize more intensively his production costs, he decided to contact N-SIDE, the company specialized in Operations Research applications for the Steel Industry.





STEEL CASE STUDY

- ▶▶▶ During the first presentation, N-SIDE's representatives made a demonstration of the SCOOP solution customized to the specific situation of the Brazilian market (limited choice of minerals and importation of coals and coke). The different types of possible simulations as well as the rapidity of the tool had the most positive impact at first sight and confirmed the strategic and economical potential that SCOOP could offer to CSN.

"SCOOP is a miracle tool!"

THE SOLUTION:

CSN HAS A TRADITION OF DEVELOPING THEIR OWN MODELS IN ORDER TO CONTROL EACH PROCESS. SCOOP GOES ONE STEP FURTHER, OFFERING AN INTEGRATED SOLUTION THAT OPTIMIZES, TECHNICALLY AND ECONOMICALLY, THE WHOLE STEEL MAKING PROCESS BY TAKING INTO ACCOUNT THE CONTRIBUTION OF EACH DEPARTMENT. FOR CSN, THE FACT THAT SCOOP WAS ABLE TO CALCULATE THE OPTIMIZED PRODUCT MIX TAKING INTO ACCOUNT THE COMPLETE RANGE OF PRODUCTION PHASES WAS THE MOST PRECIOUS ADVANTAGE OF THE TOOL.

ADDED –VALUE OF AN INTEGRATED MODEL

"THERE ARE MULTIPLE ADVANTAGES FROM THE INTEGRATED MODEL OF SCOOP AND THEY CAN BE ILLUSTRATED BY MANY EXAMPLES", SAYS MR. SIDINEY NASCIMENTO SILVA, MANAGER OF METALLURGY PROCESSES. "SCOOP IS USED DAILY WITHIN CSN".

"CSN has its own iron ore mine (sinter feed, pellet feed and lump ore)" explains Mr. Nascimento Silva. "Sometimes the Mn content is lower than needed according to our technical specifications. This means that we need to purchase some external iron ore with higher level of Mn to compensate. Is it a good decision to add external iron ore? In the past, our evaluation was limited as we could only analyze the cost of iron ore and the impact on the cost of ferro-alloys in the steel making shop. By using SCOOP, we can take into account the entire chemical composition of the iron ore. Besides Mn, we can now also trace SiO₂ that causes an increase of slag volume. And this slag supplement leads up to additional requirement for coke and PCI. Impacts are multiple and they concern all production departments. This is an example showing how today, we can quantify the economical part of each raw material thanks to the integration of all the processes into SCOOP".

"Another example is desulfurization", continues Sidney Nascimento Silva. "In the past, desulfurization was done only into torpedo ladles which were not the most efficient vessels because of the geometry. Today this treatment is also carried out in hot metal ladles in order to have a more effective reaction. Unfortunately, CSN has a plant with limited available space which doesn't allow for the implementation of a most modern facility which means in turn that the two ways of doing desulfurization still have to be considered. What is the best ratio to perform desulfurization between hot metal ladle and torpedo





ladle? Thanks to SCOOP, we can now calculate the exact percentage for each process and define the most economical way to do it. Of course, SCOOP considers the different impacts that the use of the two treatments may have on the production process. For example, the need to feed the Basic Oxygen Furnace at the right time to keep productivity at the highest level, the different chemical reactions, and of course the respect of our production planning as this is the most important line in our budget!”

According to CSN, a very important application of SCOOP is also the coke mechanical resistance (drum index). In Brazil, the cost of coals and coke is on average about 30 % of the steel production costs since 100 % of the coals are imported. If the coke oven process is considered as a separate entity, the decision taken would not be the same as if the technical requirements of the entire production process, including the Blast Furnace, are taken into account. By using SCOOP, CSN has been able to analyze the impacts it could generate on the productivity, on the coals injection, on the sulfur content in hot metal and on the costs of desulfurization at the steel making shop.

“In the case of a production plant with two blast furnaces, SCOOP also helps to define the right charging balance needed to obtain the best economical results. It is, of course, possible to do it without SCOOP but the analysis would not as deep, fast and easy to calculate”, specifies Mr. Sidney Nascimento Silva. “We have also used SCOOP to set up the production level when re-opening our Blast Furnace 3 after re-vamping it”.

MULTIPLE SCENARIOS IN JUST ONE CLICK

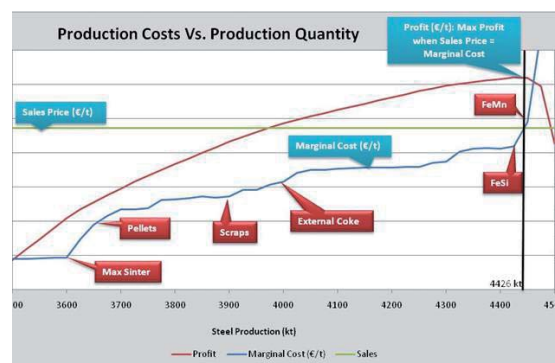
In order to facilitate the decision making process, SCOOP offers the possibility to simulate multiple scenarios and to run comparisons within seconds. SCOOP replaces multiple Excel based models and becomes a central data repository for production and cost related information. With SCOOP, the simulations are just one click away!

“Already during the implementation phase, we have been able to run many simulations with SCOOP in a very short period of time as tough decisions needed to be made. Sometimes it is necessary to be able to take a quick decision, and you need a tool such as SCOOP to make the right choice.” Sidney Nascimento Silva, Metallurgy Processes Manager

Moreover, SCOOP allows knowledge aggregation by incorporating the existing models and specific formulas and technical constraints of the customer within the interactive application which was for CSN an important criteria to make the best out of the tool. Their experience and knowledge is well preserved and useable.

SENSITIVITY ANALYSIS

“Since we have implemented SCOOP, we can now very easily calculate the **marginal production costs** and we have a deeper understanding than with the usual average production costs we used to calculate every day. Thanks to the production cost curve, we have been able to analyze when it is the optimum time to stop production to make sure we are still making profit”, says Mr. Sidney Nascimento Silva.



***N-SIDE respects the privacy of its customers and holds customer data in the highest degree of confidence, therefore: ALL FIGURES CONTAINED IN THE GRAPHS ARE APPROXIMATIONS, AND DO NOT REFLECT ACTUAL SITUATIONS. Nevertheless, we do attempt to reproduce the general lessons that N-SIDE has learned with actual simulations in SCOOP keeping a conservative attitude (less savings) compared to some real case scenarios.**

As an example, Sidney Nascimento Silva, comments about the specific situation of CSN being only self-sufficient for 80% of their production in terms of coke. "If we use external coke, it increases our marginal production cost. Considering in particular our Blast Furnace 2 process, we also need to improve its permeability by adding some pellets in order to reduce skull formation phenomena. At a certain level of production, we do not have enough sinter production and would need to add additional pellets again, etc. We have 5.1 MTPA in terms of Hot Strip Mill capacity. Depending on the slab market price and depending on the hot strip mill - which is our bottleneck, it would cost us money to continue increasing the production".

Due to specificities of CSN regarding their raw materials (the need to purchase external coke), the Executive Director of Steel, Eneas Garcia Diniz, asked N-SIDE to build a quick management decision tool based on the four most important properties of coke. As CSN needs to import 100 % of its coals and 20% of its coke, it is a crucial point to make the best product choice at the right price. Thanks to this particular module, named "COKEPIT" by Eneas Diniz, he can now take preliminary decisions for coke evaluation based on the results of this tool in just one click.



STEEL CASE STUDY

ABOUT N-SIDE:

N-SIDE, Spin-off Company from University Catholic of Louvain, provides optimization solutions to facilitate complex decision-making processes. Our approach is based on the integration of Operations Research and mathematical modelling into easy-to-use IT applications producing very fast returns.

THE RETURN ON INVESTMENT:

Based on the first presentation of SCOOP, CSN believed strongly in the economical potential of the tool and stated that the investment analysis was such an easy exercise. In order to be on the safe side, they have built their investment plan fixing a minimum ROI of 0.50 Real per tonne and considering a production lower than full capacity. "It was not difficult to prove it was worth to invest into SCOOP. In fact, even being extremely conservative, if you consider the production volume, it already means a minimum additional profit of 2.5 million Real per year. Our investment decision in the SCOOP tool was obvious", said Sidney Nascimento Silva, **Metallurgy Processes Manager**.

"It is with no doubt that CSN decided to invest into SCOOP. And 6 months after implementation, the results are already far beyond expectations!"



Sidney Nascimento Silva,
Metallurgy Processes Manager



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