

# *How to implement lean in a public company in Chile Without failing in the attempt*

## Cómo instalar lean en una empresa pública y no caer en el intento

Rojas Saavedra, Juan \*

\* Gerente Corporativo de Excelencia Operacional, CODELCO, CHILE

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### Abstract

*Chile is the largest producer of copper worldwide, where CODELCO, a state-owned enterprise, generates 10% of the global production of this metal. In 2015, the copper mining industry faced significant challenges due to price fluctuations, reaching a minimum of US\$ 2.49 per pound. As a result, the cost of operations began to gain greater importance and was highlighted as an important factor to consider.*

*Not oblivious to the, CODELCO faces the uncertainties of time while seeking to maintain its position in the global market. This article reports how the copper company decided to embark on a different and sustainable path over time: it developed a management system based on Lean methodology to enhance continuous improvement. The outcome is a system called C+ consisting of a set of disciplines, practices, and tools that have improved the company's management.*

*After years of effort and implementation, the state-owned company managed to establish a new way of doing things, leading it to be recognized in May 2023 by the Shingo Institute at the University of Utah (United States). This recognition made it the world's first mining company to receive this award for excellence in organizational culture. It is an achievement that fuels the ongoing effort for continuous improvement.*

**Keywords:** LIPS; Mining Industry; Lean methodology; Continuous Improvement; Public Sector.

### Resumen

Chile es el mayor productor de cobre a nivel mundial, donde CODELCO, empresa pública del estado, genera el 10% de la producción global de este metal. El año 2015 la industria minera del cobre experimentó desafíos importantes dadas las fluctuaciones de su precio, llegando a un mínimo de US\$ 2,49 la libra. Como resultado, el costo de las operaciones comenzó a tomar mayor importancia desde la gestión y se releva como un factor importante a considerar.

No ajeno a lo antes descrito, CODELCO se enfrenta a las inclemencias del tiempo buscando mantener su posicionamiento en el mercado global. Este artículo reporta como la cuprífera decidió emprender un camino distinto y sustentable en el tiempo: el desarrolló un sistema de gestión basado en la metodología Lean para potenciar la mejora continua. El resultado es un sistema denominado C+ que está constituido por un conjunto de disciplinas, prácticas y herramientas que han permitido mejorar la gestión de la empresa.

Luego de años de esfuerzo e implementaciones, la estatal logró establecer una nueva forma de hacer las cosas, lo que la llevó a ser reconocida en mayo de 2023 por el Instituto Shingo de la Universidad de Utah (Estados Unidos), convirtiéndose en la primera empresa minera del mundo en recibir este galardón a la excelencia en cultura organizacional. Un logro que alimenta el esfuerzo de mejora continua puesto en marcha.

**Palabras clave:** LIPS; Industria Minera; Metodología Lean; Mejora Continua; Sector Público.

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### <sup>1</sup> Corresponding author:

Gerente Corporativo de Excelencia Operacional, CODELCO.

Corresponding author: [juan.rojas@odelco.cl](mailto:juan.rojas@odelco.cl)

## 1. Introduction

*Much is said about Lean methodology, its success stories in production lines, and the benefits it brings to any operational activity, across various bibliographies, regardless of the industry. However, this article aims to capture something not typically found in books: how to steer an organization, unaccustomed to change, toward going beyond and achieving transformation.*

*We'll start with what became ingrained in the organizational culture of 20th-century companies: being rigid, hierarchical, result-oriented, among other things. We'll navigate those waters to then approach the human aspect, where the "it has always been done this way" becomes the main barrier or the worst enemy. The journey will allow us to uncover some secrets that will undoubtedly be useful for those who take on the challenge and, faced with disillusionment, don't end up in a corner of the office, frustrated with a feeling of having failed.*

*This is why the title alludes to "not falling in the attempt"; it's part of the challenge. It's also worth mentioning that the journey is not short, and that must be made clear, but it will be a great opportunity to learn and discover what this adventure offers. All the experiences analyzed here aim to involve you through acquired knowledge, to keep you vigilant and not repeat what probably should not be done. The most important thing - and the great secret - is to not fear the difference and, above all, to manage resilience very well, as it will be necessary to be strong when things don't work out or when you simply encounter an "I'm not interested."*

*That's what this journey is about, and it's precisely what this document brings: the step-by-step guide to "not falling in the attempt" and a few simple (yet useful) tips.*

*We'll approach this document in four sections. First, we'll discuss the theoretical baseline to understand the context and the main concepts. Subsequently, we'll navigate through the four disciplines defined as part of the C+ management system, familiarize ourselves with the principles, and finally, take the first steps on this journey.*

## 2. Theoretical Baseline: Lean Concepts and Utilized Know-How

*To set the context, let's discuss how Lean methodology was introduced in the largest state-owned company in Chile, responsible for producing 10% of the world's copper and contributing significantly to the Chilean government. Codelco is a company with over a century of history, where many have grown under its wing and undoubtedly hold it dear. The author of this article is, in fact, one of them and began life in Chuquicamata site, during the campsite years.*

*His father, an employee of the company, showed him what Codelco was like back then. That Chuquicamata vibrated during the Miner's Week with sports and cultural activities, offering the community events and activities such as social clubs where even New Year's parties were held.*

*Today, that campsite practically no longer exists. It transformed into part of the landscape of industrial compounds due to the Division's and the company's growth. Nevertheless, the culture endured. Starting from that point, we speak of mentalities and behaviors inherent to a group of people who spent a lot of time together, the ruggedness of the industry, the inclemency of weather, and the risk of life at every moment.*

*Over time, that child who lived in the campsite understood that Codelco was much more than Chuquicamata. He discovered there were other workplaces as significant as the one that welcomed him as a child. El Teniente, Andina, and Salvador emerged in his history. Eventually, working as a professional in the state-owned company, he witnessed the birth of Radomiro Tomic and had the opportunity to contribute to other projects. That's why this person, now a professional at Codelco and the author of this article, can claim to know this Corporation and comprehend its complexity.*

*We're talking about a company with many traditions rooted in its culture, a long history involving many people, extensive and spread from the north to the south of Chile. It's even a company with many differences! Due to these geographical distances, those living in the central-southern region thought and operated in a very different manner from those in the north. This became evident when they convened for various reasons. But change was necessary.*

*At the beginning of 2015, as mentioned earlier in this document, the company felt the need to do something different.*

*It was essential to seek a way to bring out the best in people, achieve more with the same resources, and be more productive. This pursuit was prompted by the contingency of copper prices and operational costs. In that context, it was observed how the El Teniente Division's management successfully initiated the first steps of the "Lean" methodology in the company back in 2010. The team eagerly implemented tools that led to improvements, but the learning curve was long and varied. Nevertheless, that eagerness sowed a seed that years later would become the path Codelco would follow.*

*Let's return to 2015 then. It was a tough period when copper mining was affected by low prices, costs were high, and a different approach was needed. But how could this be achieved? It was then, led by the CEO and vice presidents at that time, that the decision to adopt "Lean in Codelco" was made, and it was dubbed C+.*

### **2.1. What is Lean?**

*The Lean approach originated in the Toyota Production System (TPS) in the 1950s, developed by Taiichi Ohno (Japanese Engineer 1912-1990, creator of Just in Time and the Toyota production system) and his team to address challenges faced by the Japanese manufacturing industry at that time, including resource scarcity and the need to enhance efficiency while reducing costs.*

*The primary goal of TPS back then was to create a more flexible production system that could swiftly adapt to market demand changes and produce high-quality products at low costs. To achieve this, the model was based on the concepts of "just-in-time" (JIT) and "jidoka."*

*JIT involves producing only what is needed, in the right quantity and at the right time, to avoid excess inventory and minimize waiting time. Jidoka, on the other hand, translates to "automation with a human touch" and refers to machines' ability to detect production process issues and stop automatically to prevent the creation of defective parts. Through these concepts, the company understood the importance of the link between creating value for the customer and eliminating waste, integrating them into the goals of the new methodology.*

*Another adopted definition from TPS was "Go and see," a practice inviting individuals to physically witness an improvement made by people within a process. Through this activity, they identify who made the improvement, how they did it, and the involvement of resources. Under that paradigm, part of the Codelco team visited two national companies, and the team leader's first thought was "impossible for us to do." That was the first prejudice that is remembered to this day. Nobody would have thought that years later, the same person would be leading the implementation of Lean methodology in the company.*

*This philosophy emphasizes eliminating waste and standardizing processes. It touches on the mindsets and behaviors of individuals, involving something challenging, i.e., discipline. From the methodology, clear practices emerge, such as synchronized schedule management, performance dialogues, problem-solving, continuous improvement cycles, just-in-time, time-on-tool, and a series of tools serving ultimately to eliminate wastes, which are nothing but the inefficiencies that can be detected through on-site process analysis and that are represented in (Figure 1). By reducing waste, we lower costs, improve quality, and generate consistent production levels. At the same time, these wastes also impact variability; when we reduce them, it means we are enhancing the process's reliability. We must acknowledge that waste is nothing but work that does not physically transform the product or meet a specific customer requirement. On the other hand, incidental activities are those tasks necessary to complete value-added work but do not directly contribute value to the product (e.g., internal transport). Finally, value-added activities are any activities that directly transform the product to meet a specific customer requirement, something the customer is willing to pay for. Therefore, our focus should be on waste elimination, minimizing incidental activities, and maximizing value.*

*Nevertheless, for this philosophy, the most crucial element is people. Hence, the concept of GEMBA (the place where things happen) is highly relevant for those seeking continuous improvement.*



Figure 1. Eight Mudas Taiichi Ohno, Toyota Production System

## 2.2 Where Does Lean Come From?

As previously mentioned, Lean originates from the Toyota Production System, and it won't be detailed further than already described. However, one critical aspect must be highlighted, which will be of vital importance: the system's origin in Japan and how it helps understand that a change in mentalities and behaviors can be transformative. But why?

Those who have had the opportunity to be in that tremendous country have experienced a concept that is challenging to replicate: discipline. How did Japan recover from the Second World War? Have you ever thought about it? In the city of Hiroshima, there exists an incredible museum at Ground Zero. There, one realizes how they managed to build a developed country as it is today. That is the culture (mentality and behavior) referenced by the TPS and, therefore, Lean methodology.

Let's begin from there, a culture that we will use as a reference point. A culture that we will seek to align with: to be and to appear. Let's start to be Lean.

The first thing to do is to "believe in oneself." If individuals don't believe in or aren't convinced about the journey or the methodology, it's better to stop there and not waste time trying to implement something they doubt. On the other hand, if there's conviction, it's crucial to involve leaders and encourage them to believe in the system. This will likely require a considerable amount of energy because it won't be just one conversation but several to make them listen and possibly influence them.

I'll preempt that not everyone will agree: 70% will remain reluctant, 15% will refuse in any case because they'll perceive it as a waste of time, and only the remaining 15% will be supportive. Hence, the real strength lies in that last percentage, with their help, the goal will be to attract the 70% and, finally, to some extent, persuade a portion of the furthest 15% (who might change their opinion).

## 3. Disciplines and Practices of the C+ Management System

It was then established that Lean within Codelco would be known as the C+ management system and, to cement its implementation, it would be one of the enablers of the strategy (Figure 2).

It's also important to note that the definition of this new way of eliminating waste and capturing value is based on four disciplines: Common Goal, Continuous Improvement, Efficient Processes, and People Development. As depicted in (Figure 2), the four disciplines with their main associated practices can be seen. Through the first dimension, the company defines its full potential or maximum process capacity, respecting the safety of individuals, maintenance, its design

capability, among other assets. It is where technical limits are measured, and aspirations are determined.

From continuous improvement, different tools are implemented to help mitigate bottlenecks that prevent reaching maximum potential. Simultaneously, everything must be standardized to maintain process efficiency dynamically, striving for constant perfection. But most importantly: this must be done with the involvement of people.

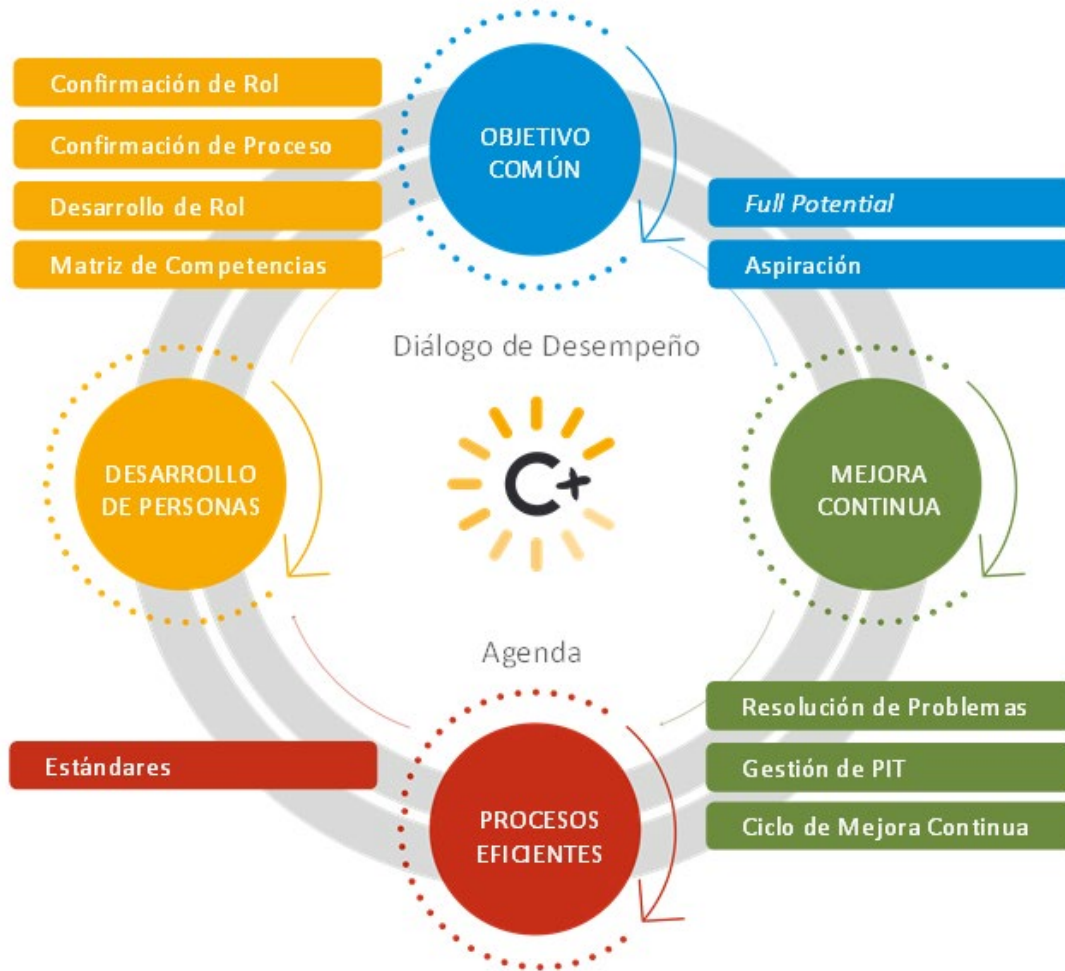


Figure 2. Disciplines, Practices, and Tools of the C+ Management System

### 3.1 Principles of the C+ Management System

Behaviors (i.e., activating the practice) must be grounded in beliefs and values (i.e., mentalities) to become deeply ingrained in the culture. For this reason, it was crucial to define the principles that would be followed, reflecting the DNA of the C+ management system. To do so, information was gathered from Toyota, and the discovery was Shingo Shingo's methodology (1909-1990), a Japanese industrial engineer and a key expert in the Toyota Production System (TPS).

Shingo is renowned for his work in improving production efficiency and eliminating waste in manufacturing processes. This Japanese industrial engineer developed the theory of "autonomous inspection," which focuses on early detection and problem-solving in the production process to prevent the creation of defective parts.

The expert also formulated the concept of "poka-yoke," which means "error-proofing." This approach involves designing processes and products that concentrate on error prevention rather than detecting and correcting them afterward. Poka-yoke devices are designed to prevent operators from making mistakes during the production process, reducing waste and enhancing product quality.

After reviewing all this background (and more), it was decided to follow that line. It made a lot of sense. Thus, Operational Excellence at Codelco, the department implementing and developing C+, declared its ten principles (Figure 3):

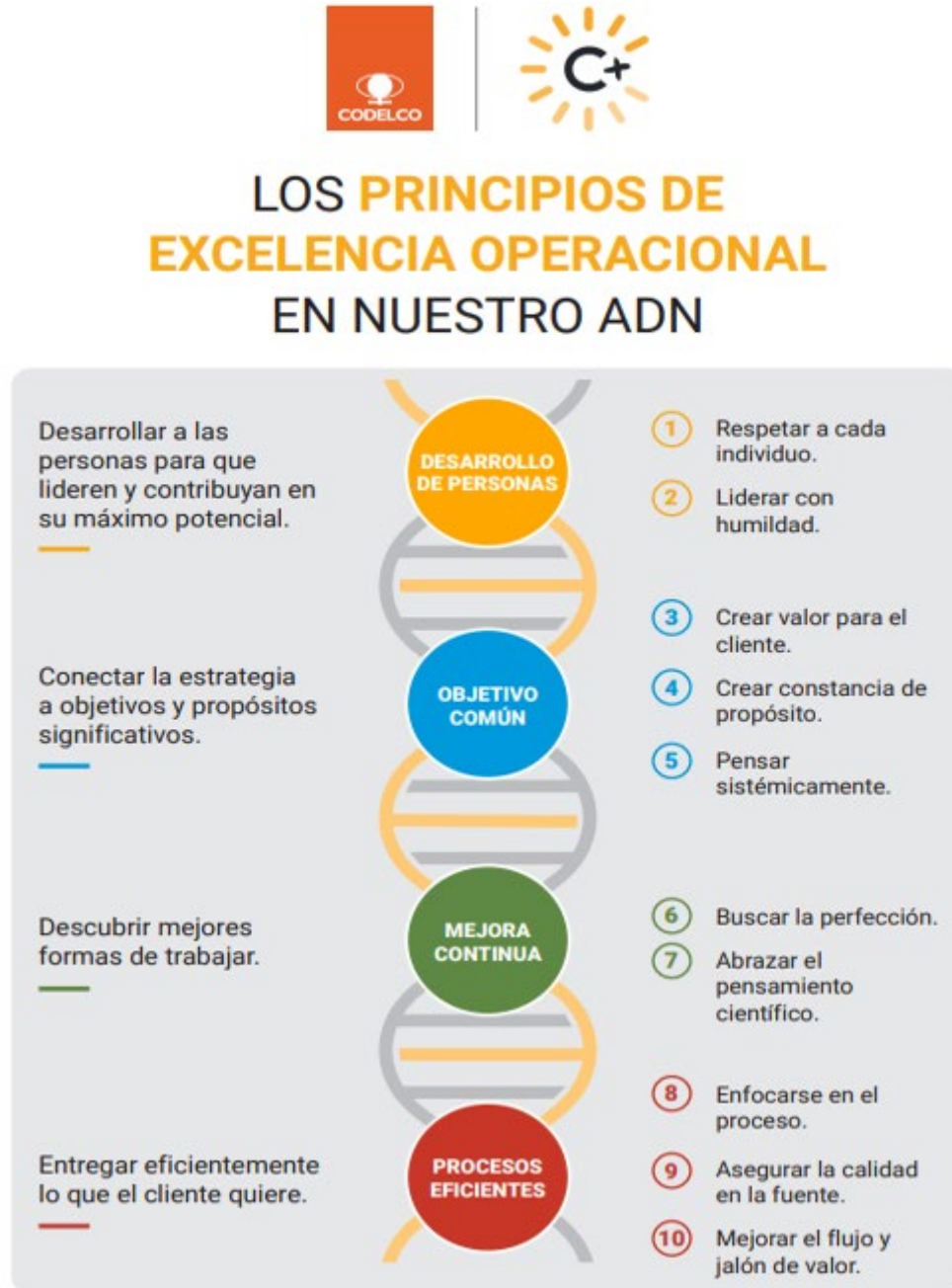


Figure 3. C+ Management System Principles. Based on the Shingo Principles, promoted by the Shingo Institute at the University of Utah in the state of the same name in the US.

## 4. *What are the Principles of Operational Excellence at Codelco?*

### 4.1C+ **Discipline: People Development**

- *Respect every individual: A core value expressed in the company's values charter as respect for the life and dignity of individuals. It's a principle that urges us to establish respect and understanding towards people as a baseline.*
- *Lead with humility: Humility is an enabling principle that precedes learning and improvement. It's a leader's action to gather opinions, listen attentively, and continuously learn from their workers, creating an environment where team members feel motivated, respected, and freely contribute their creative abilities.*

### 4.2 C+ **Discipline: Common Objective**

- *Create value for the customer: Both internal and external customers, value should be defined around what they need. Organizations that cannot deliver this effectively and efficiently are not sustainable in the long run.*
- *Create constancy of purpose: This principle acknowledges why the organization exists, what its purpose is, where it is heading, and how it will achieve that goal. It enables individuals within the organization to align their actions in connection with the common purpose.*
- *Think systemically: This principle invites us to see things in an interconnected way, understanding that obstacles don't lie in the functions performed but in the relationships between them. This approach allows for a natural alignment with the organization's desired outcomes.*

### 4.3 C+ **Discipline: Continuous Improvement**

- *Seek perfection: Perfection is an aspiration that might not be achieved, yet its pursuit creates a mindset and culture of continuous improvement. What is possible is only limited by the paradigms through which we perceive and understand the organization's current reality.*
- *Embrace scientific thinking: This principle encourages us to maintain critical and innovative thinking, go to the Gemba or "where things happen," have direct observation, and gain insights. An incessant and systematic exploration of new ideas, including failures, allows us to continually refine our understanding of reality.*

### 4.4 C+ **Discipline: Efficient Processes**

- *Focus on the process: This principle urges us to comprehend that every result is a consequence of a process. A deficient process will have negative outcomes in the long term, regardless of the quality of the individuals executing it.*
- *Ensure quality at the source: Ensuring quality at the source leads to meeting our customer's specifications by ensuring that our work is done safely, efficiently, and effectively. If a defect occurs in a product, service, or process, it should be detected and corrected instantly to prevent its downstream propagation.*
- *Improve flow and value pull: This principle invites us to understand that customer value is maximized when it's created in response to real demand and through continuous and uninterrupted flow.*

## 5. *The First Steps*

### 5.1 **Project Kickoff**

*At this point, some recommendations that will be useful when starting the journey will be provided.*

*First, assembling a team is essential, as this cannot be achieved solely with the desire to do so. This is the initial lesson. With this, the management system must be defined, as previously indicated, which will carry Lean Management in its DNA, aiming not only for the medium term but also (and to a large extent) for the long term.*

*Next, there should be a communications team that amplifies positive deviations in the process. The quickest way to reach and involve people is through a good communication strategy, so this should not be left until the end. This team must accompany those implementing the project from the beginning; otherwise, important milestones in the growth story will be missed, reducing the chances of documenting, or acquiring valuable material to contribute to the implementation tactics.*

### 5.2 **Definition of the Management System**

*In alignment with the four previously mentioned disciplines, the first one highlighted is the Common Objective. Through this, concrete goals aligned with the business strategy are defined, and initiatives to achieve them are raised. This*

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is when practices begin to emerge, supporting people in determining these steps and objectives, such as the "full potential" or maximum potential.

The full potential method aims to find the technical limit of a phase or process, determining the maximum that can be produced or done optimally. To know this, different variables must be considered, such as equipment maintenance or services. However, depending on the industry, it's highly likely that this result corresponding to the technical limit is not being met. Why? Because there are probably gaps, and wastes that astonishingly exist and have never been seen or have simply transformed into conditions that everyone is accustomed to.

This is when it's crucial to seek out who does it best within the company, the industry, or perhaps even globally. By doing so, you activate the second principle of Operational Excellence in Codelco: leading with humility. Learning from others is not a bad thing; it's perfectly fine. Remember that after that knowledge transfer, they will come to see you if the implementation is successful.

With the maximum potential and bottlenecks preventing the attainment of the full potential identified and visible, the conditions for defining the Aspiration<sup>11</sup> will be established. It's essential to bear in mind that to reach that maximum potential, several Aspirations must be defined along the way, guiding step by step towards the maximum potential. Also, it's important to emphasize that defining an aspiration equal to the full potential is a certain failure. It would be too far in terms of time and form, and the team would be demotivated by not seeing early results.

Next comes the second discipline called Continuous Improvement, where the best ways of working are discovered to prevent problems from recurring. Here, tools you've probably heard of, such as 5S, SMED, Just in Time, among others, come into play, aiding in solving bottlenecks and providing sustainability to the process. These tools must be accompanied by a practice called Problem Solving (PS), which contributes to identifying root causes and resolution initiatives that are then prioritized, organized, and executed in tactical implementation plans.

The third discipline is called Efficient Processes, where individuals acquire methods to raise best practices and drive synergies, achieving process standardization, always with a focus on what the customer requires. It might seem less relevant, but as progress is made in problem-solving with the workers, the best steps for performing a task are identified and recorded, laid out visibly in one or two sheets. This is when the standard is born, created by those who execute the process and will faithfully follow it as part of continuous improvement. These standards should be periodically adjusted as better ways of doing things emerge.

The last, but for some, the most important discipline, is People Development because none of this will be possible if we are not strongly connected with people. Spaces must be enabled for them to perform tasks more comfortably and correctly, but it's also crucial to develop them, bring out their best version. Therefore, providing good feedback or insights and empowering them through coaching will be crucial. Leadership transforms into a facilitator, teaching and helping others to develop towards their maximum potential.

### 5.3 Implementation of Disciplines

Having defined the four dimensions of the C+ management system and briefly discussed the tools and practices that comprise them, connected - of course - to governing principles, now arises the natural question of "how to put them into practice?" As we progress, some relevant and important tips will be discussed.

We talked about the common objective and the full potential, how do we implement it? First and foremost, it will be crucial to have a clear understanding of its definition: obtaining the maximum capacity of assets, considering their maintenance and without causing damage. In Codelco, a book called "Full Potential" was developed for each division, containing key information about the flow of each phase and its processes.

During this collection of information and different variables, it is recognized in detail which equipment is being used and, consequently, the maximum processing capacity of each of them according to their factory design. It is anticipated that it is not easy. Often finding this information will be a challenging task, but it will depend on the amount of equipment on the production line. Nevertheless, it will be crucial to gather all that data to later define the maximum capacity and the technical limit of each.

Therefore, based on the above, it is determined how much each one of them is processing and how much it should be according to the manufacturer's definition. In this contrast and study of why there are gaps, the first bottlenecks will begin to be identified. For example, upstream equipment cannot fill its capacity because other downstream equipment cannot produce more. This is where we start defining where the limits are that hinder smooth operation and where in the process efforts

<sup>11</sup> Aspiration: Achievable goals set with early completion dates that, as they are achieved, motivate the team to find the common end: the technical limit.



should be focused.

Then we must define the Overall Equipment Effectiveness (OEE), that is, we must construct the indicator that helps us determine the efficiency of use, availability, and performance. Here, the most important thing is to start defining, based on these variables, the tree of KPIs associated with each. For instance, truck utilization (KPI utilization based on availability) will be the result of the KPIs associated with that process. Eventually, this translates into addressing issues like time in the changing or lunchroom, etc. Often these things do not require high-cost engineering; they have always been there and can be improved, but we never see them, we just get used to them. The losses should always be valued, it's very likely that prioritizing the path to take will be necessary, but it won't be possible to take them all, especially if it involves changing people's mindsets and behaviors.

Let's go back to bottlenecks and OEE. It is essential to look at the process's OEE to know where the problem might lie. Even though this is highly focused on mining, how could this be applied to other industries? For instance, in the public service sector, one must define the customer, then the value you want to add, and subsequently identify waste; the latter is associated with the full potential while looking at the process flow.

From when the customer enters until they leave the consultation, at first glance, you can see bottlenecks such as waiting time, required documentation, and bed availability, among others. That's why correctly defining the aspiration is essential, remembering that it's the first of many to reach the optimum. But what is that optimum? It's the technical limit, which must be found by analyzing the process and seeing the maximum capacities available to operate at each step. Then you will know where the bottleneck(s) is, which should then be addressed. This works for everything, even in personal life flow. Don't forget it.

Later, Codelco's experience will be recounted on becoming the world's first mining company to be recognized by an international institution for creating a real change with results in a phase and process. But here we are, just identifying the gaps and knowing how much can be produced, handled, or generated. With this information obtained, short-term goals (Aspirations) can be defined to reach that technical limit.

Now let's move on to continuous improvement; this is where the analyzed bottlenecks and the KPIs that need improvement to yield a value-added result for the customer must be addressed. Let's use again the example of truck utilization. In an open-pit operation, there were trucks with very low utilization; no matter how much they tried to speed up, nothing happened. They were maintaining 10 effective hours out of the 24 in a day, where the industry benchmark speaks of an average of approximately 16 to 17 hours. This affected the upstream process more as less ore was transported to the crusher, and so on. To find out why it wasn't reaching the expected level, a problem-solving (or PS by its acronym<sup>22</sup>) approach was used with the team, and by this, I mean integrating all involved to analyze utilization. Once this tool was activated, the indicator in the graphs was very low, so the individuals began to look at the KPIs associated with truck availability (remember this was identified through the full potential), and as they delved into the value tree, those involved in the research group realized that the break and shift change times were the problems. They could have thought of anything else, but in the end, it was about mindsets and behaviors of people. They had to fight against the "we've always done it this way," convince the performers that there are standardized ways of doing things that will enable them to reduce variability between shifts, add value to the customer, and eliminate waste that was affecting the entire process. We won't delve into details, but it's important to highlight that one must be a change agent, a leader. Remember that this is the one who teaches and helps, works with the operator, shows them they can be optimal, and makes them see what their purpose is, and what the common goal is (remember that it was defined at the beginning).

Although the choice of the tool to shorten the gap depends on the improvement opportunity and its variables, in this case, to increase time, "Just in Time" and "Time on Tool" were used. This implementation was carried out with the operators, and they saw the problem and realized where they needed to improve. They wrote it down and created their standard with the help of the change agent. Suddenly, we enter the third discipline of "Generating the standard." After this, the change agent employs the "two-passenger bike" practice, where both pedal but only one steer:

- Station 1: The operator goes behind the bike and doesn't pedal but just holds on; the agent pedals and steers.
- Station 2: The operator pedals, the agent doesn't pedal but steers.
- Station 3: The operator pedals and steers in front, and the agent pedals behind.
- Station 4: The operator pedals and steers, the agent only observes.
- Station 5: The operator rides the bike alone.

This is part of the operator's learning process. At this point, it covers the People Development discipline: involving, teaching, and confirming the process, that is, the standard created by the operators themselves. Through this observation, the team's adherence to the standard is measured, and if training is required, it shouldn't be seen as punishment. Good

<sup>22</sup> Problem Resolution (PS), an 8-step standard that guides workgroups to seek the root cause of the problem.

*feedback helps a lot in this stage of activating the management system.*

*But now comes the question everyone expects to ask: "Did it improve?" Of course, it did! That was the initial bottleneck that was predominantly impacting the OEE. In this case, there was a 7% improvement, increasing the effective hours from 9 to 12. Undoubtedly, there's much more to be done; there are other bottlenecks that need attention. How can we know what they are? It's necessary to look at the process (full potential) once again and examine the KPI tree since the gap can be maintained in utilization or it could lie in availability, and there might be another issue (equipment performance, maintenance, etc.).*

*It's important to note that there are alerts in the process that haven't been described: it may seem straightforward, but it takes time to get used to the discipline required for progress. Achieving a KPI (12 effective hours) means nothing if it's not sustainable over time, and for that, continuous improvement is necessary through process confirmation.*

#### **5.4 Sustaining, Learning, and Improving**

*Now, practices begin to emerge that aim to sustain, address issues, and improve as much as possible. One of these is the "Performance Dialogue," which is more than just a standard created by the team to monitor their KPIs; it holds additional value. Here, something crucial is addressed, something that many overlook, people. All of this is built with people. Who created the truck standard? Who will create the standard in the primary care room? Who will set the standard for the teachers' council? As described, it's the workers who are behind this. They are the ones who know the process the best and emphasizing them is called the "Inverted Pyramid."*

*When the base of the pyramid, where the workers are, proposes ideas based on the strategic guidelines coming from the administration, the pyramid is inverted. For instance: "We need to improve production at the Plant. We've noticed that not enough ore is arriving, and there's a low truck utilization," the problem must be addressed and dealt with at the base of the pyramid, with the assistance of a change agent, and start the "Bicycle" process.*

*So, going back to the performance dialogue: first, the leader of the session will ask the operators "How are you today," genuinely concerned about them. Knowing how they are and preparing for someone who arrives at a 2 out of 5 or being pleased when someone averages 5. Here, moods are shared, results are reviewed, discussions about why there are red flags happen, and a commitment, written by them, is made on how to bridge the gap. The good KPIs are also celebrated, acknowledging the achievement. There's nothing more motivating and gratifying than proper recognition. Leverage communications, as mentioned at the beginning, to amplify those that demonstrate the desired behaviors.*

*Along this line, and periodically, communications about the achieved milestones, with workers as protagonists, should be shared. If there's continuous improvement, the standard is modified, and KPIs increase, the company's leader should be invited to confirm the process (remember that this system should be installed at all levels; the company's president should know what a performance dialogue is, what a standard is, and what continuous improvement is). When that team of operators receives the CEO to congratulate them, it creates spaces of trust and commitment. It's recommended to add a breakfast or lunch, anything that allows the president to listen to them, connecting the base of the pyramid with top management, reinforcing the idea that everyone has and follows the same common goal. If this is achieved, congratulations! You are on the right track to having a management system in place. But don't just celebrate, remember the full potential, there are many more bottlenecks, and many more operators who need help eliminating waste.*

*Japanese culture identified eight types of waste already organized within the TPS (Toyota Production System): Overproduction, Time, Transport, Processes, Inventory, Movement, Defects, and Talent. This last waste has recently been added since it has become evident that people's talent is not being leveraged or developed (the fourth discipline of the management system).*

*We've taken a general overview of the C+ management system, but this is cyclical. We must constantly review our full potential in case of changes and always look at the bottlenecks that are emerging. It's essential to be clear that there are companies in the world that have been in this virtuous circle of continuous improvement for over 30 years, better known as the CMC "Continuous Improvement Cycle," where we solve problems, so they don't happen again. And, as we also mentioned, adding a series of tools that help us improve processes.*

*Just as we saw one of the practices that cut across the four disciplines of C+ (performance dialogue), others are also relevant. When in a dialogue (lasting no more than 30 minutes), problems are detected, and there's no clear solution, one must move to a stage that isn't in that dialogue but does have a standard, and that's the Problem Resolution (PS). We mentioned this when discussing the discipline of continuous improvement.*

*PR is a standard with 8 steps that will lead you to a solution constructed with the work team:*

- 1. Define the problem.*

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2. *Break down the problem.*
3. *Define the objective.*
4. *Analyze direct causes.*
5. *Identify apparent causes.*
6. *Develop the Tactical Implementation Plan (TIP).*
7. *Perform TIP follow-up.*
8. *Finally, standardize and share the learning.*

*The solution must be transformed into a standard that can always be improved, moving to the dimension we saw earlier, but starting from a concrete base.*

*How to maintain discipline in this? Perhaps there's no clear secret, but one way to start is through the agenda, also taken as a cross-functional practice.*

*This is a very simple yet complex stage, as it requires something challenging for us - discipline and synchronization. Start by creating the leader's agenda, where activities should be highlighted, associating them with each of the management system's disciplines. It's ideal if they're also recorded in different colors for visual management (the recommendation is to keep the common goal in blue, continuous improvement in green, standards development in red, and people development in yellow).*

*So, start with the agenda and categorize it as deemed appropriate, but it should be noted that one-third of it should focus on people's development. The connection with the team should be from the perspective of people, and sessions deployed from this item should be related to providing feedback or coaching. There's literature that can help understand these two practices in detail, but it's essential to highlight that a feedback session should be prepared using the OILS method:*

- *Observation: Where specific facts that can be identified without judgments or interpretations are seen.*
- *Impact: Thoughts, feelings, and reactions that occur in response to the observed behavior and how it might impact the business or process.*
- *Listening: Allows understanding the viewpoint regarding the impact, both as an observer and the observed.*
- *Suggestion: Allows suggesting to the observed person how they could do it differently in the future, which should conclude in an improvement agreement.*

*The OILS is a practice commonly used during role and process confirmations. And again, the question arises, what is a role confirmation? It's simply the routine of observing and providing feedback (OILS) to a person on how they perform a management system practice to improve their execution and perfect it. What is process confirmation? Let's remember the discipline where the standard is developed (red), this is where this routine of observing and providing feedback (OILS) to a person on how they execute a standard and their adherence appears, to improve their performance.*

*The stages that should be kept in mind and not forgotten for these two very relevant activities are, Preparation, Observation, Feedback (OILS), and Follow-up. The latter is very important as agreements must be followed up; otherwise, they're likely to amount to nothing.}*

*So far, we've taken a practical journey through the entire Codelco's management system, but there's something crucial that cannot be overlooked: recognition. It's likely that in organizations, due to organizational culture or simply due to lack of time, recognition isn't practiced. It refers to that recognition carried out by the leadership, something intimate to the daily effort, commitment, and adherence to the management system.*

*Before delving deeper into that, let's remember that 15% will be enthusiastic about this new implementation, but 70% will be very indecisive and waiting to be influenced. In that last task, celebrating efforts and reinforcing desired behaviors through immediate recognition from leadership and in front of the team, for instance, is an excellent tool for persuading change. Here, again, the role of the communications team is very relevant, to support intelligent amplification or deployment. The remaining 15%, which simply doesn't adhere, should not be abandoned; priority should be given to those in the 70% mentioned earlier.*

## 6. Results and Shingo Prize

*From the principles of Operational Excellence (Shingo) and connected to the DNA of C+, Codelco embarked on a journey. It was thought that to have different results, something different must be done, and the Corporation undertook a path towards continuous improvement, where leadership is and will be fundamental.*

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*The implementation began in three workplaces (divisions of Codelco), but in two of them, the methodology couldn't be sustained, and only one managed to break through the barrier. This doesn't mean that the others failed in their attempt; it's just that setbacks make the journey longer. However, with all divisions now part of C+, it was observed how that third one continued to mature. It was decided to take a step further, and that became one of the turning points in our history: taking the Company to a higher level and subjecting it to an evaluation by external parties to see if we are truly on the right track. This led to the application for the Shingo recognition, granted by the Shingo Institute at the University of Utah (United States). It was a major challenge for our culture, but we were confident that the results would be positive to drive a change and make it permanent.*

*After two and a half years of working hand in hand with people in preparation, advancing in maturity, providing sustainability to the C+ system, and continuously improving, Codelco became the first mining company in the world to be recognized by this prestigious institution with the highest Shingo Prize. (Figure 4)*



**Figure 4.** Shingo Prize Recognition to Codelco RT - Dry Area<sup>33</sup>

*Many may not be familiar with this. They can seek literature that demonstrates what this recognition seeks. However, the main point to know is that it measures the state, experience, and maturity of the principles from the mentality and behavior of individuals, which translates into a culture of organizational excellence.*

*Of course, this is undeniably a source of pride for Radomiro Tomic Division and all Codelco, which generated a greater commitment from the people within the organization. Inverting the pyramid was fundamental, having the commitment of the people for a common purpose and language, embracing principles such as respect for each other and humble leadership, where people are paramount, and the ideas of workers can move mountains. This is and will always be a sure path to success.*

## 7. Conclusions

*Lean is not only for a public enterprise; Lean applies to all organizations and also in life. It has been proven that this works, provided the willingness to do so starts from within oneself.*

*To transform, one must transform oneself. The document mentioned earlier illustrates an example of what Codelco*

<sup>3</sup> The Shingo Institute is a non-profit organization dedicated to promoting business excellence through the implementation of management practices based on the principles of the Toyota Production System (TPS), also known as the Toyota Production System (TPS). The Institute's goal is to help companies and organizations improve their efficiency, quality, and profitability by implementing management practices based on TPS principles and Lean philosophy. Founded in 1988 by the Shingo family and other TPS experts, the Shingo Institute aims to promote the understanding and application of TPS principles worldwide. The Institute awards the Shingo Prize, which recognizes companies and organizations that have achieved excellence in implementing management practices based on TPS principles and Lean philosophy. The Shingo Prize is considered one of the most prestigious awards for business excellence globally.

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*has experienced in recent years. Undoubtedly, there is still much left to complete the journey, and perhaps it will never be fully completed as continuous improvement challenges us every day.*

*There's a saying that "the winner was a dreamer who never gave up." We dreamed strongly, as a team, and today almost 60% of the organization is already connected, working with the system. Yet, there is a clear understanding that there is much ground to cover. Despite all judgments about being a state-owned enterprise in Chile, we are witnesses and protagonists that this is possible to achieve. Bringing out the best version of individuals, changing mentality and behavior, won't be easy, but it's possible only if one remains steadfast to "not fall in the attempt."*

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