

# Digital Platform for Continuous Improvement in Food Industry Projects: implementation and application

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December 2020

## Abstract

Consumer expectations and beliefs are constantly changing. To ensure their position in the global market, companies must adapt quickly to these changes. Thus, it becomes imperative to use Continuous Improvement (CI) methodologies to meet their needs in the best possible way. This work was developed at the Bimbo Donuts facilities, whose main objectives were the implementation and application of a digital platform for problem solving in the food industry. During a six-week period several improvements were proposed through the usage of common CI's tools. However, a new method was adopted that used a digital platform aiming to optimize the improvement process itself. This experience made it possible to understand the impact caused by this innovation.

At the same time, the status of the platform's implementation was assessed after nine months. The attendance was not as expected, so a survey was carried out to assess possible causes. Based on the obtained results, it is intended to mitigate the found problems and adopt a more appropriate approach to the concerned population. In addition, the study for the full implementation in the factory was started, where is intended to integrate operators.

**Keywords:** Continuous improvement, Digital platform, Food industry.

## 1. Introduction

The proposed work aims to implement a digital platform within the scope of Continuous Improvement (CI), as a consequence of Bimbo Group initiative to overcome some difficulties encountered in developing the theme in the company. It follows the current trend of companies to take the advantage of technological transformation and digitalization. In this context, a study of its benefits is made through a digital platform that promises to change the dynamics of Continuous Improvement as it was known until then. In addition, since it is in the initial phase of use, work was also carried out in the scope of the platform's implementation.

In the last decades, the business environment has seen numerous changes such as globalization, powerful technological advances, increasingly demanding and informed customers. Quality is seen as a key business concept, the speed of adaptation and society's greater awareness of environmental and ethical problems as competitive variables. For these reasons, the search for Continuous Improvement has become vital for organizations to aspire to excellence [1]. It is proven that more than technical advances, organizational improvements and the development of workers' skills help the company achieve success [2].

The benefits of Continuous Improvement for a company have been known and studied for over a century. Among them, there is greater productivity and agility, as it is argued that everyone should contribute, facilitating the evolution of the organization in more areas than would be possible if only one person tried to solve all problems. In turn, it makes the organization able to easily adapt to changes inherent to market conditions, through a decentralized decision-making structure. This methodology also promotes a culture of learning, where failure is seen as an opportunity to increase knowledge [3].

This project was carried out on an internship (six week period), in which it was proposed in order to fulfill the following objectives:

- apply a digital platform for problem solving in food industry;
- assess the impacts of platform utilization regarding Continuous Improvement process;
- plan the digital platform implementation on the shop floor.

## 2. Literature Review

Continuous Improvement is a philosophy that, according to Bessant *et al.* (1994), is described as "a process focused on incremental and continuous innovation throughout the company" [4]. CI projects can be applied in different work environments. Thus, it becomes necessary to evaluate every time the type of product, the choice of the process and the degree of standardization, in order to later decide on the most appropriate methods and, consequently, to implement the best improvement practice.

To implement CI, there are several tools and methodologies. The most important tool is PDCA cycle, that is commonly represented by a wheel, in which it is needed to accomplish the four steps (Plan, Do, Check, Act) to go forward to success [5]. On the other hand, the best known and studied methodologies are Theory of Constraints, Lean Philosophy, Six Sigma and Total Quality Management. Among them, the most popular in organizations is Lean Philosophy, for being an holistic paradigm, thus generating much more solutions across all value stream map. This is based on two key concepts "Cost reduction by eliminating waste" and "Total utilization of workers' capacities" [6]. Subsequently, this paradigm provide a toolkit composed by many techniques who aims to find problems and its causes, as well as solving them based on their nature, ensuring quality, safety, cost reduction, employee commitment, etc. Between them, there is Gemba Walks, Value Stream Mapping, Overall Equipment Effectiveness, Visual Control, Single Minute Exchange of Die, Five Whys (5W's), Kaban, Poka-Yoke, 5S, which are commonly used in industry environment.

Even so, the implementation of these measures is highly difficult and, in general, becomes ineffective if there is no collaboration from all parts of the organization, as well as the necessary resources and support from top management [7]. McLean and Antony (2014) conducted extensive research on the causes of failure of Continuous Improvement initiatives, where they point out 8 main aspects: motives and expectations, since people create utopian expectations and short-term results leading to frustration; organizational culture and environment, thus some companies have an organizational culture resistant to change; management leadership, once CI projects require high levels of employee involvement and time allocation, however, companies often lack support from top management; implementation approach, where the level at which the initiative is carried out, the speed of deployment and the method used are fundamental aspects for the success of the projects; training, where many aspects have to be discussed, such as the importance of projects'

content, how to approach learning and put into practice the knowledge learned during the preparation of effective workers; project management, when there are pre-determined solutions, little active participation by the project team and lack of mentor support for improvement employees; employee involvement levels, given the importance of employee involvement, to form a team it is necessary take into account their reservations about the improvement initiative (e.g. previous experiences with other change programs); feedback and results, flaws in the mechanisms of critical analysis (poor communication within the organization), that can lead to the perceived failure of the initiative in long term.

In view of these problems, there was a need to conduct research in this area, in order to overcome the scourges found. It was realized that it would be a good choice to take advantage of technological advancement and digitalization, and to use a digital platform in CI routine. Digital transformation is defined by Buer *et al.* as a way to create new business opportunities through the use of digital technology and data [8]. Digitalization allows the collection of a vast amount of data (Big Data) generated by humans connected to the Internet, or directly connected to machines, using the Internet of things (IoT), for example. However, some companies face obstacles in this transformation, so strategies that avoid failure and consequently frustration must be adopted [9]. For this, there are compromise systems in which users interact dynamically with digital tools on a daily basis, whose value is measured in terms of the number and quality of interactions. The objective is to create a system that increases the commitment of users with high quality experience, together with greater value creation. A cycle is formed as more value generation translates into greater commitment; hence, greater involvement leads to more data, therefore more value, and so on [9]. Regarding to CI, there are platforms developed such as REVER, Parsable, Weever, Friday and The Lean Way. Currently, we are going through the fourth revolution, also known as Industry 4.0, which came up with the Internet. We are experiencing it every day and therefore its magnitude is not yet known [10]. Industry 4.0 is the first industrial revolution to be released *a priori*, which makes a concept still very ambiguous and in which there are many doubts and inconsistencies. The lack of empirical data on this topic makes the research very theoretical. Still, Buer *et al.* (2018) believe that this dynamic can be a good opportunity to define and optimize solutions before they are public [8]. Following what was discussed, one of the focuses of the present work was the understanding of the benefits of using a digital platform (REVER) in the development of Continuous Improvement works, in a food industry factory, where manufacturing is still very present.

### 3. Materials and Methods

#### 3.1. Digital platform - REVER

The digital platform used to change CI routine at Bimbo Group was REVER, that has web and app versions.

On app, it is possible to create Challenges and REVs (name given by its creators to problem solving proposals); it also allows to see and track those that are open (Challenges- those that were created, but still have no suggestions for solving the documented problem; REVs- those that are not yet implemented); this version still allows to observe the final result after the implementation of REV.

The web version allows doing everything described above, but also to access the Challenges and REVs placed by other factories of the same business group; observe the evolution of assessment, since it provides graphs with the number of REVs accumulated in the desired period of time, the REVs by state (Implemented, Failed, Ready to be implemented, In progress), and by typology (Health and Safety, Waste reduction, Quality, etc.). It also presents financial reports, namely Cost reduction, New revenue and Total investment. Finally, for motivational purposes and for possible rewards, the platform also analyzes the most committed users, based on each person's score. Each

user receives points for their activity on the platform, either for creating a Challenge or a REV, or for belonging to a team, for example. REVER has its own scoring system, in short, the user will be more scored, as more complete the Challenge/REV is.

#### Challenge

Challenge corresponds to an identified problem, and it can be more or less specific, that is, it can correspond to a section of a line identified as it stands out for presenting low performance, but also a concrete equipment that is not performing correctly its job. In the case of Challenges, it is not necessary to analyze the root cause or any other type of assessment to be placed on the platform. When a Challenge is created, it is expected that any employee will be interested in finding a way to solve it, without having to assign the work to anyone, nor create a team right away.

#### REV

REVs are proposals for solving identified problems at factory. Each Challenge can be associated with one or more REVs, however, not all REVs are necessarily implemented, as they may not be the most suitable for the problem. Even, they can be "recycled" for other Challenges.

When creating a REV, ideally, and to earn more points, the author should associate a photography of the problem together with a short description that facilitates its understanding.

The platform has a scoring system and each step completed adds points to the REV. In addition, when it is implemented, when it is reimplemented and for each "like" placed (similar to social media), the project's score also increases. As a general rule, the more points the better. This will be important when you want to reward those responsible for the best projects, for example.

Another step to take in creating a REV is to categorize it. The platform presents a list of categories (Cost reduction, Health and safety, Capacity improvement, Quality, etc.) that must be selected (one or more) by the REV author, according to the nature of the created project. This allows an analysis of the typology of all the REVs created, using the web version of the platform.

Since there are several types of problems, there are also several ways to address them, so the creators of the platform distinguished REVs into three types: Improvement Idea, Quick Action, Problem Solving. Improvement idea is intended to solve a problem that, although it is not a source of stopping production, is not yet optimized. It is intended to be applied in cases where the platform user finds a way to facilitate the operator's activity, the organization and cleanliness of the work space, or to increase food and/or personal security. The second one is used when problems are detected in the process, and are already compromising food quality and safety. It is recommended to adopt this method when the user is faced with a machine malfunction, or a raw material with unexpected behavior/performance, for example. Problem Solving REV is intended for inconsistencies in the process or recurrences of problems. These are parameterizations, unsuitable indications of procedure (Standard Operating Procedure), materials, operating times, etc. This REV applies to cases where there is a risk of loss of product quality, or accumulation of it at some point in the process due to poor parameterization, for example.

##### 3.1.1 Problem collection method

The methodology adopted to collect problems was Gemba walks. This methodology consists on going to the place where things happen, in this case, to the production lines, and collecting problems.

In the first week of the internship, a collection of errors was made without much criteria or guidance, purposefully, so the attention was not directed, in advance, to problems already identified, but to others that were eventually easily detected by new workers.

For the next two weeks, the goal was to focus on one line per shift, trying to observe the morning and afternoon shifts on all

lines. Here the focus was essentially on operators (quantity and conduct), and equipment performance.

After familiarization with the factory, with the processes, with the operators, etc., the approach was directed to the behavior of the products in its various stages, taking into account the previously studied. In other words, at this stage, it became easier to collect failures and reach more valid conclusions using tools such as 5W and 5M.

As it was the initial phase of using the platform, for each problem detected, it was recorded on paper, describing the time of collection, location, product and, if justified, the number of times it occurred in a given period. In addition, it was taken a photography (with the tablet available to use REVER on the shop floor) to associate to each problem. Yet, the problems were discussed daily, in order to understand what the approach should be for each one and whether it would be a project to create in the application or not.

### 3.2. Digital platform implementation

The implementation of REVER, in the first instance, occurred only in a multidisciplinary group of workers, more specifically, those responsible for production, safety, quality, maintenance, but also the factory supervisors. These were trained to clarify the basic aspects of the platform's operation.

To raise awareness of the use of the application, two pamphlets were made. One of them clarifies the difference between Challenge and REV, and in turn between the various types of REV that their distinction is not clear. The other one presents a proposed methodology for inserting the platform in the workers' routine.

In addition, during this internship, two different questionnaires were designed by the intern and her supervisor to assess the status of the platform's implementation.

The first survey was answered anonymously, via web using the Google application, Google Forms, and consists of twenty-five questions. Respondents belong to Bimbo's factories in Portugal, that is, Mem Martins and Albergaria. The sample corresponds to the group of workers selected to use the platform in the first phase of implementation, already mentioned.

The questionnaire was divided into four groups, each with its objectives:

- I. to characterize each respondent as to their age and academic formation, but also their contact with New Information and Communication Technologies (NICT);
- II. to understand the experience of each person in CI projects, which personality traits are most relevant to enhance a project and the difficulties felt in carrying out one through the traditional way (without the use of a digital platform);
- III. to analyze the current state (September 2020) of the platform implementation. Conclude as to the access and request suggestions to overcome the difficulties felt in the use of the platform itself, but also in its insertion in the work routine;
- IV. to conjecture as to the future of the platform at the factory. Investigate the best approach for implementation on the shop floor, considering various aspects such as preparation of the managers to provide training, preparation of operators for this novelty and the most convenient line.

To complement the study of the third and fourth groups, a second, simpler survey was conducted, with only three questions (age group, academic formation and whether they have Smartphone or Tablet) directed only to a group of operators. For the selection of the sample under study in this parallel survey, the first concern was to look for permanent workers. Within this group, account was taken of their responsibility, experience and proactivity in CI work done previously. Data collection was carried out by filling in a table, also maintaining the anonymity of the participants.

Survey 1
- <b>Sample:</b> 19 employees (middle managers) from Mem Martins and Albergaria factories
- <b>Number of questions:</b> 25 (divided into 4 groups)
- <b>Term:</b> 2020-08-27 to 2020-09-23

Survey 2
- <b>Sample:</b> 28 operators of the five production lines (morning and afternoon shifts) at the Mem Martins factory
- <b>Number of questions:</b> 3
- <b>Term:</b> 2020-09-01 to 2020-09-16

## 4. Results and Discussion

### 4.1. Digital platform implementation

In order to start implementing the platform, it was decided not to include operators immediately, so that only supervisors and those responsible for production, safety, quality and maintenance were given access. Thus, by making this multidisciplinary selection, at the time of expansion for employees subordinate to the former, the training is expected to be in chain, which allows it to be more targeted and effective.

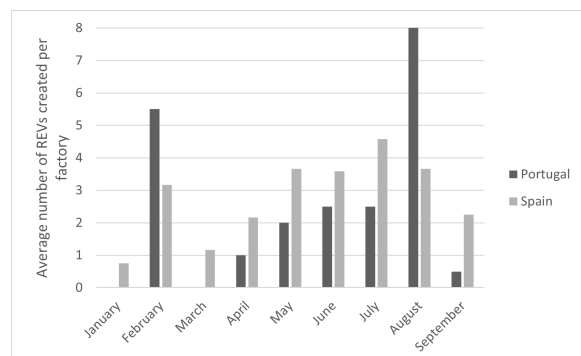


Figure 1: Monthly average of REVs created at Bimbo Group factories in Portugal and Spain in the first nine months of implementation of the REVER digital platform (2020).

In Figure 1 it is possible to observe the average number of REVs created by factory in Portugal and Spain in each month since the start of the platform implementation. That is, the total number of REVs created in each month was divided by the number of factories in each country. It should be noted that in Portugal the platform was implemented only in February and there are only 2 factories with a total of 16 active users (approximately 8 per factory), Spain has already started using REVER in January and participates with 12 factories, in a total 146 active users (about 12 per factory). Note that the number of users corresponds to the number of accounts created up to September, and it is not possible to understand from what moment and if these values are constant.

It can be seen that, in general, in Spanish factories more REVs are created, however, there are two very evident moments in the behavior of factories in Portugal, namely in February and August. The first accounts for the month in which the training was given to employees, where exclusive time was dedicated for this purpose, so it would be expected that several REVs would be created. The second moment coincides with the training of an intern, that is, when there was a person entirely dedicated to continuous improvement work. The internship started in mid-July, however, due to the adaptation period at the factory, the results were only pronounced in August.

It is also important to note that in the months from March to June, both countries were initially in a state of emergency and later calamity, due to the Covid-19 pandemic, so that platform users had shorter hours and/or worked on a rotation system. This explains the sharp drop in March, followed by a gradual growth in the following months.

#### 4.1.1 Implementation at middle management level

As a consequence of the results exposed above, it was tried to understand the causes of the low access of Portuguese workers to the new problem solving methodology. For that, it was necessary to step back and the platform implementation itself became an improvement project. Thereupon, a survey was created for employees with accounts already open. 19 responses were obtained, 10 from Mem Martins and 9 from Albergaria factories. The survey was carried out in such a way that the first three groups provided a root causes analysis of this low access to REVER. The fourth aimed to find solutions to mitigate or extinguish the identified problems and make a study of what should be the best way to take the next step, that is, to integrate the operators in the REVER user group. Also because of this last factor, the propensity of operators to use the platform was also studied, so another simpler survey was carried out.

To analyze the possible causes of the failure of platform implementation, an Ishikawa Diagram was designed (Figure 2), proceeding to a 5M analysis (Materials, Mother nature, Measurement, Man and Method). Although it is a tool commonly used for the industrial area specifically, it was adapted to this situation.

In Materials, are presented the difficulties felt during the internship, as is the case Tablet operation and the difficult accessibility to the Internet in certain factory spots. These factors will become especially critical when it is intended to use the platform on the shop floor, as aimed. If it is not fully functional, it will cause operators' disinterest and will not have the desired impact. The lack of smartphones in the company refers specifically to the coordinators of the departments involved. The app download on personal mobile phones is not allowed for security reasons. On the other hand, since they are key workers for the evolution of the projects, both for their guidance and for their validation, it is important that they have a device that can be consulted at any time, such as smartphone.

As for the "Mother nature" category, the main factors that divert users' attention are the pandemic COVID-19 and the arrival of new equipment at the factory. With the emergence of the pandemic, the priority was to carry out the best possible management that would allow production to continue, since in a food industry company (basic goods are produced), and at the same time, the safety of all workers had to be guaranteed. Furthermore, due to the various phases of the pandemic, the measures could not be tight, so they had to be constantly updated as the situation evolved.

As for the causes dependent on people (Man), as well as those dependent on the implementation Method, and even on the Measurement, they require more attention, so the survey responses assist in this analysis.

##### Age/scholarship

From first survey, it was verified that almost 73% of the middle managers belongs to millennials generation. It is a generation made up of people who grew up at a time when technology began to have an influence on the daily lives of the population. For this reason, they were born with an innate capacity for the digital world. Furthermore, it was concluded that about 90% have at least secondary education. These are great indicators to platform utilization, so it should not be a constraint.

##### Uncomfortableness with NICT

In response to the question "What devices do you use daily?", it was obtained the trend observed in Figure 3. The preferred devices with a wide margin are the Computer and Smartphone, followed by the slightly less chosen Tablet. Well, the three most used devices are the same ones where the platform can be accessed, therefore, the vast majority are able to use the available tool.

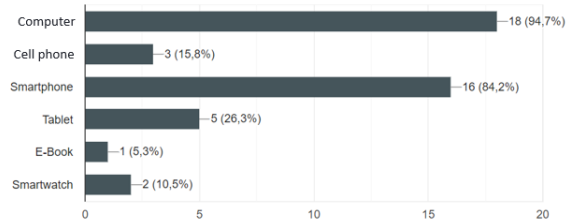


Figure 3: Devices commonly used by selected workers (Survey 1).

It should be noted that 3 of the 19 respondents prefer to use Cell phone over Smartphone. Cell phone means a device with less sophisticated technology, with a keyboard, capable of making calls, sending SMS, taking photos and making videos, even having Bluetooth and Wi-Fi, however it does not allow downloading applications or PDF documents, for example. The reason for the preference was questioned and 100% said they did not feel the need to have a Smartphone and one of them revealed "price" as another reason for choosing.

##### Low contact with social media/digital platforms

Then, was asked "Are you a user of social media? If so, which one(s)?" and "If the answer to the previous question was affirmative: What are you looking for on social media?".

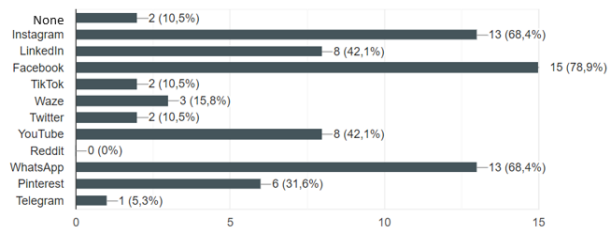


Figure 4: Social media used by the surveyed population (Survey 1).

From the results obtained (Figure 4), it can be seen that only two people do not have any contact with digital platforms. On the other hand, the most used social media are Facebook, WhatsApp and Instagram. Accordingly with results obtained from second question, what respondents look for in social media corroborates the chosen applications, since they seek to keep in touch with others, to be aware of what is happening around them and still find ideas for solving problems.

REVER, although used in a professional context, meets these three main needs. This platform allows dialogue with other members of the work team, in fact in a very similar way to Facebook and Instagram. The communication is made through the images with the appropriate descriptions, it has a comment box in each Challenge/REV, which enhances the discussion among the members of the platform, and it is still possible to put "likes" in the suggested ideas, as in social media. The application also makes it possible to keep abreast of the development of posted works, either of which the user is responsible, or of other teams. Also, in its web version, since it allows access to projects from other factories, it allows to take ideas or effectively find solutions based on the experience of others, resulting in less experimentation time and less risk of failure. Sometimes, in these researches, we still find ideas that have never been questioned until then, but that could be an asset for the factory.

##### Inexperience in CI

On the second group of survey 1, it was inquired about CI experience. Therefore, close to 1/3 of the population never had contact with CI works and also approximately 1/3 has less than 2 years of experience in the work position where you are currently. A thorough research on answers allowed us to realize that 2/3 of the people who had never participated in CI projects, have less than 2 years of experience in the work position, and the rest have been in the current position for more than 10 years. This may indicate, in the first case, that these are new elements in the company, generally motivated and open to new

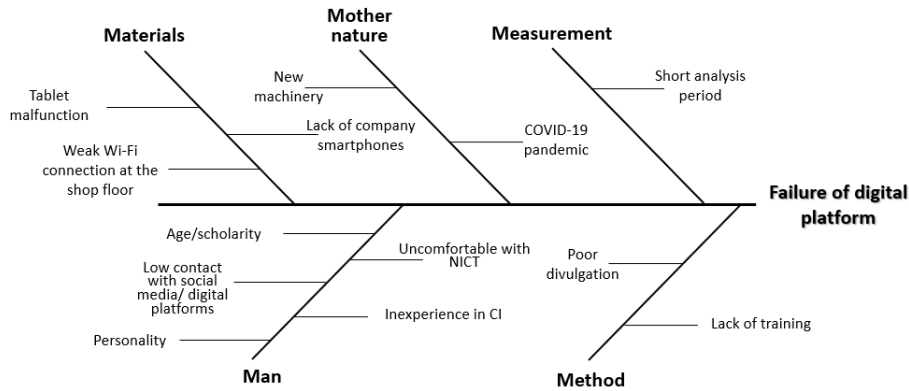


Figure 2: Root cause analysis of REVER implementation failure in Portuguese Bimbo Group factories through the Ishikawa Diagram (5M analysis).

challenges. In the second, it can refer to workers who have been showing useful for projects and the years of experience in their work position may be advantageous for a more thoughtful and assertive contribution. Even so, most of the workers surveyed have participated in CI projects and have several years of experience in their current work position, which reduces the possibility of embarrassment when it comes to contributing with good ideas.

### Personality

Given that several studies on the Lean paradigm (TPS) indicate that the main cause of the failure of CI projects are people, it was decided to analyze the personality of this select group of workers [11].

Firstly, they were asked to select the 3 personality traits considered most relevant to successful CI works. The most voted were proactivity, persistence and openness.

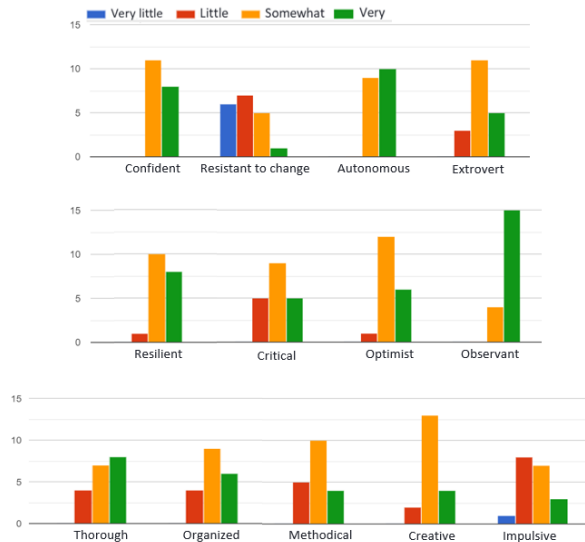


Figure 5: Self-assessment of the personality of the surveyed population (Survey 1).

It was solicited to each employee to do his self-assessment taking into account the list of personality traits presented. Thus, it can be seen from Figure 5 that the most common traits are "confident", "autonomous" and "observant". Those with greater dispersion are "resistant to change", "thorough", "critic" and "impulsive". Bearing in mind the answers given, the selected elements are, in general, adequate, although there are aspects that must be improved. These employees are considered almost entirely, at least reasonably resilient. On the other hand, when it comes to openness, there is less consistency and more than 50 % have some difficulty in dealing with change. Regarding proactivity, in the scope of CI, it was considered that it can

be unfolded into confidence, autonomy, creativity and observation. However, future work must be developed to confirm that proactivity in the CI domain becomes the four personality traits considered.

### Short analysis period

They were asked to estimate the frequency which they accessed the platform, converting it on a scale of 0 to 5, where 0 equals "never" and 5 corresponds to "daily" (survey 1). Note that attendance does not only correspond to the opening of projects, but also to contribute to the evolution of those already open, or to search for ideas in other Bimbo Group factory.

It was concluded that only 21% accessed platform at least once a week, however, the percentage that corresponds to "never having explored the application" is around 26%. Once more than a quarter never had any contact with REVER, the possibility that the low creation of projects is influenced by the short period of analysis, or even a little problematic phase of the factory, may be excluded.

### Lack of training

At the beginning of February, workers (middle managers) began to be trained in groups, but it was not possible to train everyone before the state of emergency was declared in Portugal, because of the pandemic. Still, new workers arrived afterwards, so some workers did not practice. For this reason, this was a point mentioned as an obstacle to platform utilization. However, it is a very intuitive platform, so it does not require intensive training.

### Poor divulgation

Along with the training itself, which also aims to publicize the platform, two pamphlets were also sent via email. One with the objective of clarifying the distinction between Challenge, REV and the different types of REV. The other suggests a routine of using the platform, to avoid problems of compromise. However, when asking for suggestions to overcome the barriers felt when using the platform, some people mentioned greater disclosure.

## 4.1.2 Implementation at operator level

The Bimbo Group factory is not very automated and, since it is a food industry, operators are not required to have a high level of education. Specifically, in an analysis of a group of 28 effective operators (survey 2), it was concluded that the average age is between 46 and 55 years old (around 46% is older than 55 years) and 68% have only the basic education. Regardless, it was also concluded that 75% use smartphone or tablet daily. Although it is an older and low literate population, 3/4 of them is familiarized with devices where REVER is accessed. Since all of them can read and write, the new tool should not be a constraint.

Knowing that operators are prepared to use this novelty, the next step is to start training them. Since the first phase of implementation (with middle managers) had some problems, it

is needed to correct them, avoiding relapses. Yet, it was discussed that would be a good approach implement each production line at a time. Therefore, to plan the starting was asked to middle managers (survey 1):

- Regarding to improvement opportunities, which production line do you consider to have more work to do?
- In which production line do you believe it will be easier to implement REVER taking into account the operators?
- In which shift do you believe will be the easier to implement REVER, based on previous answer?
- In which production line do you believe REVER will be easier to implement considering the complexity of the process and equipment?

The answers will not be released because they are not relevant to the scientific community, they are only of interest for each specific factory. However, the results obtained allow a considered choice, since, prioritization can be done based on three aspects: line with more opportunities for improvement and therefore greater urgency to implement the platform; easier to train new users and who are willing to use the new tool effectively; and a simpler line, where workers must be also more available to introduce a new feature or even to help each other, and test different training approaches.

## 4.2. Platform utilization

During nine months, several problems and improvement opportunities were detected in the Portuguese factories of Bimbo Group, and documented on REVER. One of the steps required in creating a REV is to categorize it, as already mentioned. From the list of categories on the platform, the author of the project must select the one(s) he deems appropriate. By compiling all the projects created in this period, Figure 6 was obtained through the web version of REVER.



Figure 6: Typology of REVs created at Bimbo Group factories in Portugal (January-September 2020).

When analyzing the history of other works developed at the Mem Martins factory, within the scope of CI, specifically in previous internships, it was concluded that these focused essentially on the waste/optimization of the process and quality. However, looking at Figure 6, it appears that the trend is not the same.

In fact, all of these works were developed by the production department, so they are in accordance with the type of projects expected. On the other hand, in this internship, also developed by the production department, the majority of open projects were related to the health and safety of employees. In effect, this platform broadens boundaries in so far as that anyone can take initiatives even if they are not within the ambit of their department.

This is a platform where most of the actions are immediate and simple, so it is normal that most of the ideas come to enhance areas whose return is not directly converted into money, however, over time the impact is visible.

In this case, the safety category guarantees the well-being of workers in the factory, which makes them feel more confident and motivated to perform their tasks without constraints. After a while, this assurance can also result in less human error productions, therefore less waste and consequently more profit, now in euros. This is a factor that, without a doubt, should be prioritized especially in factories low automatized. In fact, studies show that workers in the food industry in USA have a rate of occupational illnesses or accidents at work about 60% higher than other industries [12].

Another feature of the web version of the platform is the presentation of the economic impact of open projects in the desired time interval. By selecting the tab "Dashboard", followed by "Economic impact", we get donuts charts relating to Cost reduction, Total investment, and New revenue. However, none of the projects created in the Portuguese factories have been financially validated yet, so the graphics are not presented.

### 4.2.1 Experience of platform

Throughout the internship, with the daily use of the platform and in discussion with workers familiar with CI traditional methodology, several positive aspects of this change were found, which will be discussed below.

Firstly, it is a methodology with a clearer and more objective structure than the previous one. The gamification of CI softens the theme, making it more attractive. This attribute mitigates the commitment problem as many point out as a major obstacle to the usual CI projects. However, as in all games, if the reward is not in the interest of their players, the enthusiasm fades. For this reason, it is important that those responsible for the development of CI in the company invest in maintaining attention. Note that, in order to have the desired effect, the bonus must be appropriate to the nature of the benefited. This is because, for example, for some, promotion to a higher position may be an objective, but for others it can be seen only as more responsibility and work, which is not what they want.

Another point in favor of this novelty is the fact that it contributes to time management optimization. In the traditional execution of CI projects, it is necessary to spend time in several project follow-up meetings. If we consider that one meeting is held per week and that each meeting takes 90 minutes, at the end of a month 6 hours will have been spent in follow-up meetings for just one project. Applying the platform, time management is tailored to each individual. It is no longer necessary to reconcile the schedules of all elements of the team destined for a given project. In addition, the time allocated for monitoring the project should decrease considerably. Supposing that this time is reduced to one third (an average of 30 minutes per week), for example, at the end of the month there are 4 hours left to allow for other tasks. Note that this estimate is based on the fact that this methodology gives rise to the creation of projects whose action-reaction is considerably faster than the previous ones. Seen from another perspective, if we consider that the same hours for CI and the same proportion of hours per project continue to be spent, three times as many projects can be generated. A greater number of corrections or improvements should result in fewer defective products, therefore a more efficient factory, as it requires lower production costs, which results in a higher profit margin.

In the specific case of REVER, this allows access to all projects created by all the factories of the same business group around the world. This feature promotes the sharing of ideas to a dimension substantially greater than what would ever be possible without the platform. This causes the implementation of an idea or correction to occur at considerably higher speed and with less resources, as the steps of experimentation are eliminated, often with failures. In addition, in cases where there

is a recurring problem, there is no longer dependence on the knowledge/experience of those who solved it the first time. This saves time and resources.

The application of this platform within the scope of the CI is useful in the context of communication. Sometimes, in the conventional way, communication could be a challenge. As consequence of platform utilization, everyone knows exactly what to do, because everything is properly described. Nevertheless, in case of doubt, you can ask questions in the comment boxes associated with each Challenge/REV. This fact overpasses another plausible problem to occur without a platform, the loss of information. Through the application, all indications can be registered in the cloud reducing mistakes. The fact that everything is documented also allows us to understand the impact of the work developed. On the one hand, it will make the workers involved motivate themselves to create more, on the other hand it keeps management aware of the importance of CI. With the awareness of the value of the projects, it is expected that the administration will also focus and prioritize the development of the CI culture.

Seeing that almost everything can be handled remotely, it greatly reduces the waiting times for projects progress. Still in this line of thought, the traditional methodology would be strongly affected during the pandemic, largely because of the mandatory teleworking regime. Although there was a decrease in the opening of REVs, this was not null in any months of study, the result of the possibility of being able to assess problems and solutions remotely.

This new method guarantees maximum use of all the ideas exposed, which encourages the creation of more solutions. In the traditional way, each idea that comes up is a suggestion that has to pass through a "filter", that is, a pre-evaluation and validation. Even good ideas are sometimes rejected, which are not implemented due to the lack of human/financial resources at the time, or because they are not the best solution to solve the problem in question, even though it may be for another situation that arises later. Due to digital platform, all ideas are experiences ready to be tested and prove their potential. No ideas are discarded, so they can be used at any time. It gathers from the smallest ideas (returning only after several months) to the largest (immediate positive impact).

Another consequence of using this type of platforms is the existence of collaborative teams without restrictions, contrary to what happened until then. Although a team is associated with each REV (selected by the project author), since all users have access to all REVs, even without belonging to the team, it is possible to contribute to the progress and implementation of it. In addition, this new method gives operators greater openness to participate, which is extremely advantageous, as they are the ones who best know the process and the product, so they are also the best able to detect problems and develop solutions.

Finally, this is an innovation that has the advantage of requiring low investment, unlike others. Remember that to use the platform, the necessary means are computers, smartphones and/or tablets, and Wi-Fi available at the places of use. As result of technological evolution, it is increasingly common to obtain these devices at low cost.

## 5. Conclusions

Throughout this work, we tried to detect and solve problems in food industry production lines. For this, among the various CI methodologies and tools that exist, essentially Lean Philosophy was used. However, unlike the works carried out until then at the Bimbo Donuts Portugal- Mem Martins factory, a digital platform was used, in this case, REVER. From the experience of using the platform for about six weeks, several advantages of this acquisition were found for the routine of CI.

It is a methodology that streamlines the implementation of improvement and correction projects, since it makes it possible to evaluate and validate the progress of projects remotely, as well as time/work management tailored to each worker. Consequently, this feature gives the opportunity to carry out a greater

number of projects after one year, for example, compared to the traditional way. In the specific case of REVER, since it makes it possible to search for projects in other factories of the same business group, it allows reusing already tested and successful ideas, eliminating experimentation times.

The platform has a simple, objective and game-like structure, which may raise greater interest in CI. This structure also facilitates communication, which is an important factor for the evolution and execution of projects. Being user-friendly allows any worker to use it easily, without requiring intensive training. Hence, it generates collaborative teams without restrictions.

A company that uses a platform of this nature has a support that presents all the projects that were carried out and the impact they had on the efficiency of the factory. Thus, management has greater control over the performance of the factory and its employees. In this way, it is easier to recognize the commitment of workers who, upon realizing that their effort is valued, tend to remain motivated to seek to improve their work more and more. In addition to all the platform's potential, unlike others, it is a low investment innovation, which makes its acquisition more attractive.

Along with the use of the platform and the advantages it provides for CI domain, another objective of this work was to implement it and evaluate its feasibility on the shop floor on a food industry factory. Before being implemented on the shop floor, this took place in a first phase only in a multidisciplinary group of workers responsible for departments closely linked to the factory environment (production, quality, safety, maintenance, supervision). Hence, based on the results obtained at this stage, the approach to implement on the shop floor would take into account the problems detected. The results obtained in this first phase did not meet expectations. Taking into account the answers given in the survey and the experience of the internship, the main causes were the Covid-19 pandemic and the alteration of a section of one of the production lines.

For the future, when it is to be implemented on the shop floor, in addition to taking measures based on these results, this should be phased, that is, one line at a time. For this reason, the end of the survey should help decide the order of implementation. In such a way, there are three different modes of action: starting by the line where there are more opportunities for improvement, so there is more work to be done in this area and, consequently, it should be a priority to start working with the new methodology; start with the line (and shift) whose operators, in general, have greater capacity for using the platform, either because of their age or training, or because of their predisposition to learn; start with the least complex line in terms of equipment/extension, allowing more time to be spent on training and experiment different approaches, if necessary.

It should be noted that the planning of the second phase of implementation must be meticulous, it requires such attention that the recurrence of problems already detected is avoided. If this does not happen, the company is unable to take advantage of total digital platform potential pointed out throughout this work. It is a structure that proposes to turn a theme that has not evolved for decades. This may just be the beginning of this transformation and companies must aspire to be aware of it, making their activity increasingly profitable.

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