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Original Article

Application of Working Method And Ergonomic To Optimize The Packaging Process In An Asparagus Industry

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Abstract **-** *Currently, the Asparagus Export Industry presents a growing trend. Therefore, agro-exporters, to remain current in the market and be competitive, must improve their processes. The importance of providing adequate working conditions is related to labor productivity since only manual processes are carried out in these types of companies. This article aims to analyze the low labor productivity rate in the packing station of asparagus processing. The current difference in the rate is 18.22%. This problem has an economic impact that represents 2.97% of its sales. In order to confront this problem, an improvement model was developed using the ADKAR model, Work Method, Anthropometric Workstation Redesign, and Poka-Yoke. The main results obtained were an increase in labor productivity of 19.83% and a reduction in the risk level of positions by 54%. The conclusion of this research is that through the application of this model, not only will an improvement in productivity be obtained, but also better working conditions will be provided.*

Keywords — *Labor productivity, Work Method, Poka-Yoke, RULA assessment, Asparagus*

I. INTRODUCTION

The asparagus industry is one of the most important sectors in Peru, which is the second producer of asparagus in the world[1]. According to Cavero Castillo[2], in Peru, agro-industrial activities are fundamental since, in the country, the coastal valleys are fed by the rivers coming from the Sierra. There is evidence of an increase in the demand in the supermarkets of Europe, Asia, and North America due to changes in consumer diets [3].

The food industry is a mature sector where competition obliges to generate new products that maintain and conquer new markets [4]. Therefore, it is important to have good productivity management generates an increase in competitiveness; however, given the characteristics of the agro-industrial sector, which presents difficulties with employment conditions and work processes [5]. It is important that the Workplace is ergonomically designed to fit the worker's anthropometry in order to provide safer and more comfortable work [6].

In some manual process industries such as furniture, textile, assembly, and printing industries that implemented tools similar to the one in the case study, they had satisfactory results, since they obtained an increase in productivity in a range of 15% to 26% [7, 8, 9].

The short paper "Proposal of Work Study and Anthropometric Workstation Redesign to increase the productivity on asparagus industries" isa work prior to the present one. This research presents a proposal for the improvement of labor productivity of the packing station by combining the work method, line balance, poka-yoke, and redesign of the workstation. Finally, unnecessary movements will be eliminated, and a new work method will be designed and standardized using the Work Method tool. Moreover, it was validated through a simulation using Delmia V5 Software[10].

This article is structured as follows: the first part focuses on analyzing the problem. The second one is on the literature review of the tools and methods to be used. The third part describes the innovative proposal. Finally, the conclusions and recommendations for future investigations.

II. LITERATURE REVIEW

A. Application of the Line Balance Tool

Various small and medium-scale industries focus on productivity over time, redesign of work elements, and workers apply this tool [11]. Also, in labor-intensive processes where the task time is uncertain, it is advisable to apply this tool and includes factors such as worker skill, work fatigue, working conditions, among others, in the problem analysis[12].

On the other hand, to achieve an exact result, it is advisable to complement it with simulation since this helps to optimize the design of the process and other available resources to obtain a balanced line[13].

Such as the case of Nallusamy [11], which proposes to increase the efficiency of production processes in a CNC

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metal industry through the combination of Line Balance and Work Standardization to recognize the waste that is found or generated in the process and can be eliminated. Likewise, the authors used the Timer-pro, i-Graphix, and Arena software to simulate and validate the results obtained. After the improvement, a 17% reduction in total NPV was obtained, an increase in production of 5 to 7 components per day, and a reduction in the cycle time of 153 minutes. Similarly, Chan and Tay [8]implemented the same tools at a Kaizen event to increase productivity and reduce the excessive amount of waste in the printing industry. The purpose of this research is to improve the quality and productivity of the processes to obtain a competitive advantage over the competition. Likewise, Dinesh et al. [14]applied Line Balance at a Kaizen event to increase the capacity of a compressor production line. The validation of this study was carried out through the implementation in a Kaizen event, where the results were an increase in production capacity of 86%, an improvement in the efficiency of the line from 79.7% to 97.9%, and an improvement in the value-added ratio of 33% to 37%. On the other hand, Yemane et al. [13]decided to apply Line Balance to increase low productivity in the textile industry. The validation of this study was carried out through simulation in the SAM software, where a study of times and estimates of distributions is carried out, and then the model is built. The results that were evidenced through the simulation were an increase in daily production from 365 to 379 pants per line and an increase in assembly efficiency from 42% to 58.42%.

In conclusion, it was shown that most of the case studies combined Line Balance with various Lean Manufacturing tools in order to obtain better results. Likewise, for the validation of the results, they chose to use simulation programs such as Arena, Timer-Pro, i-Graphix, and SAM to support the planning and scheduling of production, evaluating the rate of performance, the use of labor, and the use of machines comparing the current and improved situation in a more precise and dynamic [15].

B. Ergonomic assessment application

The ergonomic evaluation is based on the identification of the positions of the workers and the assessment of the risk factors in the jobs. Likewise, several studies focus on the identification of ergonomic problems such as disorders in the muscles, joints, nerves, and blood vessels through postural evaluation methods. For this reason, it is important to carry out an ergonomic evaluation of the workers, since an incorrect posture can cause musculoskeletal disorders such as the presence of injuries in the operators, which are usually common in the industries of the agricultural sector, which is the main cause of the loss of working time and economic losses in both industrialized and developing countries[16].

The ergonomics of the user when performing their functions is indispensable in all types of activity, as is the case of Hoque et al. [17] which designs the ergonomically oriented classroom furniture for the students guarantee not only the adjustment capacity but also improving the level of comfort.

In addition to this, Joshi et al. [18]mention that the consequences of an incorrect ergonomic design are detrimental to the company and the staff, such as work stress, work overload, depression, worsening health, job dissatisfaction, among others. On the other hand, various authors propose ergonomic evaluation in the initial design stage and include virtual reality technology for the simulation of tasks since they are capable of dynamically reproducing the operational tasks of each job and carrying out an evaluation[19].

Among the conventional techniques used by the authors are the OWAS, REBA, and especially the RULA method, since it allows a rapid assessment of the upper extremities, neck, and torso in two groups. In addition, this technique is recommended for the analysis of repetitive activities such as in assembly and packaging lines since it has been shown that in manual process industries, labor and organizational ergonomics are important since they directly affect productivity [20, 21].

Various industries have combined ergonomic evaluations with Lean Manufacturing tools or with Job Redesign, such as the case of Sakthi et al. [22], who implemented the Value Mapping because the workers of a textile industry presented an incorrect position. The authors chose to carry out a diagnosis of the times and yields of the process using the VSM and an ergonomic evaluation of the workstations. Likewise, implement elements for the comfort of the staff and a redesign of the workplace according to its anthropometric measurements. The results obtained from the implementation were a 26% reduction in cycle time, 7% delivery time, 43% scrap, and 18% defects. As well as Wang et al. [23]applied the same tools in a liquefied natural gas (LNG) plant that had low productivity. The validation technique used was optimization using the Ergofellow software, based on the combinatorial theory of permutations, which can help managers to determine the best waste reduction strategy in various improvement expectations. This simulation resulted in a 40% reduction in the risk of workers' postures and a reduction in waste generated in the production process. On the other hand, in particular cases such as the case study of reducing the incorrect postures of the religious ritual of Muslims, they used the RULA method to design a portable ablution system considering essential factors such as safety, comfort, better posture. of the body, the convenience to avoid fatigue and maximize resources such as the use of water during ablution. The validation of the research was carried out through simulation with the Catia V5 program, obtaining as result the reduction of the risk level of the positions from 7 to 3 [24].

C. Implementation of working method

It is important that for any agricultural activity to be sustainable, it must be competitive in terms of productivity, costs, quality, delivery, among others. For this reason, the work method, through the application of time and movement studies, simplifies and establishes new methods that optimize resources, such as costs. The proper application generates the ability to produce more with fewer resources [7]. Likewise, having a procedure of the new working method is crucial since it serves as a guide for each worker in their production process in order to eliminate decision time and product variation [8] In addition, Silva et al. [25]analyzes the case of a company dedicated to the processing of grapes in Mexico that presents problems with competitiveness since its labor productivity at the packing station is low. For this reason, the proposed solution includes carrying out a new working method, time and movement analysis, the elaboration of a bimanual diagram of the micro-movements of the operators in the packaging of grapes. The authors choose to validate this proposal by implementing it in the company. Finally, it is evident that movements in this station are considerably reduced, which generates an improvement in labor productivity of 20%. The authors point out that good tool handling increases productivity, which improves costs and the ability to offer lower prices to improve competitiveness.

On the other hand, globalization in India has faced a challenge for some industries regarding productivity, cost, delivery, among others. Likewise, Realyvásquez et al. [26]in their study on the low performance of the human factor and productivity index in the box assembly department. The importance of this problem is that there is no standardized method, and workers have problems with job fatigue due to an inappropriate job. The authors opted for the work method, REBA ergonomic analysis, line balance, anthropometric redesign of the workstation, and movement analysis. Through this model, the number of inefficient movements was improved by 66%, the standard time was reduced by 19%, and the operators increased their satisfaction and quality of life, delivery, among others. Similarly, Realyvásquez et al. [26]studied the low performance of the human factor and productivity index in the box assembly department. The importance of this problem is that there is no standardized method, and workers have problems with job fatigue due to an inappropriate job. The authors opted for the work method, REBA ergonomic analysis, line balance, anthropometric redesign of the workstation, and movement analysis. Using this model, the number of inefficient movements was improved by 66%, the standard time was reduced by 19%, and the operators increased their satisfaction and quality of life.

In conclusion, this tool deals mainly with productivity and is used to increase production with fewer resources[27].

Additionally, it helps identify process improvements by highlighting waste and specifying exactly how work can be done efficiently to gain a competitive advantage over other companies.

It allows to establish the best work method and sequence of activities for each process and to be able to reduce processes by reducing or eliminating waste [28]. In addition, by combining the standardization of a new work method and the anthropometric design of the workstations, a positive impact is obtained in reducing the unit cost and increasing the demand fulfillment rate [26].

III. INNOVATIVE PROPOSAL

Figure1showsthe model of the proposal, which has also been previously featured in the short paper, where it focuses on minimizing the negative impact through ergonomics and work-study. This model has been adapted from a case study of a publisher where they had unnecessary movements, over time, production delays, and late deliveries that affected their performance. Therefore, they decided to implement the Line Balance, redesign the workstation based on an anthropometric study and standardize the work method[29].

A. Change management: ADKAR model:

This proposal begins with the management of change using the ADKAR model, where the first step is “awareness”, where informative talks are given to workers about the negative impact of the current methodology, the phases and benefits of the project, and the importance of support. Of all workers.

The next step is "desire", that is, motivating workers to have the desire to participate. For this reason, a poster was made showing the benefits of the proposal. The next step is "knowledge", where the content and objectives of the talk will be planned so that the steps of the proposal are clear. The fourth step is “the skill”, where new capabilities and skills of the operator are evaluated and implemented to improve behavior and achieve the expected change. And the last step, "reinforcement," will keep the proposed changes in the organization.

B. Redesign of Workplace and implementation of Poka-Yoke

According to the RULA analysis carried out on the operators at the packing station, it was found that on average, 85% of the postures performed at the time of work were at levels 3 and 4; that is, they are postures that require immediate changes because they affect to the worker. In addition, it was observed that the postures of the wrist, legs, and trunk are the most affected. That is why the optimal solution is to acquire adjustable seats for workers for their wide mobility with support for the arms to avoid any type of discomfort. Likewise, for the design of the seat, the 95th percentile of the workers, the anthropometric measurements of the workers, and an analysis of the parameters established by the National Institute of Safety and Hygiene at Work were considered.

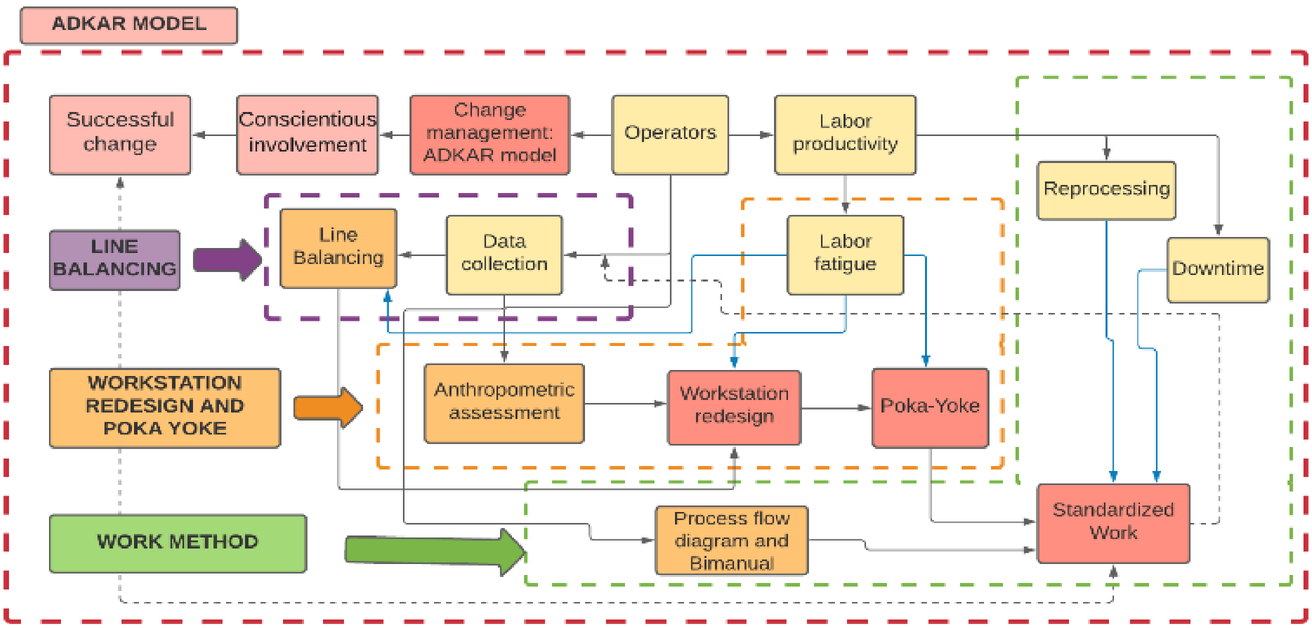

Figure 1 Proposed model

Following this, the width of the hips of the workers and the maximum and minimum height of the seat was found based on the 95th percentile and the Hispanic Anthropometric Table, where it was obtained that the measurement of the width of the chair, including the armrests, is 57.37 cm, the minimum height that the chair could be modified is 43.82 cm, and the maximum height would be 47.01 cm.

On the other hand, because the workers perform the cutting of the bundles on the worktable, the physical Poka-Yoke tool will be applied. This application is based on including in the design support where the operators can cut making a more even work, with greater comfort and that there can be more space on the worktable.

C. Work method

After conducting an evaluation of the current methods using the Bimanual Diagrams, it was found that it was not the appropriate working method.

Likewise, it was observed that there was disorganization of activities, such as cleaning the workplace, supply of materials, and order in the workplace. For this reason, a method was developed for cleaning the workplace at established times, the tools and materials necessary for the workers were relocated, and a new method for supplying materials to the workers was developed, which will be carried out by the supervisors of each line. After the proposed changes, the new packaging work method was developed, where the design of stage 1 was also considered. Finally, the methods were standardized, and a training and monitoring plan was developed.

First, the work to be carried out was selected, and through the information, it was corroborated that the packing station had low productivity problems. Next, in the recording stage, diagrams were drawn up to understand the sequence of the process. On the other hand, in the step of examining, through observation in several visits to the plant, a Bimanual Diagram was elaborated for each work method.

IV. VALIDATION

The validation of this research work will be carried out using the Delmia V5 software and through success stories, as shown in the following figure:

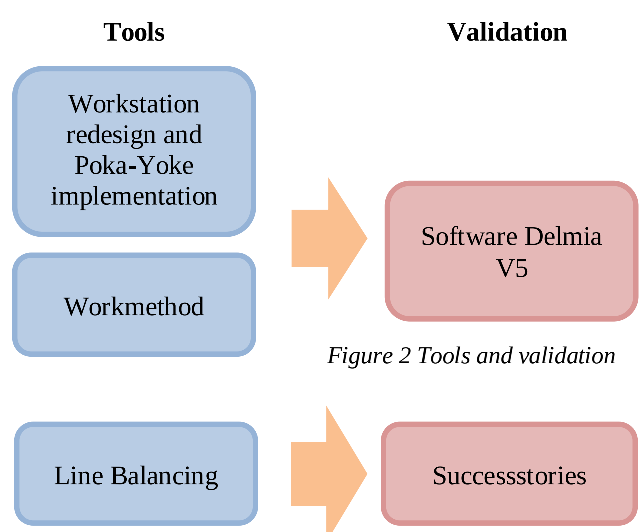

Figure 2 Tools and validation

A. Simulation

Using the Delmia V5 program, the simulation of the current process and the proposed model were performed, obtaining the results of the cycle time and the RULA ergonomic analysis.

a) Before

For the simulation of the current situation, the worktable, the tools such as the scale and the knife, the raw material, and the materials such as the box, the box lid, and the rubber bands were designed. Likewise, the worker was designed according to the anthropometric measurements of the workers in the Redesign of Workplace. The process carried out is shown in the following images:

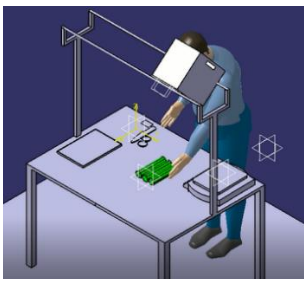

Figure3 Assemble asparagus bundle – Current model

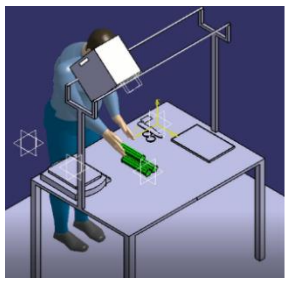

Figure 4Accommodate asparagus bundle – Current model

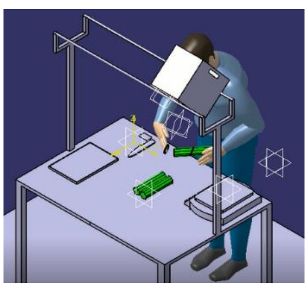

Figure5 Place garters – Current model

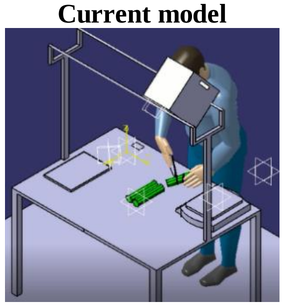

Figure6 Cut bundle – Current model

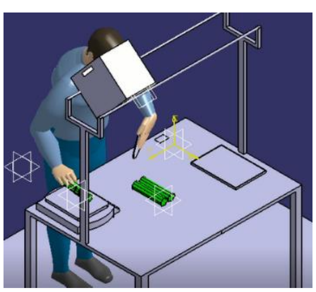

Figure7 Weigh bundle – Current model

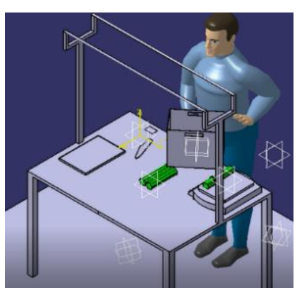

Figure8 Place box on the table – Current model

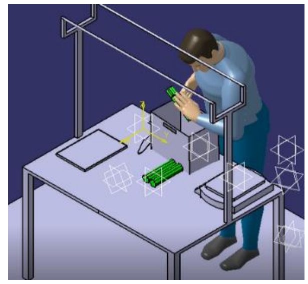

Figure9 Place bundle in the box – Current model

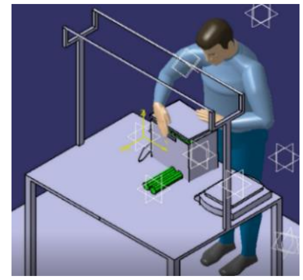

Figure10 Place lid – Current model

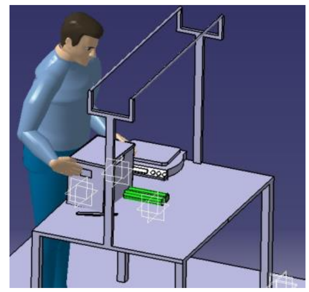

Figure11Label the box – Current model

The times obtained from the simulation of the current situation are shown in the following table:

Table1 Packaging operation time before proposal

Activities	Time (seconds)	N° times	Time per activity
Assemble bundle	3.80	11	41.80
Accommodate bundle	3.70	44	162.80
Put rubber bands	3.10	22	68.20
Cut bundle	2.50	66	165.00
Weigh bundle	2.40	66	158.40
Put box on the table	7.40	4	7.40
Put bundle in the box	5.70	6	34.20
Cover box	8.80	1	8.80
Label the box	5.7	1	5.57
Total time (min/box)			**10.87**

1) Ergonomic validation

Through the simulation created, an ergonomic evaluation was made of the worker's postures, from which the following result was obtained:

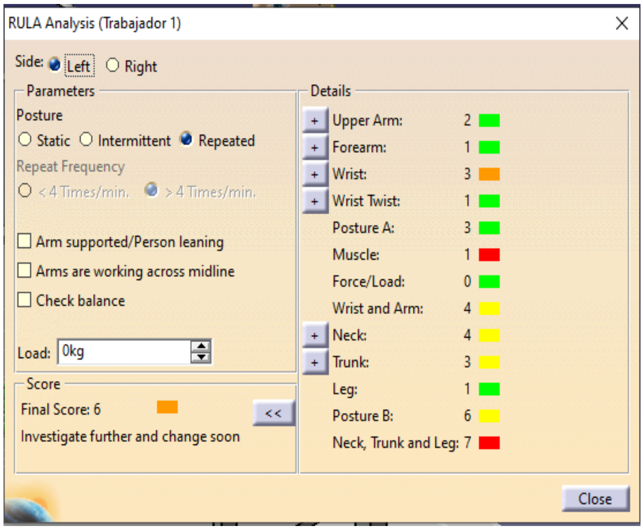

Figure12 RULA analysis - current status

As can be seen in Figure 12, the results obtained from the positions of the operators present a final score of 6 points; that is, they are positions that are at risk level 3 and that require a redesign of the tasks. Likewise, these results coincide with the initial diagnosis made of the cause of the incorrect work posture.

b) After

For the simulation of the proposed model, the worktable with the support, the seat, and the operator were designed according to the anthropometric measurements of the operators and the calculations made in the Redesign of Workplace and implementation of Poka-Yoke. Likewise, the tools such as the scale and the knife, the raw material, and the materials such as the box, the box lid, and the rubber bands were added. The process carried out is shown in the following images:

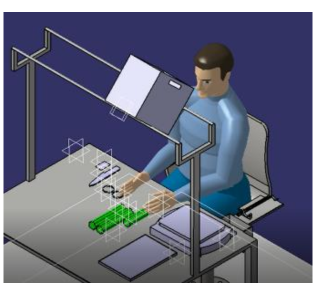

Figure 13 Assemble asparagus bundle – Proposed model

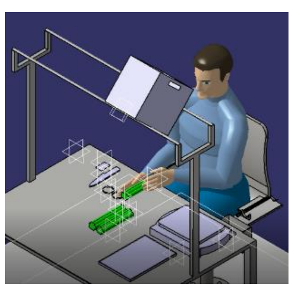

Figure 14 Accommodate asparagus bundle – Proposed model

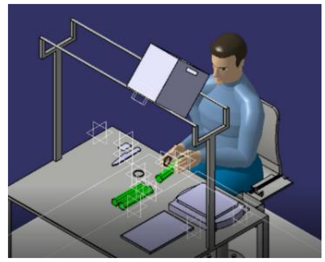

Figure 15 Place garters – Current model – Proposed model

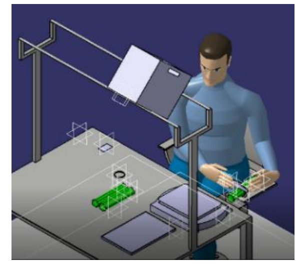

Figure 16 Cut bundle – Proposed model

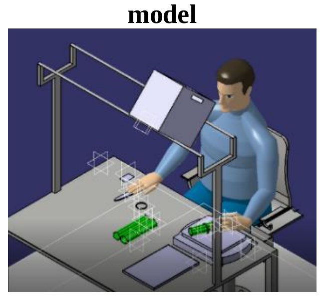

Figure 17 Weigh bundle – Proposed model

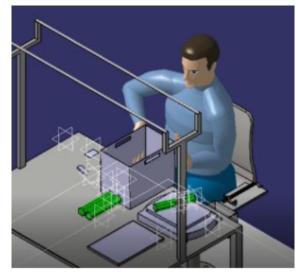

Figure 18 Place box on the table – Proposed model

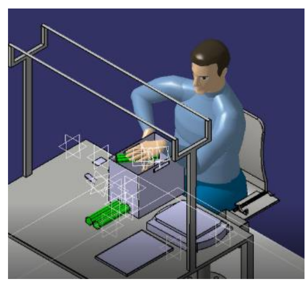

Figure 19 Place bundle in the box – Proposed model

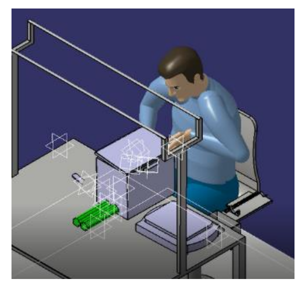

Figure 20 Place lid – Proposed model

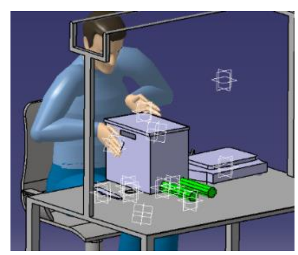

Figure 21 Label the box – Proposed model

The times obtained from the simulation of the proposed model are shown in the following table:

Table2 Packaging operation time after the proposal

Activities	Time (seconds)	N° times	Time per activity
Assemble bundle	3.80	11	41.80
Accommodate bundle	3.60	44	158.40
Put rubber bands	4.60	11	50.60
Cut bundle	5.70	22	125.40
Weigh bundle	5.20	22	114.40
Put box on the table	7.10	1	7.10
Put bundle in the box	5.50	6	33.0
Cover box	8.50	1	8.50
Label the box	5.10	1	5.10
Total time (min/box)			**9.07**

1) Ergonomic validation

Through the simulation created, an ergonomic evaluation was made of the worker's postures, from which the following result was obtained: As can be seen in Figure 22, it was observed that the positions obtained a final score of 2 points, that is, they are at level 1 (acceptable risk level)

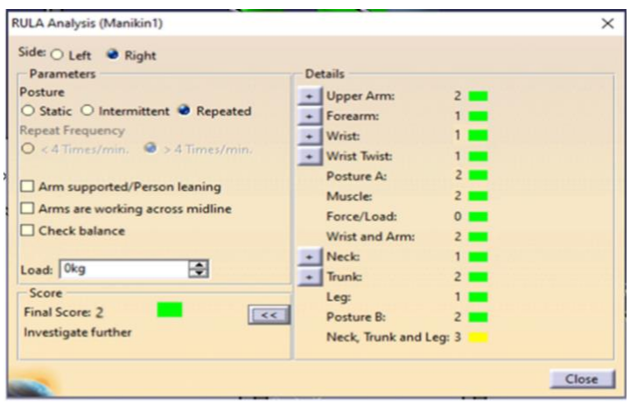

Figure22 RULA analysis – proposed model

As can be seen in Figure 22, it was observed that the positions obtained a final score of 2 points. That is, they are at level 1 (acceptable risk level)

2) Line Balancing validation

The current situation of the packing station presents labor productivity of 27.33 kg per man-hour and 91 operators to meet the daily demand of 21,000 kg of asparagus. However, when the proposed model was applied, a reduction in time was observed, that is, a reduction in labor productivity. For this reason, it will be validated by the Line Balance formula if the number of operators initially proposed are necessary to reduce the cause of the Work Overload.

$$N = \frac{TxP}{H}$$

$$32.75\,\frac{kg}{hour} \div 4.95\,\frac{kg}{box} = 6.62\,\frac{box}{hour} = 0.1511\,\frac{hour}{box.man}$$

$$D = 21\,000\,\frac{kg}{day} * \frac{box}{4.95kg} = 4\,243\,\frac{boxes}{day}$$

$$N = \frac{0.1511\,\frac{hour}{box} * 4\,243\,\frac{boxes}{day}}{7.5\,\frac{hours}{day}} = 85.48$$

$$\approx 86\ operators$$

As can be seen in the previous formula, the number of workers needed to meet the daily demand of the company is 86 workers, which is less than the current amount and the amount initially proposed.

On the other hand, various scientific articles that have implemented this tool have had similar results, as is the case in the textile industry that had low productivity in the trouser sewing line. Using this tool, the authors chose to reduce the number of operators by 5.10%, obtaining. As a result an increase in production by 3.85% [13]. In addition, Realyvásquez et al. [29]implemented this tool in a publishing house that presented various problems such as an unbalanced line, low production, high rate of complaints, among others that had an impact on labor productivity. The authors reduced the number of operators from 15 to 12 and obtained as a result an increase in production by 63.20%, a reduction in cycle time by 18% and unnecessary movements by 66%.

Compared to the case studies, the company "Fresquito" has presented a similar reduction in the cycle time of 15.32% and a reduction of unnecessary movements to 100%.

V. DISCUSSION

A. Cycle time

According to the comparison of times in the current situation and proposed by the Delmia V5 program, a reduction in the cycle time of 16.56% was obtained, and it is within the levels proposed in the indicators, as detailed in the table below:

Table 3Cycle time comparison

Activities	Time per activity (minutes)		
	Current	Proposal	Variation
Assemble bundle	41.80	41.80	0.00%
Accommodate bundle	162.80	158.40	-2.70%
Put rubber bands	68.20	50.60	-25.81%
Cut bundle	165.00	125.40	-24.00%
Weigh bundle	158.40	114.40	-27.78%
Put box on the table	7.40	7.10	-4.05%
Put bundle in the box	34.20	33.00	-3.51%
Cover box	8.80	8.50	-3.41%
Label the box	5.70	5.10	-10.53%
Cycle Time	**10.87**	**9.07**	**-16.56%**

As seen in Table 3, there is a reduction of each activity that varies between 0% to 27.78%; this is due to the implementation of the Working Method since by applying the appropriate and standardized method, the sequence of operations is reduced of each limb as seen in Table 4 and 5.

Table4 Comparative table of the current and proposed method

	Current model		Proposed model		Variation	
	L	R	L	R	L	R
Operations	151	370	139	257	-8.0%	-30.5%
Transports	78	118	110	105	41.0%	-11.0%
Delays	54	56	29	56	-46.3%	0.0%
Supports	245	0	157	22	-35.9%	22.0%
Total	528	544	435	440	-17.6%	-19.1%

Note: The letter "L" represents the left extremity, and the letter "R" represents the worker's right extremity.

On the other hand, the activities with a significant reduction are 'place garters, 'cut tied'and'weigh tied 'of 26%, 24%, and 28% respectively. This is not only due to a reduction in time, but also to the number of times the activity is repeated, since previously they were appreciated more frequently because the operators carried out their activities without guidelines to follow or because they made mistakes when training. the bundle.

Table5 Comparative table of activities

Activities	Current method		Proposed method	
	N° times	Time (seconds)	N° times	Time (seconds)
Put rubber bands	22	68.20	11	50.60
Cut bundle	66	165.00	22	125.40
Weigh bundle	66	158.40	22	114.40

Table6Comparative table of activities- variation

Activity	Variation	
	N° times	Time
Put rubber bands	-50.0%	-25.8%
Cut bundle	-66.7%	-24.0%
Weigh bundle	-66.7%	-27.8%

B. Ergonomic analysis of postures:

According to the ergonomic evaluation of the postures in the current situation and proposed by the Delmia V5 program, a considered reduction in the risk level of the postures was obtained, as detailed in the table below:

Table7 Ergonomic evaluation comparison

	Current		Proposal		Variation
Activity	Score	Level	Score	Level	Score
1	6	3	2	1	-67%
2	5	3	2	1	-60%
3	7	4	3	2	-57%
4	4	2	3	2	-25%
5	6	3	2	1	-67%
6	4	2	2	1	-50%
7	4	2	2	1	-50%

As seen in Table 7, the RULA method score was considerably reduced in each of the postures performed by each activity between 25% to 67%. Likewise, the risk level of the positions is acceptable, and they are within the appropriate reference levels. This reduction in the risk of postures is reflected in the variation of the score in each of the parts of the body analyzed, especially the arm, wrist, neck, and trunk since in the initial analysis carried out, they presented a score of up to 4 points and through the proposed proposal it was possible to reduce to 1. The risk reduction in the arm, neck, and trunk is due to the Redesign of Workplace since it was based on designing a workstation according to the anthropometric measurements of the operators to avoid forced or inappropriate postures such as a bent neck, bent trunk, and/or flexed arms without leaning on a fixed place. In the same way, the risk reduction in the wrist is due to the application of the Poka-Yoke, since its objective is not only to avoid errors when making the cut to the bundle but to provide greater comfort to the worker with his work. In addition, the support was designed according to the established measures of the asparagus bundles and located in a strategic place to the worker's seat.

Table8 Posture score comparison

Posture	Average score		
	Current	Proposal	Variation
Wrist	2	1	-50.00%
Arm	3	1	-66.67%
Neck	3	1	-66.67%
Trunk	2	1	-50.00%

On the other hand, there has been evidence of an improvement in the proposed indicators, such as the number of incidents due to an incorrect posture that, through the proposed model, presents 5 incidents on a quarterly basis, that is, it is within the acceptable reference level (<7 incidents /quarterly). In addition, the time of absenteeism of workers has been reduced by 5.7 min/hr.hm, which is within the established range (<15 min/hr.hm). In the same way, reprocesses have been reduced to 1.54% of the total boxes produced; that is, this percentage meets the objective of being below 4%. In the same way, the unproductive time has been reduced to 4.44% of the total hours available to produce, having exceeded the value established by the different authors (<10%). Finally, labor productivity has shown an increase of 32.75 kg/hr.hm, which said improvement is within the ideal expected value of this indicator.

VI. CONCLUSIONS

The joint application of the ADKAR model, Redesign of Workplace, Poka-Yoke, and work method has allowed increasing the labor productivity of the operators by approximately 20%.

Likewise, the improvement in productivity was achieved by reducing the cycle time by 16% due to the standardization of the proposed work method. Even when applying this tool, a reduction in the sequence of operations of each limb is observed by approximately 18%. It should be noted that to develop the new work method, the changes made to the workstation (the support of the table and the seat), the supply of materials, and the cleaning of the workstation were considered.

In the same way, the improvement was achieved by reducing the level of risk of the positions of the operators between 25% to 67%. This reduction is due to the Redesign of Workplace to avoid forced postures such as the inclined neck, inclined trunk, and/or flexed arms without leaning on a fixed place and the application of the Poka-Yoke, which not only allows to avoid errors when performing the cut to the bundle but to reduce the level of risk on the wrist and provide greater comfort to the worker with his work.

To reduce work fatigue in companies with manual processes, it is important to have an ergonomic workplace together with a standardized work method since it has been proven that operators have ergonomic problems due to the incorrect postures adopted during their working hours.

On the other hand, the use of change management in the model was vital since it made it possible to take advantage of human resources and deal with the transition from the new working method so that the staff could adapt in a better way.

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