

# **Work Organization through Methods Engineering and Time Study to Increase Productivity in a Floriculture Company: A Case Study**

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## **Abstract**

This research was carried out through a methodology to diagnose and improve the work organization, based on methods engineering tools and time study. A case study was carried out in the floriculture company in La Esperanza-Ibarra, Ecuador. With the aim of increasing productivity, optimizing working methods and setting standards of time and performance. The bibliographical review allowed us to support the theoretical and scientific bases concerning the engineering of methods and study of times necessary to carry out the Investigation. With a diagnosis of the company case study, through tools of diagrams of processes and routes, were able to visualize the activities in each one of the workstations of the post-harvest area, such as: reception of roses, take off leaves, classification, bunch, cutting of stems, quality control and packaging. In addition, the times were taken in each of the operations of the operations of the above processes. According to the data obtained from the diagnosis, the company carried out a production of 11 893 stems per day according to the limiting capacity, for a demand of 12 500. As a result, improvements were made in the physical distribution of the post-harvest area, the standardization of times and with it, time and performance standards, and working methods are proposed. All the above proposed would allow us to achieve a decrease of cycle time from 2.01 minutes to 1.79 minutes per unit, estimating as a result the increase in production capacity to 13 400 stems per day, and increasing productivity by 12.67%; achieving the main objective of this case study.

## **Keywords**

Work Organization, Methods Engineering, Time Study, Standard Time, Productivity, Floriculture Company

## **1. Introduction**

Currently the business world is developing around the needs of the environment that surrounds it, therefore, companies are becoming more competitive, to gain greater participation in the market, each struggle to develop strategies that will allow differentiate yourself from the competition. Not having studies of measurement of the productivity in the company, because of the ignorance of a group of techniques that facilitates its diagnosis in the organization of the work, has led to not perform a quality work.

According (Schroeder et al., 2011) project planning and scheduling consists of four phases: planning, scheduling, control and closure, which provide a general sequence of administrative decisions that are demanded in all Projects.

Other authors (Nieves, 2008) refer that the work organization is an integrated and dynamic system, aimed at determining the amount of living work and helping to make work become the first vital need of man. It comprises the study and analysis of what is done, where, how and with what; in order to design and implement measures aimed at perfecting man's participation in the production and/or service process (Niebel, 2009; García, 2008; García, 2010). To perfect the way in which the labor activities of men are executed, in their mutual and constant liaison; with the means of production, between jobs, workshops, productive sectors, companies, and at the national economy level.

García, 2005 states: The design of work is the technique that aims to increase the productivity of work by eliminating all waste of materials, time and effort; In addition, it seeks to make each task easier and more lucrative and increases the quality of the products by making them available to the largest number of consumers.

The floriculture company in study is a flower company that has been developing its activities in an empirical way, therefore, there are disorder in the processes that cause delays in the production order. In the post-harvest area have not developed any type of studies to determine the standard time of production, also does not have a method established for the development of tasks, all with the objective of a correct planning business.

The work organization uses techniques such as methods engineering and time studies. Method engineering is a thorough and systematic inspection of all direct and indirect operations, to find those productivity reserves that facilitate work in terms of the safety and health of the worker, and to allow takes place in less time, with less investment per unit with greater profitability (Heizer and Render, 2009; Neira, 2006; Sai et al., 2016; Schuh et al., 2013; Lorente et al., 2018). The time study is the technique of measurement of the work that is used to record the times and the working rhythms corresponding to the elements of a defined task, carried out in certain conditions. To analyze the data in order to find out the time required to perform a task according to a pre-established execution standard complying with the required quality (Schuh et al., 2014; Machado et al., 2018).

## **2. Materials and Methods**

Various procedures for the diagnosis and improvement of the work organization can be found. All of them disaggregated, in the greatest of cases, in phases, stages and steps, as well as the definition of the techniques to be used, have as coinciding points that their objective is to diagnose and propose solutions, besides analyzing from different points of view the elements of the work organization. The following describes each of the phases that make up the procedure proposed by Nieves, 2008; a description of this is made (López, 2014).

### **Phase 1: Preparation**

The objective of this phase is to guarantee from the beginning of the study and during the whole process of implantation of the organization of the work, the participation and collaboration of the senior management, department of human resources and workers, in the different tasks to develop.

### **Phase 2: Characterization of the Organization**

The characterization of the organization is performer taking into account a set of elements that provide the information necessary to achieve the goal set. These elements may be related to the organism, to which it belongs, main achievements of the organization, social object, mission, vision. It performs a characterization of the main suppliers and Supplies. Reference is made to the main customers and their satisfaction. The techniques to use review of documents, surveys. Counting with the following steps:

**Step 1:** Characterization of the entity in study. Is made taking into account the elements that provide the necessary information for it.

**Step 2:** Characterization of human capital. Knowing the characteristics of human capital is essential for the operation of the entity. A trained, informed and motivated worker contributes to the achievement of organizational objectives. Hence the importance of knowing the main characteristics of human capital with which it is counted. To characterize human capital, the following indicators may be considered:

Distribution of the workforce by occupational category, age groups, level of schooling, sex and the seniority of workers that will reflect the degree of commitment, belonging and ageing of the human structure of the organization.

**Step 3:** Economic analysis. Overall, the economic analysis should focus on the study of expenditure items, such as material expenditure, energy expenditure, fuel and lubricants, wage expenditure, short-term social security benefits. Use tax of the labor force, depreciation, expenses of goods and services, current maintenance and repairs, professional services, other services contracted. In addition, services not previously specified, taxes and fees, financial expenses and other current transfers, and other expenses.

**Step 4:** Description and analysis of organizational processes. The analysis of the processes is carried out in order to know the activities that the unit performs its correct distribution. The application of the technique of the critical examination will allow to carry out diagnosis of these. You can use the process map for the graphical representation.

**Step 5:** Analysis of the environmental aspects that the system presents. It analyses the implementation and compliance of environmental aspects, occupational safety and health and legislation in this area to take into account, in order to assess its situation in the organization (López, 2014).

### **Phase 3: Diagnosis of the work organization.**

The objective of this phase is to diagnose the study of the organization of work and to know what situation the investigator will face.

**Step 1:** Definition of the processes. In this step we point out the processes in which the study carried out and the criterion for their choice will be focused, in which they carry out the following tasks:

- Characterization of the Jobs.
- Characterization of equipment and means of work.
- Define the techniques to be used.

**Step 2:** Diagnosis of the organization of the work of the process. To perform this diagnosis, the task force must consider the following:

- Define the techniques to be used.
- Define why it is necessary to organize the process or workstation.
- Define and analyze the potential problems (López, 2014).

### **Phase 4: Analysis and evaluation of possible solutions**

The objective of this phase is to consider the possible solutions that can solve the problem and the possible causes that originate it.

**Step 1:** Analysis of possible solutions. It raises the possible solutions by the team of work. The participation of workers is vital; they can provide solutions to problems.

**Step 2:** Assessment of potential solutions. For assessing labour productivity indicator can be used in its narrow or broad sense (López, 2014).

**Phase 5: Tracking**

The objective of this phase is to establish a manual for the organization of work and to monitor and control the solutions used. This phase verifies the fulfillment of the solutions posed. Indicators can also be used to measure studies of the work organization of the studied process or of any other.

**3. Result**

**Monthly production volume**

The floriculture company has historical data on monthly stem production by variety of roses, as shown in the Figure 1.

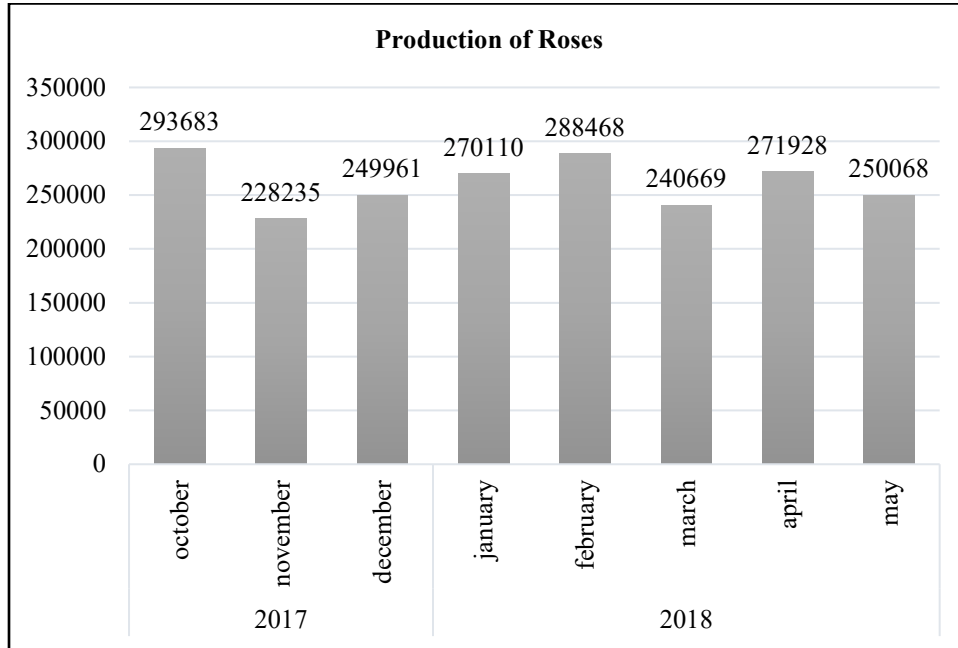


Figure 1. Monthly stem production

Based on the historical data of the monthly production, the production of stems per day and time is calculated.

$$\text{Monthly stems production} = \frac{2093122 \text{ Units produced}}{8 \text{ months}} = 261640 \text{ Stems/month}$$

$$\text{Daily stems production} = \frac{261640 \left(\frac{\text{Units produced}}{\text{month}}\right)}{22 \text{ work days}} = 11893 \text{ Stems /day}$$

$$\text{Stems production by hours} = \frac{11893 \left(\frac{\text{Units produced}}{\text{day}}\right)}{8 \left(\frac{\text{hours}}{\text{day}}\right)} = 1486 \text{ Stems/hour}$$

The average production of stems per day was calculated by dividing the total monthly average for the 22 working days that the company works, likewise, to calculate the production of stems per hour is divided the average production per day for 8 hours working.

Table 1 shows the standard time results for each stage of the process:

Table 1. Standard time per process

Processes	Standard time (ST)
Rose Mesh Reception	0.83
Take off leafs	0.96
Classification	2.83
Bunch	1.89
Cutting of stems	0.94
Quality control and hydration	0.96
Packing	5.64

### Productivity Current Method

Production capacity:

Production capacity or production volume is calculated in the bunch process. Based on the standard time used by a single worker that is 1.89 min per bunch (25 stems), the number of units produced per hour / day can be determined.

### Production capacity with standard time

$$\text{Stems production by hours} = 60 \text{ min} * \frac{25 \text{ stems}}{1,89 \text{ min}} * 2 \text{ workers} = 1587 \text{ stems/hour}$$

$$\text{Daily stems production} = 1587 \frac{\text{stems}}{\text{hour}} * 8 \text{ hours} = 12696 \text{ stems/day}$$

$$\text{Monthly stems production} = 12696 \text{ units} * 22 \text{ days} = 279312 \text{ stems/month}$$

### Proposed design of new working method in the production line of export stems of the post-harvest Distribution of the plant

Through engineering methods and studies of time was achieved to determine the distribution of the post-harvest plant is not adequate, therefore, changes of job of defoliation, classification, bunch and hooded. This will help reduce distances that the worker, as well as the time it takes.

### Rotation of jobs

The process of classification and bunch are activities in which a monotonous and repetitive work is done which generates occupational stress in the operators. One of the alternatives to reduce the work stress is to plan the rotation of the job during the day, spending a day, or every week in different location, ie the person who is classifying will go to bunch and the one that is bunching will pass to classify which will reduce monotonous and repetitive work.

### Time standardization with the new method

For the determination of the standard time we proceeded to follow the same steps of the times study. Table 2 shows the processes with their operations, to which the standard time study was submitted.

Table 2. Description of operations and their elements

Process	N°	Description of elements
Reception of roses	1	Receive and register
	2	Move the flower pots to the place of immersion
	3	Immerse the flower meshes in the product
	4	Move the flower pot to the well
	5	Place the flower meshes in the well
Defoliation	6	Remove the flower meshes from the well and put in the basket
	7	Carry to the stem defoliation area
	8	Defoliate the stem of the flowers
	9	Move to classification area
	10	Catch the flower and check its quality

Classification	11	Remove the petals
	12	Measure stem length and size of flower head
	13	Place in the classification lira
Bunchs	14	Remove the flowers from the classification lira
	15	Move to the bunch table
	16	Place the flowers on the corrugated sheet
	17	Secure with staples
	18	Place measurement label
Cut of stems	19	Take the bunchs to the cutting table
	20	Cut the stems according to their length
	21	Remove the remaining leaves from the stems
	22	Place the suspenders on the legs of the branches
	23	Register
Quality control and storage in the cold room	24	Labels of varieties of the day
	25	Check if there are any trips
	26	Placing cap
	27	Attach rubber bands to hold the cap
	28	Place the bunch in the car with drawers
	29	Take the bunchs to the cold room
	30	Place the bunchs in the respective drawer
	31	Return to the control table
Packing and storage of boxes	32	Arming boxes
	33	Take boxes to the packing area
	34	Verify order
	35	Take and place the bunchs in the tub
	36	Take to the packing place
	37	Place the bunchs in the box
	38	Enzounchar the box
	39	Place label
	40	Store

The results with the new working method are shown below.

Table 3. Standard time for the method proposed by processes

Processes	Standard time (ST)
Rose Mesh Reception	0.71
Take off leafs	0.82
Classification	2.65
Bunch	1.79
Cutting of stems	0.89
Quality control and hydration	0.88
Packing	5.34

### Productivity proposed method

To determine the productivity is based on the standard time improved bunch process that are 1.79 min per each bunch (25 stems), which can determine the number of units produced per hour and day.

$$\text{Stems production by hours} = 60 \text{ min} * \frac{25 \text{ stems}}{1,79 \text{ min}} * 2 \text{ workers} = 1675 \text{ Stems/hour}$$

$$\text{Daily stems production} = 1675 \frac{\text{stems}}{\text{hour}} * 8 \text{ hours} = 13400 \text{ Stems/day}$$

$$\text{Monthly stems production} = 12176 \text{ units} * 22 \text{ days} = 294800 \text{ Stems/month}$$

### **Increase productivity**

Table 4 shows the productivity variation with upward trend. The first variation is 6.75%, which means that there is an increase in productivity between the production of the diagnosis with respect to the standardization of the Processes. Similarly, the second variation is 5.54%, which is the percentage of increase in productivity between production with standardized processes of the initial method with the standard-time production of the proposed method.

Table 4. Table of productivity variation

<b>Increase productivity</b>			
<b>Method</b>	<b>Formula</b>	<b>Calculation</b>	<b>%</b>
Diagnostics of production volume vs. productivity in ST of initial method	$\Delta P_{2-1} = \frac{P_2 - P_1}{P_1} * 100$	$\Delta P_{2-1} = \frac{12696 - 11893}{11893} * 100$	6,75
Productivity in ST of initial method vs. productivity in ST of proposed method	$\Delta P_{3-2} = \frac{P_3 - P_2}{P_2} * 100$	$\Delta P_{3-2} = \frac{13400 - 12696}{12696} * 100$	5,54

- ✓ It was demonstrated that standardizing time and performance standards could achieve an increase in productivity of 6.75% to what was currently occurring.
- ✓ It is anticipated that implementing the proposed work organization method can achieve an increase in productivity of 12, 67 % with respect to the working method that is currently used.

### **4. Discussion**

The present study covers: the design, formulation and selection of the best methods, processes, tools and equipment needed to process a product in the post-harvest area of the company floriculture.

Method engineering aims to optimize the way to perform a task or activity, eliminating unproductive working times and methods that do not add value to the post-harvest process. In addition, this standardization of tasks is achieved by studying the time needed to carry out this Activity. The best method must be linked to the best techniques or skills available, in order to achieve an efficient human-machine interrelation and thus increase the level of productivity.

The procedure used for the organization of work allowed us to know through an organizational diagnosis, the current performance of the company and identify the productivity reserves that could be exploited. This tool used is very easy to apply and at the same time very flexible, because it could be applied to any type of organization. It not only guides us, it also provides us with techniques to obtain Information.

It is essential that all areas be committed to the improvement and objective of research in the company. To follow the proposed working method, as well as the specific standard times of each one of the processes, as this will help to reduce unproductive times, production planning with less uncertainty, Increase of production capacity and productivity for the company.

It is recommended to extend this study to all the processes of the company, to achieve a better organizational performance in the company. It is necessary to equip personal protective equipment in case it is impossible to act on the source, according to the need of the process in such a way that it helps the worker to carry out his activities in a more efficient way in safe conditions.

### **5. Conclusions**

The procedure for the organization of the work that was used to support the investigation allowed making an effective diagnosis to focus the problems detected in the company under study. A time study was conducted to determine the standard weather with the initial method, resulting 1.89 min by bunch (25 stems), which reveals a reserve of productivity exploited of 6.75%. It was proposed an improvement in the distribution of the jobs with which was achieved the optimization of spaces and reduction of the distance that travels the worker in the operating cycle of about 58.7 to 48.8 meters. By proposing, the rotation of workers for jobs is expected to reduce monotony's at work and would reduce time by supplements, which would help reduce the standard time from 2.02 min/u to 1.79 min/u. With the implementation of these organizational technical measures would be achieved increase production to 13 400 stems/day and meet the demand of 12 500 stems/day. The new working method would increase productivity by 12.67 %.

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