

SCIENTIFIC ARTICLE

" APPLICATION OF TOOLS OF PLANNING AND CONTROL OF THE PRODUCTION IN BRASIERES's LINE COMFORT OF THE COMPANY ANY PRINTEX FOR THE IMPROVEMENT OF THE PRODUCTIVITY. "

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Abstract.

The purpose of applying tools of planning and control of production in the company of clothing Any Printex is to improve the productivity of the production line of bras and to better meet the requirements of customers.

The study and research starting with the situational analysis of the company, was defined the production line that will carry out the study, using diagram cause and effect Ishikawa was identified the problems that presents the process and was selected the main problem, described the necessary scientific theoretical necessary, subsequently rose necessary information of the current situation by direct observation Finally applied the tools of planning and control of production in order to consolidate and appreciate the results that the study.

KEYWORDS

Planning, control, production, efficiency, effectiveness, productivity, capacity, forecasts, distribution and processes.

1.Introduction

The application of tools of planning and control of the production, it will allow to the company to improve the satisfaction of the clients what will generate the opening to new markets allowing to overcome his expectations of growth in the productive, economic, social and cultural area, the permanency of his workers in his

working places and that generate new squares(seats) of employment. In addition, to improve his productivity to optimize his resources and for ende the attention to the client, and hereby will continue enjoying himself of the loyalty and acceptance of the products, which causes that the company has the capacity of competitiveness with the textile companies of the sector and is positioned more on the local and national market of confections.

2.Context.

2.1 Tools of planning and control of the production.

Forecasts Predictions. It is the art and the science of predicting the future events by means of the use of historical information and his projection towards the future. The goal of any system of forecasts predictions is to provide these forecasts predictions with the necessary accuracy, in time and to a reasonable cost. (Sipper, 1998 , pág. 102).

The added planeación. It is a process by means of which a company determines the ideal levels of capacity, production, subcontracting, inventory, lacking and enclosedly prices, during a horizon of specific time. The object of the added planeación is to satisfy the demand lawsuit and at the same time to maximize the usefulness. (Chopra & Meindl, 2013 , págs. 211,212).

Planeación and utilization of the capacity. The capacity is the " volume of production " (throughput) or number of units that it can lodge, receive, store or produce an installation in a specific period of time. (Render & Heizer, 2009 , pág. 288).

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Control of production. The control of activities of production (CAP) concerns, when it is necessary, the programming detailed to the control of the individual works in the centers of work in the floor of the plant, as well as the programming supplier. (Vollman, 2005 , pág. 392).

2.2 Application of tools of planning and control of the production.

For the application of the tools of planning and control of the production use of the following formulae.

FORMULA	ECUACIÓN
Variación de la productividad	$\Delta P_m = \left(\frac{P_{mf}}{P_{mo}} - 1 \right) * 100\%$
Productividad mono factorial	$\text{Productividad} = \frac{\text{Número de unidades producidas}}{\text{Insumo empleado}}$
Productividad multifactorial	$\text{Productividad} = \frac{\text{Salida}}{\text{MO} + \text{MP} + \text{Energía} + \text{Capital} + \text{Otros}}$
Error de pronóstico	$\text{Error de pronóstico (et)} = D_t - F_t$
Desviación media absoluta	$\text{MAD}_t = \alpha D_t - F_t + (1 - \alpha) \text{MAD}_{t-1}$
Señal de rastreo	$\text{Señal de rastreo} = T = \frac{\text{Suma acumulada de la desviación del pronóstico}}{\text{MAD}}$
Promedio móvil	$\text{Promedio móvil} = \frac{\sum \text{Demanda en los n periodos previos}}{n}$
Promedio móvil ponderado	$\text{PMP} = \frac{\sum (\text{Ponderación para el periodo n})(\text{Demanda en el periodo n})}{\sum \text{Ponderaciones}}$
Suavizamiento exponencial	$F_t = F_{t-1} + \alpha (A_t - F_{t-1})$
Colchón de capacidad	$\text{Colchón de capacidad} = 100\% - \% \text{ de Utilización}$
Capacidad diseñada	$\text{Capacidad Diseñada} = (\text{Días/Semana} * \text{Turnos} * \text{Horas trabajadas}) * (\text{Producción por hora})$
Capacidad efectiva	$\text{Capacidad efectiva} = \frac{(\text{Disponibilidad neta}) * (\text{Carga consolidada})}{\text{Carga unitaria}}$
Utilización	$\text{Utilización} = \frac{\text{Producción real}}{\text{Capacidad de diseño}}$

Eficiencia	$\text{Eficiencia} = \frac{\text{Producción real}}{\text{Capacidad efectiva}}$
Eficacia	$\text{Porcentaje de eficacia} = \left(\frac{\text{Producción real}}{\text{Producción programada}} \right) * 100$
Taza de utilización	$\text{Taza de utilización} = \frac{(\text{Salida real} / \text{Capacidad proyectada}) * 100\%}{100\%}$
Tiempo observado	$T_o (1 + s) = \frac{T_s}{F_v}$
Tiempo estándar	$T_s = F_v * T_o * (1 + s)$
Suplementos	$(1 + s)$
Abaco de lifson	$B = \frac{S - I}{S + I}$
Grado de ocupación de máquinas	$\text{Grado de Ocupación} = \frac{\text{Minutos necesarios por operación}}{\text{Tiempo neto de trabajo}} * 100$
Índice de producción	$IP = \frac{\text{Unidades a fabricar}}{\text{Tiempo disponible de un operador}}$
Número de operadores	$NO = \frac{TE * IP}{E}$
Número de máquinas	$\text{Número de máquinas requeridas} = \frac{D_p}{N [(1 - C/100)]}$
Punto de equilibrio en unidades	$PE_u = \frac{\text{Costos fijos totales}}{\text{Precio de venta por unidad} - \text{Costo variable por unidad}}$
Punto de equilibrio dólares	$\text{Punto de equilibrio } \$ = \frac{\text{Costos fijos totales}}{1 - \text{Costos variables}}$
Valor actual neto	$VAN = \sum_{t=1}^n \frac{FE_t}{(1+k)^t} - FE_0$
Tasa interna de retorno	$\$ 0 = \sum_{t=1}^n \frac{FE_t}{(1+TIR)^t} - FE_0$
Relación costo beneficio	$\text{Relación costo beneficio (C/B)}$
Mínimos cuadrados	$\hat{y} = a + bx$
Valor b de los mínimos cuadrados	$b = \frac{N \sum xy - \sum x \sum y}{N \sum x^2 - (\sum x)^2}$
Valor a de los mínimos cuadrados	$a = \frac{\sum y - b \sum x}{N}$

Crecimiento de ventas	$c = \frac{b(n)}{\sum y}$
ROI	$ROI = \frac{(\text{Ingresos} - \text{Inversión})}{\text{Inversión}} \times 100$
Periodo de repago	$PR = \frac{\text{Inversión inicial}}{\text{Entrada efectivo}}$
Mínimo teórico	$\text{Mínimo Teórico} = TM = \frac{\sum t}{c}$
Tiempo de ciclo	$c = \frac{1}{r}$

Table 1. Formulae used in the project.

(García Criollo, Estudio del Trabajo, 2005). (Cruelles Ruiz, 2013). (Hanke & Reitsch, 1996). (Niebel & Freivalds, 2009). (Gutiérrez Pulido, 2010) (Rubinfeld, 2005). (Render & Heizer, 2009). (Schroeder, 2011). (Chapman, 2006). (Chase, Jacobs, & Aquilano, 2009). (Hanke & Reitsch, 1996).

Forecasts Predictions of demand.

Suavizamiento exponencial.

Period N° 2

$$F_t = F_{t-1} + \alpha(A_{t-1} - F_{t-1})$$

$$F_t = 690 + .10(650 - 690)$$

$$F_t = 686$$

$$\text{Error of forecast (et)} = D_t - F_t$$

$$\text{Error of forecast (et)} = 700 - 686$$

$$\text{Error of forecast (et)} = 14$$

$$MAD_t = \alpha|D_t - F_t| + (1 - \alpha) MAD_{t-1}$$

$$MAD_t = .1|14| + .9 (9)$$

$$MAD_t = 9,5$$

$$\text{Tracking signal} = T = \frac{\text{Sum accumulated of the diversion of the forecast prediction}}{MAD}$$

$$\text{Tracking signal} = T = \frac{14}{9,5}$$

$$\text{Tracking signal} = T = 1,47$$

One presents the calculations for a period the final result appears in the following table.

Royal demand	Forecast $\alpha .10$	Forecast $\alpha .15$	Forecast $\alpha .30$
8080	8124	8088	8028

Table 2. Results of the model of forecast prediction.

Regresión lineal

YEARS (x)	SALES (y)	x ²	y ²	(x) (y)
1	8080	1	65286400	8080
2	8484	4	71978256	16968
3	16564	5	137264656	25048

Table 3. Components to apply the formula of square minimums.

Growth of the sales

PROJECTION OF SALES IN UNITS				
Year 1	Year 2	Year 3	Year 4	Year 5
8080	8484	8888	9292	9696

Table 4 Projection of sales to 5 years.

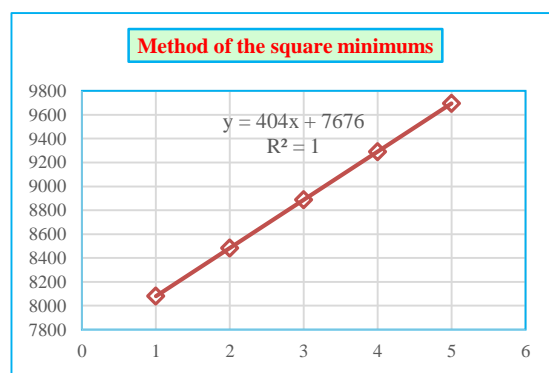


Illustration 1. Method of the square minimums equation of the straight line.

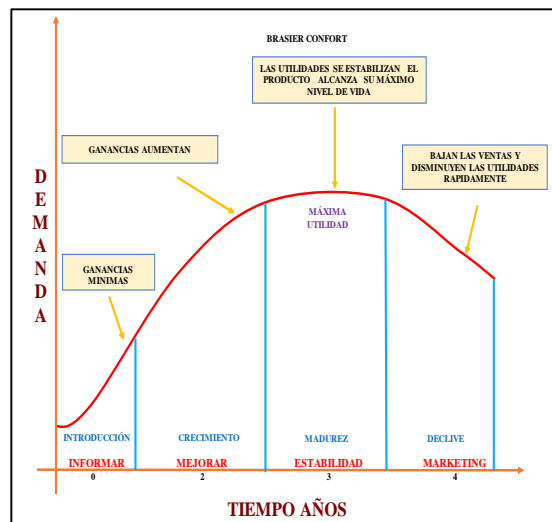


Illustration 2. Life cycle of the product.

Added Planeacion.

Times of current production.

$$\text{Total time} = (13,5 \text{ min /u})$$

$$\text{Time of cycle} = c = \frac{1}{40} \times 60 = 1,5 \text{ min/u}$$

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$$\text{Standard time for unit} = \frac{1,5 \text{ min}}{1 \text{ prenda}} = 1,5 \text{ min/u}$$

$$\text{Production} \left(\frac{\text{Clothing}}{\text{hour}} \right) = \frac{60 \text{ min}}{1,5 \text{ min/ clothing}} = 40 \text{ clothing/ hour}$$

$$\text{Production} \left(\frac{\text{Clothing}}{\text{day}} \right) = \frac{1 \text{ clothing} * 480 \text{ min}}{1,5 \text{ min}} = 320 \text{ Clothing/ day}$$

Times of production improved.

$$\text{Total time} = (10,8 \text{ min /u})$$

$$\text{Time of cycle} = c = \frac{1}{45} * 60 = 1,33 \text{ min/u}$$

$$\text{Standard time for unit} = \frac{1,33 \text{ min}}{1 \text{ prenda}} = 1,33 \text{ min/ u}$$

$$\text{Production} \left(\frac{\text{Clothing}}{\text{hour}} \right) = \frac{60 \text{ min}}{1,33 \text{ min/ clothing}} = 45 \text{ clothing/ hour}$$

$$\text{Production} \left(\frac{\text{Clothing}}{\text{day}} \right) = \frac{1 \text{ clothing} * 480 \text{ min}}{1,33 \text{ min}} = 360 \text{ clothing/ day}$$

Production brasieres comfort.

Activity	PRODUCTION FOR HOUR (units)	TIME IN HOURS (hours)	TIME IN (minutes)	PERCENTAGE (%)	WORK IN DAYS
Tejido	14	25,71	1543	49%	3,21
Tinturado	95	3,79	227	7%	0,47
Pre secado	712	0,51	30	1%	0,06
Secado	285	1,26	76	2%	0,16
Pasar Filo	279	1,29	77	2%	0,16
Reflado	127	2,83	170	5%	0,35
Unión de hombros	406	0,89	53	2%	0,11
Abierto de hombros	1487	0,24	15	0,46%	0,03
Pegado de elástico	46	7,83	470	15%	0,98
Tracado	406	0,89	53	2%	0,11
Pegado de etiqueta	319	1,13	68	2%	0,14
Revisado	106	3,40	204	6%	0,42
Enfundado	313	1,15	69	2%	0,14
Sellado	297	1,21	73	2%	0,15
Empacado	765	0,47	28	1%	0,06
TOTAL		52,60	3155,80	100%	6,57

Table 5. Summary of production

$$\text{Degree of occupation} = \frac{\text{Necessary minutes for operation}}{\text{Clear time of work}} * 100$$

Type of machine	Necessary minutes for operation	Clear time of work	Days of work	Degree of occupation for production	Activity
Máquina circular	1543	480	3,21	100%	Tejido
Máquina Overlock	77	480	0,16	16%	Pasar Filo
Máquina Overlock	170	480	0,35	35%	Reflado
Máquina Overlock	53	480	0,11	11%	Unión de hombros
Máquina Recubridora	470	480	0,98	100%	Pegado de elástico
Máquina Tracadora	53	480	0,11	11%	Tracado
Máquina Tinturadora	227	480	0,47	47%	Tintura
Máquina Secadora	30	480	0,06	6%	Pre secado
Máquina Secadora	76	480	0,16	16%	Secado
Máquina Recta	68	480	0,14	14%	Pegado de etiqueta
Máquina Selladora	73	480	0,15	15%	Sellado

Table 6. Summary of occupation you machinate

Men's assignment and you machinate.

Calculation of the number of operators.

$$IP = \frac{\text{Units to making}}{\text{Available time of an operator}}$$

$$NO = \frac{TE * IP}{E}$$

$$IP = \frac{360}{(8)(60)} = 0,75$$

$$\text{Number of operators tinturado} = \frac{0,63 * 0,75}{0,90} = 0,53$$

Activities	Standard time of the piece (TE)	Index of production (IP)	Planned Efficiency (E)	Number of operators for the line (NO)
Tejido	4,22	0,75	0,9	3,52
Pasar filo	0,22	0,75	0,9	0,18
Reflado	0,47	0,75	0,9	0,39
Unión de hombros	0,15	0,75	0,9	0,12
Abierto de hombros	0,04	0,75	0,9	0,03
Pegado de elástico	1,30	0,75	0,9	1,08
Tracado	0,15	0,75	0,9	0,12
Tinturado	0,63	0,75	0,9	0,53
Presecado	0,08	0,75	0,9	0,07
Secado	0,21	0,75	0,9	0,18
Pegado de etiqueta	0,19	0,75	0,9	0,16
Revisado	0,56	0,75	0,9	0,47
Enfundado	0,19	0,75	0,9	0,16
Sellado	0,20	0,75	0,9	0,17
Empacado	0,08	0,75	0,9	0,07

Table 7. Assignment of operatives workforce

Calculation of the number of machines.

$$\text{Number of needed asked machines} = \frac{Dp}{N [(1 - C/100)]}$$

D= Forecast of the number of units per year

P= Time of standard processing

N= Total number of Hours per year

C= Mattress of capacity wished

$$\text{Needed Asked machines} = \frac{8124 \times 1,35}{\left[\left(240 \frac{\text{días}}{\text{año}}\right) \left(1 \frac{\text{turno}}{\text{día}}\right) \left(8 \frac{\text{horas}}{\text{turno}}\right) \right] \left(1 - \frac{12}{100}\right)}$$

$$\text{Machines} = \frac{8124 \times 1,35}{\left[\left(240 \frac{\text{días}}{\text{año}}\right) \left(1 \frac{\text{turno}}{\text{día}}\right) \left(8 \frac{\text{horas}}{\text{turno}}\right) \right] \left(1 - \frac{12}{100}\right)} = \frac{10967,4}{1689,6} = 6,49 \approx 7$$

Readjustment of times

Operation	STANDARD UNITARY TIME(Ts)	OPERATIVES	TIME	STANDARD ASSIGNED TIME
1	4,22	3,52	1,2	1,33
2	0,63	0,53	1,19	1,33
3	0,08	0,07	1,14	1,33
4	0,21	0,18	1,17	1,33
5	0,21	0,18	1,17	1,33
6	0,47	0,39	1,21	1,33
7	0,15	0,12	1,25	1,33
8	0,04	0,03	1,33	1,33
9	1,3	1,08	1,2	1,33
10	0,15	0,12	1,25	1,33
11	0,18	0,16	1,13	1,33
12	0,56	0,47	1,19	1,33
13	0,19	0,16	1,19	1,33
14	0,2	0,17	1,18	1,33
15	0,08	0,07	1,14	1,33

Table 8. Assignment of standard time.

Production take per day by means of the assignment of standard time.

The activity N ° 8 is the one that was determining the production of the line, the activity of the operative with the time more shortly in this case the process of opened of shoulders.

$$\text{Clothing per day} = \frac{0,03 \text{ operator} \times 480 \text{ min}}{0,04 \text{ Standard time}} = 360 \text{ clothing}$$

Point of balance (P.E)

$$\text{Point of balance } u = \frac{\text{Fixed total costs}}{\text{Price of sale for unit} - \text{Variable cost for unit}}$$

$$\text{Point of balance } u = \frac{1750,17}{3,95} = 443 \text{ unit}$$

$$\text{Point of balance } \$ = \frac{\text{Fixed total costs}}{1 - \frac{\text{Variable total costs}}{\text{Total volume of sales}}}$$

$$\text{Point of balance } \$ = \frac{1750,17}{1 - \frac{1157,65}{2907,82}} = 2907,87 \$$$

P.E by means of Excel.

POINT OF OPERATIVE BALANCE					
COMPANY ANY PRINTEX					
POINT OF BALANCE (P.E)					
INFORMATION OF ENTRY					
Price of sale for unit	6,57				
Variable cost of operation for unit	2,62				
Fixed cost of operation per period	\$ 1.750,17				
Fixed not monetary cost	0,00	Optional			
Point of operative balance	443 units				
Point of balance in cash	443 units				
Point of monetary balance	\$ 2.911,04	Dollars			

	Units	Income	Costs Fixed	Costs Variables	Costs Total
0,00	0	\$ -	\$ 1.750,17	0,00	\$ 1.750,17
0,10	89	\$ 582,21	\$ 1.750,17	232,17	\$ 1.982,34
0,20	177	\$ 1.164,42	\$ 1.750,17	464,35	\$ 2.214,52
0,30	266	\$ 1.746,63	\$ 1.750,17	696,52	\$ 2.446,69
0,40	354	\$ 2.328,83	\$ 1.750,17	928,70	\$ 2.678,87
0,50	443	\$ 2.911,04	\$ 1.750,17	1.160,87	\$ 2.911,04
0,60	532	\$ 3.493,25	\$ 1.750,17	1.393,05	\$ 3.143,22
0,70	620	\$ 4.075,46	\$ 1.750,17	1.625,22	\$ 3.375,39
0,80	709	\$ 4.657,67	\$ 1.750,17	1.857,40	\$ 3.607,57
0,90	798	\$ 5.239,88	\$ 1.750,17	2.089,57	\$ 3.839,74
1,00	886	\$ 5.822,08	\$ 1.750,17	2.321,74	\$ 4.071,91

Table 9. Point of operative balance

Graph of the point of balance (P.E)

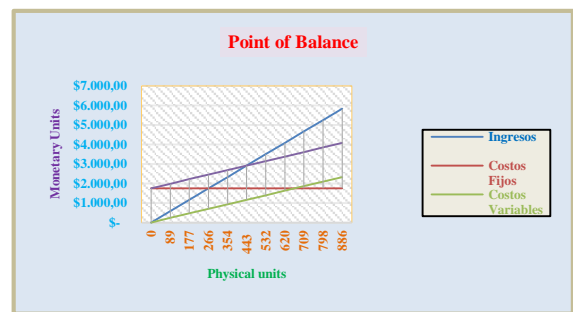


Illustration 3. Point of balance in sales

Balance sheet of the line of production

Current efficiency

$$E = \frac{\text{Minutes standard for operation}}{\text{Minutes standard assigned} \times \text{Number of operatives}}$$

$$E = \frac{10,8}{(1,33) \times (9)} \times 100 = 90,22 \%$$

$$\text{Efficiency} = \frac{\sum t}{n \times c}$$

$\sum t$ = Total time needed for assemblies of a unit.

n = Number of working stations.

c = Time of cycle.

$$\text{Efficiency} = \frac{10,8}{9 \times 1,33} = 90,22 \%$$

Improved efficiency

$$\text{Theoretical minimum} = TM = \frac{\sum t}{c}$$

$\sum t$ = Total time needed for assemblies of a unit.

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C = Time of cycle.

Theoretical minimum = $TM = \frac{10,8}{1,33} = 8$ Operatives.

$E = \frac{10,8}{(1,33) \times (8)} \times 100 = 100 \%$

Efficiency = $\frac{10,8}{8 \times 1,33} = 100 \%$

Capacity of desing = $\frac{1920}{1,33} = 1444$ units

Royal capacity = 320 Unit

Effective capacity = $\frac{\text{Total of working hours a year} - \text{Hours of maintenance}}{\text{Average of working hours for unit}}$

Projected production.

Plaster of elastic tape with 2 operatives

Standard production = $\frac{N^\circ \text{ of operatives} \times \text{Clear time}}{T_s}$

Standard production plaster of elastic tape = $\frac{2 \times 480}{1,3} = 738$ clothing

59,04 \$ costs

Fabric of the article to double shift

Capacity = Shifts x Prendas/hour x hours / Shift

Capacity = $2 \times 14 \times 8 = 224$ clothing
47,94 \$ costs

Effective capacity = $\frac{1824}{1,33} = 1371$ unit

Designed capacity = (5/week * 1 * 8 Hours) * (45unit / Hour)

Project capacity = 1800 units / Weeks

Utilization

% Utilization = $0,88 \times 100 = 88 \%$

Efficiency

Efficiency = $\frac{1200}{1371} = 88 \%$

Comparative analysis

Planning of the production

ACTIVITY	PERSON IN CHARGE	MACHINE	MATERIAL	TIME (seg)	CODIFICATION	UTILIZATION
Tejido	José Vimesa	Circular	spin for fabric microfiber in "Z" and in "S", Liera covered with microfiber	253,2	TE2	1
Tinturado		Tinturadora	Chemists	63	TI1	1
Pre secado		Secadora	Artículos tinturados	8	SE1	1
Secado			21			
Pasar filo	Zulema Ramirez	Overlock	Woven articles	22	OV1	1
Refinado	Paulina Limaico	Overlock	Threads of confection, scissors	15	OV2	0,5
Unión de hombros				4		
Abierto de hombros						
Pegado de elástico	Gladis Terán	Recubridora	Elastico sesgo, hilos de confección	78	RE1	1
Tracado	Silvia Medavilla	Tracadora	Designed case, adhesive Label (Etiquette), Label (Etiquette) of carton	15	TR1	0,5
Revisado				19		
Enfundado				56		
Pegado de etiqueta	Mery Tambo	Recta	Labels (Etiquettes) of design that go in the article (garment security)	19	RA2	0,5
Sellado	Silvio Calderón	Selladora	Boxes (Cash desks) of carton	20	SA1	0,5
Empacado				8		

Table 10. Planning of the production

Planeacion and utilization of the capacity.

Capacity of design of the plant

Capacity of design = $\frac{\text{Total of working hours a year}}{\text{Average of working hours for unit}}$

CAPACITY			
Designed	Royal	Project	Efectiva
1444	1200	1800	1371

Table 11. Planning of the capacity

Graph causes effect.

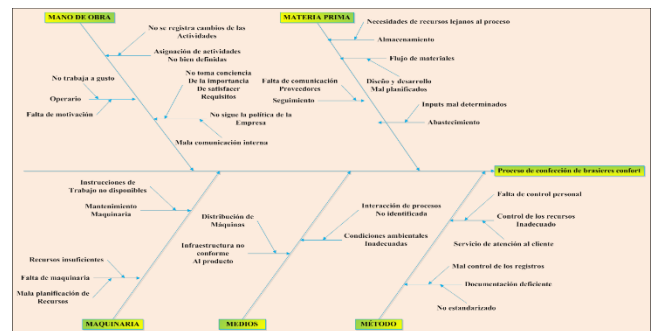


Illustration 4: Graph Causes effect Ishikawa

Description of the improvements

BEFORE

AFTER



Photographs. 1. Area of fabric.

BEFORE AFTER



Photographs. 2. Area of tinturado

BEFORE AFTER



Photographs. 3. Area of confection.

Control of production.

Process flow chart

Activity	Distance (m)	Fv	(1 + a)	Tiempo	Tv min/seg	Tv seg
Tejido	2	1,19	0,13	3,14	4,22	253,2
Tinturado	12	1,19	0,18	0,75	1,05	65
Pre secado	1	1,19	0,18	0,06	0,08	8
Secado	1	1,19	0,18	0,15	0,21	21
Pasar filo	1	1,19	0,13	0,16	0,22	22
Refinado	45	1,19	0,13	0,25	0,47	47
Unión de hombros	2	1,19	0,13	0,11	0,15	15
Abierto de hombros	2	1,19	0,13	0,03	0,04	4
Pagado de elástico	2	1,19	0,13	0,58	0,78	78
Tracado	2	1,19	0,13	0,11	0,15	15
Pegado de etiqueta	2	1,19	0,13	0,14	0,19	19
Revisado	2	1,19	0,13	0,42	0,56	56
Empaque	1	1,19	0,13	0,14	0,19	19
Sellado	1	1,19	0,13	0,15	0,2	20
Empacado	1	1,19	0,13	0,7	0,08	8
Total	15	2	4	1	73	628

Figure 1. General graph of processes

Specification sheet

ANY PRINTEX		
ÁREA DE CONFECCIÓN		
FICHA DE PRODUCCIÓN		
Lote de producción del brasier confort.		
ARTÍCULO: Brasier Confort		
COLOR: Negro	N: 16	
OPERARIA: Sra. Alicia Calderón		
CANTIDAD: 360 prendas		
FECHA: 2015-11-30		
PROCESO	MÁQUINA	TIEMPO
1. Puesto en caja	Manual	10,8
TOTAL		
10,8 min		
OBSERVACIONES:		
JEFE DE PRODUCCIÓN: Sra. Alicia Calderón		

Table 12. Card of process production

Gantt's graph



Figure 1. Gantt's graph of the process of confection

Rule of sequences

Rule of sequence FCFS

TRABAJO EN ORDEN	TIEMPO		TIEMPO TRANSITO
	PROCESAMIENTO	PLAZO EN DÍAS	
Tejeduría	3,21	6,55	3,21
Tintura	0,69	6,55	3,90
Cortado	0,51	6,55	4,41
Preparación	0,14	6,55	4,55
Armado	1,65	6,55	6,20
Empaque	0,35	6,55	6,55
TOTAL	6,55		28,82

Table 13. Rule of priority of production FCFS Table 13. Rule of priority of production FCFS

Rule of sequence SOT

TRABAJO EN ORDEN	TIEMPO PROCESAMIENTO O DÍAS	PLAZO EN DÍAS	TIEMPO TRANSITO
Preparación	0,14	6,55	0,14
Empaque	0,35	6,55	0,49
Cortado	0,51	6,55	1,00
Tintura	0,69	6,55	1,69
Armado	1,65	6,55	3,34
Tejeduría	3,21	6,55	6,55
TOTAL	6,55		13,21

Table 14. Rule of priority of production SOT

Implements for the improvements in the production



Lay out area of fabric and tinturado

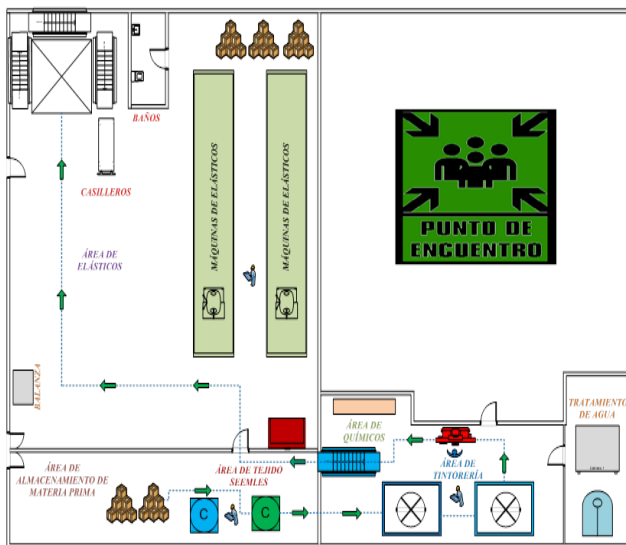


Illustration 5. Lay out ground plant

Lay out area of confection

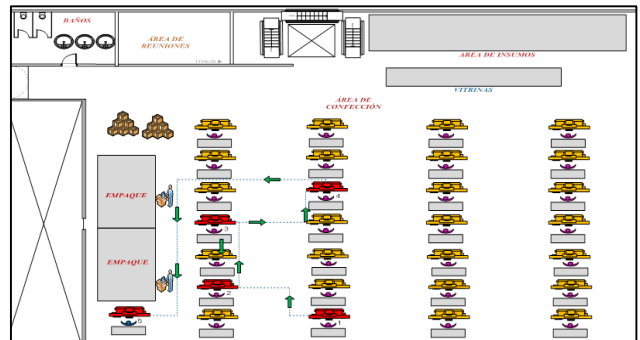


Illustration 6. Lay out plants discharge

Strategies of marketing

Administration of the strategy of marketing

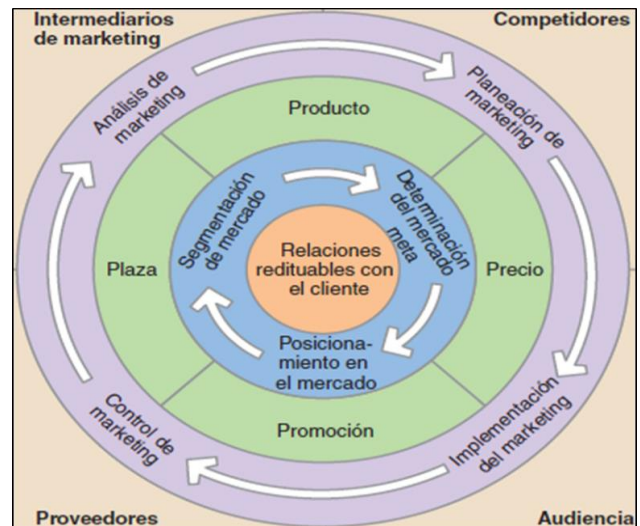


Figure 2. Strategy of marketing orientated to the product

The 4 p of the mixture of the marketing

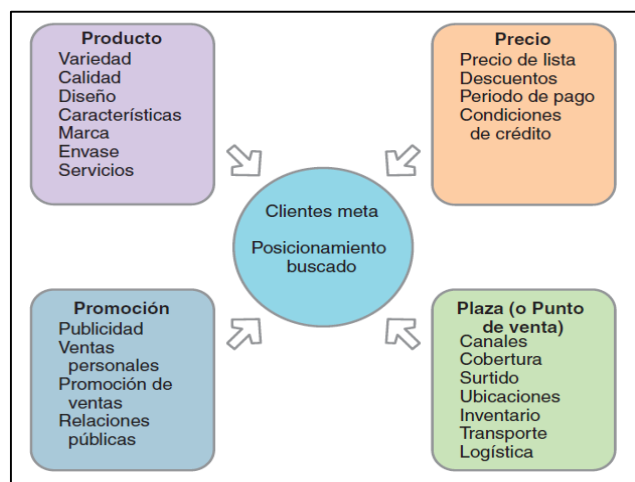


Figure 3. Mixture of marketing of the product

3.Results.

INDICATORS.			
INITIAL ANALYSIS.		FINAL ANALYSIS.	
General.		General.	
Indicator.	Value.	Indicator.	Value.
Productivity mono factorial (workforce).	7,91 u/\$	Productivity mono factorial (workforce).	11,33 u/\$
Productivity multifactorial (workforce(manpower) + raw material(commodity) + CIF).	2,83 u/\$	Productivity multifactorial (workforce(manpower) + raw material(commodity) + CIF).	3,65 u/\$
Productivity of the workforce(manpower) for worn out hour.	4,44 u	Productivity of the workforce(manpower) for worn out hour.	5,6 u
Productive deficit in units on the basis of the Point of balance	123 u	Productive deficit in units on the basis of the Point of balance	83 u
Efficiency of the line	90,22%	Efficiency of the line	100%
ECONOMIC LOSSES.			
INITIAL ANALYSIS.		FINAL ANALYSIS.	
Pvu	4,59 \$	Pvu	6,57 \$
Daily loss.	564,57 \$	Daily loss.	545,31 \$
Weekly loss.	2822,85 \$	Weekly loss.	2726,55
INCREASE OF PRODUCTIVITY AND PERCENTAGE OF DECREASE OF LOSSES.			
Decrease of losses (%).		-96%	
Increase of the productivity units (%).		12,50%	
Increase of productivity mono factorial (%).		43,24%	
Increase of productivity multifactorial (%).		29%	

Table 15. Analysis of indicators after the study of investigation(research)

BEFORE		AFTER	
LOT PLC 77836		LOT PLC 1008633	
Brasier Black Comfort		Brasier Black Comfort	
Produced units.	320	Produced units.	360
Number of operatives.	9	Number of operatives.	8
Number of machines.	9	Number of machines.	7

Table 16. Production before and after the improvements

Recovery of the investment

EMPRESA ANY PRINTEX						
ESTUDIO TECNICO						
INVERSIONES	CANTIDAD	VALOR	TOTAL	AÑOS	VALOR RESIDUAL	GASTO DEPRECIACION
VEHICULO	0	\$ -	\$ -	0	\$ -	\$ -
SOFTWARE	1	\$ 20.000,00	\$ 20.000,00	10	\$ 6.600,00	\$ 1.340,00
EQUIPAMIENTO	1	\$ 6.039,00	\$ 6.039,00	5	\$ 603,90	\$ 1.087,02
CAPITAL TRABAJO		\$ 26.039,00	\$ -		\$ -	\$ -
		\$ 26.039,00	\$ 26.039,00		\$ 7.203,90	\$ 2.427,02
FINANCIAMIENTO						
EMPRESA	USD	%	TASA INTERES	WACC	D) Inmuebles (excepto terrenos), naves, aeronaves, barcos y similares 5% anual	
CFN (Bancos)	\$ 6.039,00	23%	0%	0,0%	(E) Instalaciones, maquinarias, equipos y muebles 10% anual.	
TOTAL	\$ 26.039,00	100%	10%	7,8%	(H) Vehículos, equipos de transporte y equipo camión móvil 20% anual.	
PRIMA DE RIESGO				1%	(V) Equipos de cómputo y software 33% anual.	
COSTO OPORTUNIDAD				20%		
TABLA AMORTIZACIÓN						
N (Años)	0	1	2	3	4	5
AMORT K		\$ 4.000,00	\$ 4.000,00	\$ 4.000,00	\$ 4.000,00	\$ 4.000,00
INTERES		\$ 2.042,00	\$ 1.633,60	\$ 1.225,20	\$ 816,80	\$ 408,40
SALDO	\$ 20.000,00	\$ 16.000,00	\$ 12.000,00	\$ 8.000,00	\$ 4.000,00	\$ -

Table 17. Technical study of the Project

EMPRESA ANY PRINTEX							
ESTUDIO FINANCIERO							
INVERSION	DETALLE	0	1	2	3	4	5
INGRESOS		\$ 26.039,00					
PRECIO	INFL. ESTIMADA 5%		\$ 6,57	\$ 6,90	\$ 7,24	\$ 7,61	\$ 7,99
CANTIDAD	CREC %		8.080	8.484	8.888	9.292	9.696
TOTAL INGRESOS		\$ 83.085,00	\$ 88.526,87	\$ 94.379,56	\$ 100.671,20	\$ 107.431,05	\$ 114.711,15
COSTO DE VENTAS							
COSTO UNITARIO	INFL. ESTIMADA 5%		\$ 2,62	\$ 2,75	\$ 2,89	\$ 3,03	\$ 3,18
CANTIDAD			4.080	4.844	5.696	6.640	7.776
TOTAL COSTO VENTAS		\$ 21.169,60	\$ 23.339,48	\$ 25.673,43	\$ 28.182,43	\$ 30.878,14	\$ 33.764,14
UTILIDAD BRUTA			31.916,0	35.147,4	38.706,1	42.488,8	46.552,9
GASTO OPERATIVO	INFL. ESTIMADA 5%	\$ 1.780,17	\$ 1.837,68	\$ 1.929,56	\$ 2.026,04	\$ 2.127,34	\$ 2.232,54
OTROS GASTOS		\$ 25,00	\$ 26,25	\$ 27,56	\$ 28,94	\$ 30,39	\$ 31,89
GASTO DEPRECIACION	UNITARIO	\$ 0,30	\$ 0,30	\$ 0,30	\$ 0,30	\$ 0,30	\$ 0,30
UTILIDAD OPERATIVA		\$ 30.140,53	\$ 33.323,16	\$ 36.748,70	\$ 40.433,49	\$ 44.394,89	\$ 48.594,89
GASTO FINANCIERO		\$ 2.042,00	\$ 1.633,60	\$ 1.225,20	\$ 816,80	\$ 408,40	\$ -
UTILIDAD ANTES IMPUESTO		\$ 28.098,53	\$ 31.689,56	\$ 35.523,50	\$ 39.616,69	\$ 43.986,49	\$ 48.594,89
TRABAJADORES (15%)		\$ 4.214,78	\$ 4.753,43	\$ 5.328,53	\$ 5.942,50	\$ 6.597,97	\$ 7.294,23
IMPUESTO (25%)		\$ 7.024,63	\$ 7.922,39	\$ 8.880,88	\$ 9.904,17	\$ 10.996,62	\$ 12.150,66
UTILIDAD NETA		\$ 16.859,12	\$ 19.013,74	\$ 21.314,10	\$ 23.770,02	\$ 26.390,89	\$ 29.150,50
GASTO DEPRECIACION	TOTAL	\$ 2.427,02	\$ 2.427,02	\$ 2.427,02	\$ 2.427,02	\$ 2.427,02	\$ 2.427,02
PRESTAMO RECIBIDO		\$ 20.000,00					
PAGO PRESTAMO		\$ 4.000,00	\$ 4.000,00	\$ 4.000,00	\$ 4.000,00	\$ 4.000,00	\$ 4.000,00
VALOR RESIDUAL			\$ 46.039,00	\$ 15.286,14	\$ 17.440,76	\$ 19.741,12	\$ 22.197,04
FLUJO EFECTIVO			\$ -	\$ -	\$ -	\$ -	\$ -
TASA CORTE DESCUENTO	20%						
VALOR PRESENTE		\$ 59.313,67					
VAN		\$ 105.352,67					

Table 18. Financial study of the project

PROJECT	ANALYSIS OF INDICATORS
VP	\$ 59.313,67
VAN	\$ 105.352,67
TIR	64%
RCB	\$ 2,98

Table 19. Recovery of the investment

4.Conclusions.

It was fulfilled by the raising of the theoretical scientific documented information of the company by means of technologies of direct observation and investigation(research), to obtain primary information, of the process in study and bibliographical reference of the topic as secondary information.

The suitable application of the tools of planning and control of the production in the company of confections Any Printex allowed to increase the quantity of units made from 320 articles to 360 articles finished during a labor day.

The control and short-term planning provide relevant information of the need of resources that has the company, and facilitate the coordination of activities and details of the manufacture. By means of the balance sheet of line the number of operatives diminished from 9 to 8

10 Diego TIXILIMA, Ramiro SARAGURO, " Application of tools of planning and control of the production in brasieres's line comfort of the company Any Printex for the improvement of the productivity "

persons and of the machinery from 9 to 7 machines for the whole process of confection.

The means necessary for the confection of the brasieres comfort as, operatives, machineries, time of production, spaces in the plant were organized in an efficient way, which allowed to reduce the time of cycle from 1,5 minutes to 1,35 minutes for every unit produced in the line and the productivity was improved in 43,24 %.

The inadequate distribution of plant was concerning notably the performances of the processes of production, with what with a suitable distribution of the lay Out one managed to improve the flow of materials and the distances crossed by the operatives the tour diminished from 164 to 73 meters what does that the line of production is more productive.

5.Thanks.

God and the Holiest Virgin of the Quinche, for being the light that they illuminate and guide my way, and me strength(fortress) and benedictions have given to overcome of the best way the adversities that me they have presented and be able to have reached successfully one more stage in my life.

I am grateful to the prestigious Technical University of the North of a special way to the Faculty of Engineering in Applied Hardworking Sciences for mention to the career of Industrial Engineering; to my teachers, friends, companions, clerical staff and of services that during these years have been an essential part of my formation training and professional development.

I express my sincerer gratefulness to the lady Bolaños Jaramillo Ana Bertha and to his distinguished family for having collaborated in the development of this project of investigation research of thesis, for opening me the doors of your prestigious company and for the unconditional and constant help that they have offered to me.

To the Ing. Ramiro Saraguro, for sharing his knowledge and being the director of the present work.

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