

Time and motion study of a cashew nut processing factory in Dapoli

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■ **ABSTRACT** : Cashew is the one of the major horticultural crops in the Konkan Region of Maharashtra. Hence, the cashew processing industries are having good scope in this region. The usual trend is that the entrepreneurs here start their cashew processing unit on small scale and with the availability of funds they expand their unit. Hence, there is no logical expansion of the processing plants occur that ultimately add to the processing cost. The processing units which are set with proper planning can save time and motion and the cost of processing. This article presents the time and motion study of two cashew processing units one of which is gradually expanded while the other one is set up with proper planning. A theoretical attempt is made to improve the planning of the gradually expanded unit to reduce the time and motion.

■ **KEY WORDS** : Cashew nut processing, Time motion study, Layout, Distance

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The major cashew growing countries in the world includes India, Brazil, Vietnam, Indonesia and several African countries such as Tanzania, Mozambique, and Ivory coast etc. India has a creditable record of attaining good amount of foreign exchange by way of export of cashew kernels. The main cashew growing and processing states in India are Kerala, Karnataka, Tamil Nadu, Andhra Pradesh, Maharashtra, Goa, and Orissa. The top ten cashew processing industries in India during 2012 – 13 are shown in Fig. A.

The area, production and yield of top ten cashew processing states in India during 2012 – 13 are given below in the Table A. According to the tabulated values, even though Maharashtra and Andhra Pradesh have same area of cultivation under cashew, the yield of Maharashtra is almost double compared to Andhra Pradesh. The Maharashtra ranks first in production and

yield.

Cashew nut processing is an important aspect as unprocessed cashew nut has null value. For processing of the cashew nut, a set procedure is adopted worldwide with minor variations according to the availability of the machines or facilities and the local trends. The cashew nut processing industry is woman labour based industry. They share more than 90 % of total labour in this industry (Anonymous, 2014).

Maharashtra leads in production of cashew nut in India followed by Andhra Pradesh (Anonymous¹, 2013). In Maharashtra state cashew nut is grown mainly in Ratnagiri and Sindhudurg districts. Most of the cashew producers in Ratnagiri and Sindhudurg districts are small producers and they are unorganized. (Anonymous, 2009). On the basis of the pollution index, this industry comes under “Orange category” i.e. industrial sectors having

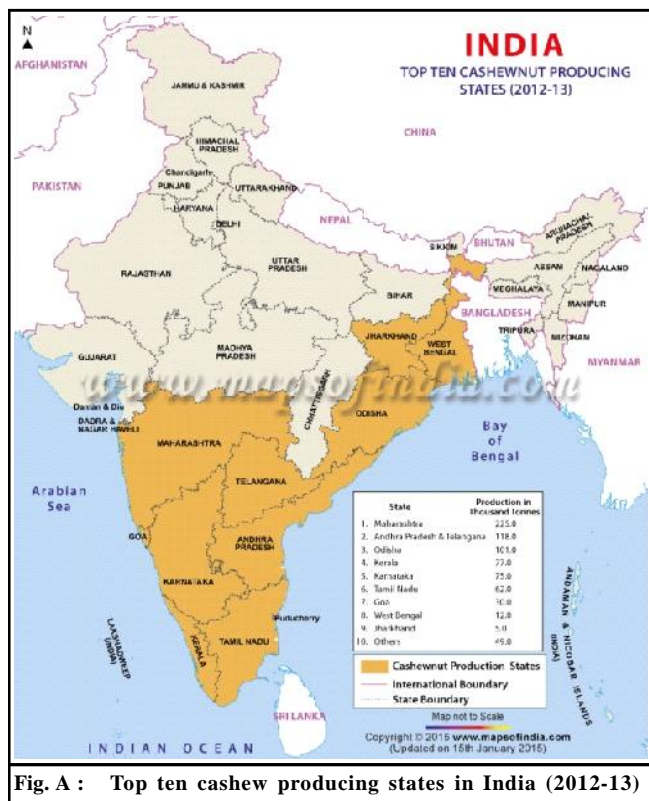


Fig. A : Top ten cashew producing states in India (2012-13)

pollution index score of 41 to 59 (Javadekar, 2016). The cashew nut processing industries in Maharashtra can be classified on the basis of processing capacity per day as i. Home scale unit (0.5 to .7 q/day), ii. Small medium / medium scale (4 to 5 q/day) and iii. Large scale units (13 to 14 q/day). Due to the progress in the processing capacity of the unit, the small / medium scale units are getting expanded to large scale units. Sometimes, no

scientific or technical logic is followed during its expansion. Hence, a need was felt to study such a gradually expanded cashew processing industry for its time and motion study. A case study was conducted at M/s Vishwas Cashew Processing Industry, Asond, Tal Dapoli, Dist Ratnagiri to evaluate the time and motion in the factory. Also to compare it with preplanned setup, M/s Anuasaya Cashew Factory, MIDC, Dapoli was also studied. This industry is setup with pre defined capacity and layout is made considering the need for the future expansion. The study will help to find out the motion and time study comparison between gradually expanded factory and planned layout of the factory. Also, the modified layout was suggested to the gradually expanded factory for proper flow of the material to save the time and labour.

Objectives of the case study :

- To study the time and motion required for cashew nut processing in the selected factory
- To propose the suitable layout of the factory to reduce time and motion
- To find out the man hours per kg required for the processing cashew nut
- To find out the cost of cashew nut processing at Rs./kg.
- To find out the body part discomfort faced by the workers due to working in the industry by interviewing them.
- To find out the light intensity in the scooping and grading rooms.

Rank	State name	Area	Production	Yield
1	Maharashtra	184.0	225.0	1221.0
2	Andhra Pradesh	184.0	118.0	641.0
3	Odisha	164.0	101.0	616.0
4	Kerala	85.0	77.0	906.0
5	Karnataka	122.0	75.0	611.0
6	Tamil Nadu	136.0	62.0	454.0
7	Others	36.0	49.0	1357.0
8	Goa	57.0	30.0	526.0
9	West Bengal	11.0	12.0	1091.0
10	Jharkhand	12.0	5.0	417.0

Area-000' Hectares, Production- 000'Tonnes, Yield-kg/hectare
 Source: Department of Agriculture and Cooperation (Horticulture division)
<http://eands.dacnet.nic.in/Publication12-12-2013/Agricultureat%20a%20Glance2013/ page128-185.pdf>

METHODOLOGY

The M/s Vishwas Cashew Processing Industry, Asond, Tal Dapoli, Dist Ratnagiri was selected for the study as the factory is gradually expanded from small processing unit (300 kg/year processing capacity) to large factory (110 T/year processing capacity). The owner has expanded the unit as the space available with the gradual increase in the capacity. The layout of the factory was studied. The work flow of the processing was studied through the interview with the owner. The layout of the unit is as shown in the Fig. 1. The process was split in different events so as to study it separately. The time required for each event in the process was recorded using the stop watch. Most of the events were studied in actual practice while for some others the time recorded as per the experience of the owner and the experienced labour working there. The motion paths were also recorded during the study to find out the time required and the distance travelled by the person during the event of the process. The number of labours (male / female), rate of wages and capacity of the labours were found through an interview with the owner of the factory. The study was conducted for the batch of 440 kg of raw cashew nut as the industry is having two boilers each of capacity 320 kg and 120 kg, respectively which can be operated at a time. Similar study was conducted at M/s Anusaya Cashew Factory, MIDC, Dapoli. As per the availability of the machineries and lay out of the factory, the cashew nut process was split in the events as enlisted in the Table 1 and 3 to study the time and motion. For these events, the time required, distance travelled, capacity and wages rates were studied. The workers were interviewed personally to find the strains they are facing due to working in the industry. The body part discomfort picture (Fig. 3) was shown to the workers for easily locating the discomfort body part. The information obtained from the interview is also discussed below.

RESULTS AND DISCUSSION

The results obtained from the present investigation as well as relevant discussion have been summarized under following heads :

Time and motion study :

The time and motion for the above mentioned events were measured are tabulated below for a batch of 440

kg cashew nut processing as the processing industry is having two boilers of total capacity of 440 kg. The time required for each operation and the distance travelled by the persons give the idea about the time and motion study. The motion study helps to relocate the units in the industry to curtail the motion so as to save the time and the movement in the industry. The layout of the industry (not to the scale) is shown in Fig. 1 while the suggestions for the relocation of the units are shown in Fig. 2.

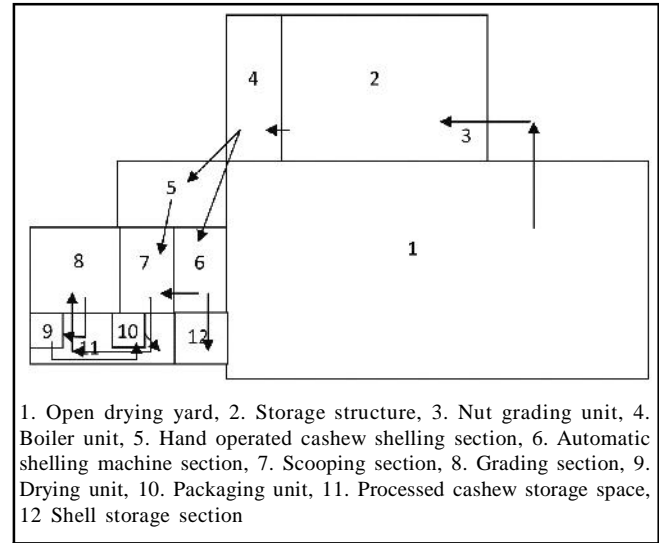


Fig. 1 : Existing layout with process flow of M/s Vishwas Cashew Processing Industry, Asond, Dapoli

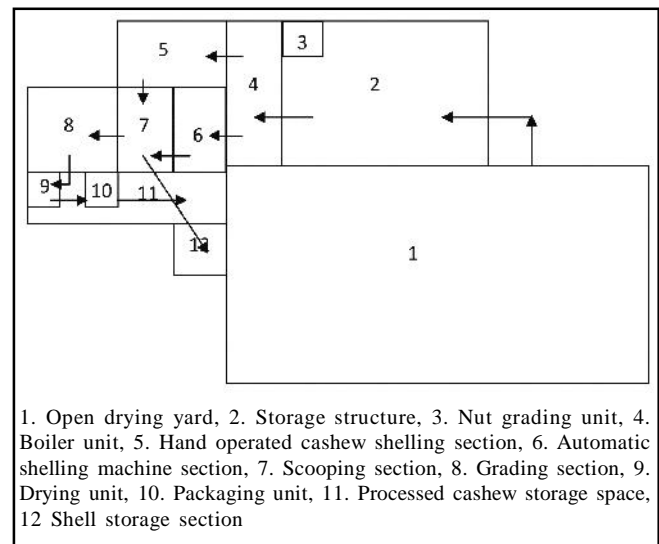


Fig. 2 : Proposed layout process flow for M/s Vishwas Cashew Processing Industry, Asond, Dapoli to reduce labour movement in factory

The time required for processing 440 kg of cashew nuts by manual cutting machine was found to be 3252 min *i.e.* 7.4 min/kg while in the same factory, if the cutting operation is done by machine, then the approximate time required will be 2813 min for 440 kg *i.e.* 6.4 min/kg. It means, for per kg process of cashew nuts, about 1 min can be saved if the cutting operation is done with three machines. The man-hour required for processing 440 kg of raw cashew nuts by machines was found to be 256.5

i.e. 0.58 mah-hr/kg. The man-hour required for processing 440 kg of raw cashew nuts by manual cutting machines was found to be 372.6 *i.e.* 0.84 mah-hr/kg. This shows that the man-hr required in case of manual cutting machine are much more (145 %) than that of the automatic cutting machine. This includes the operations as enlisted in the Table 1. In these calculations, the time required for cooling of the steamed cashew nuts is not considered. Hence, to start the shelling operations in the

Table 1 : Event wise time and motion study along with labour required at M/s Vishwas Cashew Processing Industry, Asond, Tal Dapoli Dist Ratnagiri

Sr. No.	Events	Time required, min	Distance travelled, m	Rate of doing work, qty per hour	Wages, Rs./kg	No. of labours (M/F)
1.	Manual transportation of cashew nut from drying yard to storage	5.5	30.6	--	--	2 M
2.	Inside storage only to raw cashew nut grader	2	8	--	--	2 M
3.	Grading	110	--	240 kg/h	--	2 M
4.	Grader to storage space	2	8	--	--	2 M
5.	Storage to boiler	2	8	--	--	2 M
6.	Filling cashew nut in the boiler	4	--	--	--	2 M
7.	Boiler preparation	60	10	--	--	1 M
8.	Boiling process (320 kg boiler unit)	20	--	--	--	0.5 M
9.	Boiler process (120 kg boiler unit)	20	--	--	--	0.5 M
10.	Emptying the boiler	15	1	--	--	2 M
11.	Boiler to cutting machine					
	Manual cutting machine	2	7.8	--	--	2 M
	Automatic cutting machine	3	13	--	--	2 M
12.	Cutting operation	--	--	--	--	
	Manual cutting machine	880	--	(@ 30 kg seed /day/person)	Rs. 10 /kg	8 F
	Automatic cutting machine	440	--	(@20 kg/h/machine)	--	3 m/c
13.	From machine to Scooping table	5	5	--	--	4 F
14.	Scooping operation	440	--	(@ 15 kg/day/person)		8 F
15.	Transferring shells to store	10	10	--	--	2 F
16.	Transferring kernels to drying	6	14.5	--	--	2 F
17.	Dryer loading	10	--	--	--	1 F
18.	Drying process (9 h at 70°C)	540	--	110 kg/batch		
19.	Dryer unloading	10	--	--	--	1 F
20.	Peeling (out sourcing)	300	--	1 kg/h	Rs. 14/ kg	22 F
21.	Peeling to cleaning and primary grading table	6	14	--	--	2 F
22.	Cleaning and primary grading	264	--	25 kg/day	Rs. 110/day	8 F
23.	Primary to secondary grading table	3	2	--	--	2 F
24.	Secondary grading	300	--	22 kg/day	Rs. 120/day	8 F
25.	Grading table to dryer	6	14	--	--	2 F
26.	Dryer loading	10	--	--	--	1 F
27.	Drying (2-3 h at 70°C)	150	--	110/batch	--	
28.	Drying to packaging unit	3	7	--	--	2 F
29.	Vacuum packing (10 kg tin) and shifting to storage	66	3			3 F

early hours of the day, the raw cashew nuts have to be steamed a day before for its proper cooling or in other words, the raw cashew nuts steamed today have to be shelled tomorrow. In regular practice, the two or three batches of raw cashew nuts are steamed once the boiler is operated. In this way, the time required for the boiler preparation can be saved.

It is observed from the Table 1 that the initial enlisted 11 jobs are done by the male workers only while the jobs from 12 to 29 enlisted above are done by the female workers only. It can be said that the heavy jobs are done by the male workers while the light and critical jobs are done by female workers. It is observed that 2 male workers can complete the initial 11 tasks *i.e.* from transportation of raw cashew nuts from drying yard to storage, from storage upto boiler to steam cashew nuts, from boiler to cutting machines or cutting tables (manual cutting machines) in only 190 min *i.e.* approximately in 3 hours. After completing the initial tasks, these male workers are engaged doing different operations. The male workers starts working at 7 am and work till 11 am. Then after lunch break, they resume duties from 3 pm to 5 pm. While the female workers start working at 8 am and work till 1 pm. After one hour lunch break,

they resume the duty at 2 pm and work till 5 pm.

A comparative study distance travelled and time required for the existing layout and proposed modified layout was conducted. This gave the idea about the time and motion reduced due to the modifications made. The same is depicted in Table 2.

The total distance travelled to complete the process was 155.9 m as per the present location of the units. The travel distances *i.e.* the mobility can be reduced to 123.6 m *i.e.* by about 20% if the units are relocated. This in turn reduce the time required for the operations *i.e.* from 133.5 to 119.5 (by about 11%) and hence saves the labour that can be utilized somewhere else for productive work. In other words the motion and time saved in the process is 32.3 m and 14 min, respectively (Table 2).

The time and motion study of the M/s Anusaya Cashew Factory, Dapoli are tabulated in Table 3 (for 640 kg cashew nut processing).

From the data (Table 3), the approximate time required for processing 640 kg of cashew was found to be 3630 min *i.e.* 5.7 min/kg. So, as compared to M/s ishawas cashew processing industry, Asond, at M/s Anusaya Cashew Factory, Dapoli the time required to

Table 2 : Event wise time and motion required as per existing layout and as per proposed layout of M/s Vishwas Cashew Processing Industry, Asond, Tal Dapoli Dist. Ratnagiri

Sr. No.	Events	Distance travelled, m	Time required, min	Distance travelled (approx) as per proposed layout, m	Expected time required at the determined speed, min
1.	Manual transportation of cashew nut from drying yard to storage	30.6	5.5	30.6	5.5
2.	Inside storage only to raw cashew nut grader	8	2	8	2
3.	Grader to storage space	8	2	8	2
4.	Storage to boiler	8	2	8	2
5.	Boiler preparation	10	60	10	60
6.	Emptying the boiler	1	15	1	15
7.	Boiler to cutting machine				
8.	Manual cutting machine	7.8	2	4	1
9.	Automatic cutting machine	13	3	4	1
10.	From machine to scooping table	5	5	3	3
11.	Transferring shells to store	10	10	12	12
12.	Transferring kernels to drying	14.5	6	7	3
13.	Peeling to cleaning and primary grading table	14	6	14	3
14.	Primary to secondary grading table	2	3	2	3
15.	Grading table to dryer	14	6	7	3
16.	Drying to packaging unit	7	3	2	1
17.	Vacuum packing (10 kg tin) and shifting to storage	3		3	3
	Total	155.9	133.5	123.6	119.5

process cashew was found to be less by 0.7 min. The movement of the material from the storage to final product was only 76 m at M/s Anusaya Cashew Factory, Dapoli while it was found to be 155.9 m at M/s Vishwas Cashew Processing Industry, Asond, Dapoli. The saving in both time and motion was at M/s Anusaya Cashew Factory, Dapoli just because of pre planned layout of the factory. The total man-hr required for the processing was found to be 133.53 *i.e.* 0.21 man-hr/kg which is less than half what that required at M/s Vishwas Cashew Processing Industry, Asond, Dapoli using automatic cutting machine and exactly one fourth of the man-hr required for doing

the operation with manual cutting machines.

It shows that, the man-hrs required using automatic cutting machines are very less compared to the manual cutting machines. It also shows that the layout of the factory also affects the man-hrs required for the processing.

Cost of processing the cashew nut :

The cost of processing the cashew nuts was calculated by considering the wages of the male and female labour as Rs. 140/day and Rs. 120/day, respectively. The wages were then converted as Rs.

Table 3 : Event wise time and motion study along with labour required at M/s Anusaya Cashew Factory, MIDC, Tal Dapoli Dist Ratnagiri

Sr. No.	Events	Time required, min	Distance travelled, m	Rate of doing work, qty per hour	No. of labours (M/F)
1.	Inside storage only to raw cashew nut grader	8	4		1 M
2.	Grading	130		300 kg/h	1 M
3.	Grader to storage space	8	4		1 M
4.	Storage to boiler	16	10		1 M
5.	Filling cashew nut in the boiler	6	--		1 M
6.	Boiler preparation	180	--		1 M
7.	Boiling process (320 kg boiler unit)	30	--		0.5 M
8.	Boiling process (320 kg boiler unit)	30	--		0.5 M
9.	Emptying the boiler	20	--		1 M
10.	Boiler to cutting machine	140	4		1 M
11.	Automatic cutting operation	660		20 kg/h	1 M
12.	Cutting machine to grader	8	2		1 M
13.	Vibrator – Oscillator unit for shell separation	270	--	150 kg/h	
14.	From machine to scooping table	6	3		4 F
15.	Scooping operation (only 30% of total material to be scooped)	48	--	60 kg/day	4 F
16.	Transferring shells to store	20	12	--	1 F
17.	Transferring kernels to drying	20	12		1 F
18.	Hot duct dryer loading	45	--	250 kg/batch	1 F
19.	Hot duct drying process (9 h at 65 ⁰ C) thermostat operated blower 1 HP motor	540			
20.	Unloading dryer	20			1 F
21.	Peeling (out sourcing)	200		60kg/h	1 M
22.	Peeling to cleaning and primary grading table	5	10		1 M
23.	Cleaning and primary grading	240		40kg/day	8 F
24.	Secondary grading	480		20kg/day	8 F
25.	Grading table to dryer	10	12		1 F
26.	Dryer loading	45			1 F
27.	Drying (2-3 h at 65 ⁰ C)	180			
28.	Unloading dryer	20			1 F
29.	Drying to packaging unit	5	3		1 F
30.	Weighing and Packing	240			2 F

17.5/h and Rs. 15/h, respectively considering 8 working hours per day. The number of hours for which the work was done by male and female workers for processing 440 kg batch of raw cashew nuts was determined separately. The number of hours for which the oven used and the vacuum packaging machine used was also determined. Considering the motor capacity (kW) of these units and the tariff for the industrial electricity consumption as Rs. 9 per unit, the cost for use of these machines was determined. Summing the costs, the cost for processing 440 kg of cashew nuts was determined. The total male hours required were 6.12 while female hours required were 412.5 for processing 440 kg of raw cashew. The labour cost at M/s Vishwas Cashew Processing Industry, Asond was determined as

$$\begin{aligned} \text{Labour cost} &= \text{Male hours} \times \text{Wages, Rs./h} + \text{Female hours} \times \text{Wages, Rs./h} \\ &= 6.12 \times 17.5 + 412.5 \times 15 = 107.1 + 6187.5 = \text{Rs. } 6294.6 = \text{Rs. } 6295 \end{aligned}$$

The oven dryer (4kW) was run for 11.5 h while the vacuum packaging machine 2.24 kW was run for 1 h.

Hence, the total electricity consumption was 46 kWh + 2.24 kWh = 48.24 kWh

Considering the tariff of electricity consumption as Rs. 9 / kWh, the charges were Rs. 434.16.

Hence, the total processing cost was Rs. 6295 + Rs. 434 = Rs. 6729.

The rate of raw cashew was Rs. 135/kg. Out of 440 raw cashew nuts, 110 kg process cashew was obtained.

Total cost o raw cashew nuts = 135 × 440 = Rs. 59400.

Accordingly, the cost of 110 processed cashew without labour cost = 59400 ÷ 110 = Rs. 540.

The processing cost to obtain 110 kg processed cashew was Rs. 6295 *i.e.* Rs. 57/kg.

Hence, the actual cost of processed cashew at the factory was Rs. 540 + Rs. 57 = Rs. 597/kg.

The labour cost at M/s Anusaya Cashew Factory, Dapoli was determined as

$$\begin{aligned} \text{Labour cost} &= \text{Male hours} \times \text{Wages, Rs./h} + \text{Female hours} \times \text{Wages, Rs./h} \\ &= 22.85 \times 17.5 + 110.68 \times 15 = 399.9 + 1660 = \text{Rs. } 2060 \end{aligned}$$

Three cutting machines (0.37 kW each) run continuously for 11 h to complete the cutting task. The hot air duct type dryer (0.74 kW) was run for 2 h

intermittantly or total 10 h of drying operation. The thermal sealing machine (0.185 kW) was used for 2 hours for bag packing.

Hence, the total electricity consumption was 12.21 kW + 1.48 kWh + 0.37 kWh = 14.06 kWh

Considering the tariff of electricity consumption as Rs. 9 / kWh, the charges were Rs. 126.5 = Rs. 127.

Hence, the total processing cost was Rs. 2060 + Rs. 127 = Rs. 2187.

The rate of raw cashew was Rs. 135/kg. Out of 640 raw cashew nuts, 160 kg process cashew was obtained.

Total cost of raw cashew nuts = 135 × 640 = Rs. 86400.

Accordingly, the cost of 160 processed cashew without labour cost = 86400 ÷ 160 = Rs. 540.

The processing cost to obtain 160 kg processed cashew was Rs. 2060 *i.e.* Rs. 12.87/kg = Rs. 13/kg.

Hence, the actual cost of processed cashew at the factory was Rs. 540 + Rs. 13 = Rs. 553/kg.

Hence, it indicates that the cost of processed cashew at M/s Anusaya Cashew Factory was less (Rs. 553 /kg) as compared to at M/s Vishwas Cashew Processing Industry, Asond (Rs. 597/kg). It indicates that the proper mechanization and layout of the factory can save the

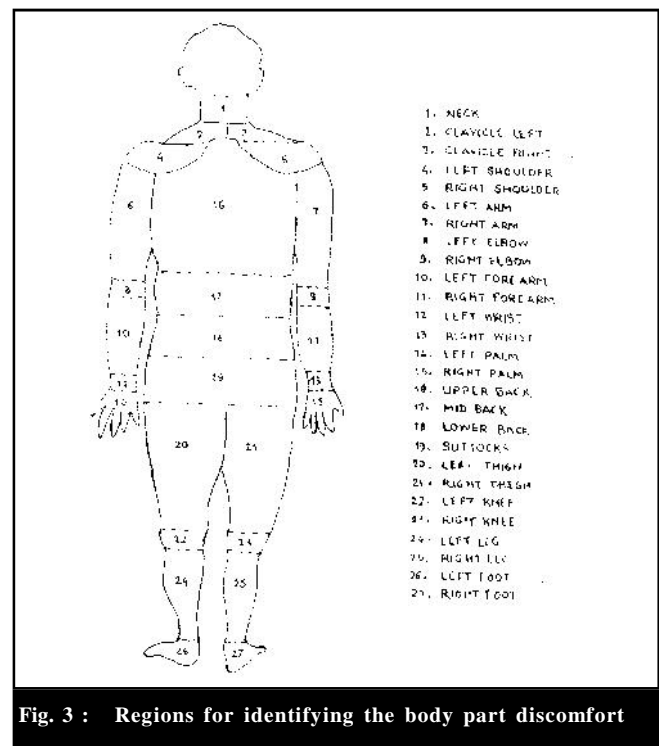


Fig. 3 : Regions for identifying the body part discomfort

processing cost.

Determination of body part discomfort :

The workers were interviewed personally to find out the body part discomfort experienced by the workers in the industry. The picture as depicted in Fig. 3 was shown to the labors to correctly identify the discomfort body part. The height and weight of the subjects interviewed were measured. The information on the following seven points was collected.

1. Name, 2. Age, 3. Weight, 4. Height, 5. Nature of work in factory, 6. Working since, 7. Body part facing discomfort.

In all 26 subjects were interviewed out of which 4 were males while 22 were females. The picture as shown

in the Fig. 3 was shown to the workers to identify the discomfort body part. The information collected is given in Table 4.

The parameters studied through the personal interview are presented in the Table 4. It is observed from the above information that, most of the women and the men were facing the discomfort of knees. It can be said that for the initial working years upto 3 years in the factory, no discomfort was experienced by the workers exceptionally one who was having the knee pain. It is also observed that the young workers were not facing any discomfort. The discomfort increases with the age and the working years in the factory. It is observed that the knee pain is the most common in the workers. Two of the women workers interviewed claimed chest

Table 4 : Body part discomfort faced by the labours working in the M/s Vishwas Cashew Processing Industry, Asond, Dapoli

Sr. No.	Name	Age (yr) and gender	Weight, kg	Height, m	Nature of work in the factory	Working since, yr	Body part facing discomfort as per Fig. 3
1.	Mrs. R.R. Bhurmadkar	35, F	45	5.2	Shelling in standing position	8	4, 5, 22, 23, 16, chest
2.	Mrs. R. R. Khedekar	45, F	55	4.9	Shelling in standing position	13	4, 5, 22, 23, 16, chest
3.	Mrs. P. P. Khedekar	43, F	46	4.10	Shelling in standing position	6	22, 23
4.	Mrs. H. H. Paingankar	32, F	48	5.1	Shelling in standing position	11	22, 23, 24, 25, 26, 27
5.	Mrs. H. D. Khedekar	40, F	47	5.1	Shelling in standing position	10	4, 5, 22, 23, lower back
6.	Mrs. R. D. Murbadkar	43, F	45	5.0	Shelling in standing position	8	5, 22, 23, 24, 25, lower back and right side complete portion
7.	Mrs. A. A. Ghratkar	35, F	42	5.1	Scooping operation in seating position	8	22, 23
8.	Ms. A. D. Murbadkar	18, F	40	5.1	Scooping operation in seating position	1	24, 25
9.	Mrs. S. S. Murbadkar	27, F	55	5.2	Scooping and cleaning operation in seating position	7	Nil
10.	Mrs. P. P. Yenkar	20, F	42	5.2	Scooping operation in seating position	2	24
11.	Mrs. S. S. Tembkar	28, F	45	5.3	Scooping operation in seating position	2	7
12.	Mrs. R.L. Chogale	40, F	50	5.2	Grading	6	Back bone
13.	Mrs. S. S. Kalamkar	40, F	45	5.2	Grading	11	22, 23
14.	Mrs. M. M. Murbadkar	43, F	56	5.0	Grading	14	Complete right hand side
15.	Mrs. A. A. Khedekar	43, F	52	4.11	Grading	3	Nil
16.	Mrs. S. M. Pridankar	21, F	45	5.2	Grading, packing	3	Nil
17.	Mrs. B. Kalamkar	21, F	38	5.2	Grading	3	Nil
18.	Mrs D. V. Khedekar	21, F	45	4.2	Grading	3	Nil
19.	Mrs. P. C. Tembkar	50, F	48	5.3	Peeling, cleaning	3	22, 23
20.	Mrs. S. R. Bhuwad	18, F	42	5.3	Grading, Cleaning, Packing	1	Nil
21.	Mrs. V. V. Padvekar	50, F	48	5.2	Multi tasking	7	Lower back
22.	Mrs. C.C. Parbalkar	58, F	52	5.1	Multi tasking	6	Lower back
23.	Mr. E. Kolbandrekar	55, M	5.6	62	Labour	6	22, 23
24.	Mr. V. Padvekar	53, M	5.6	65	Labour	6	22, 23
25.	Mr. V. Rale	57, M	5.7	72	Labour	5	22, 23
26.	Mr. S. Parbalkar	40, M	5.5	68	Labour	7	Nil

pain and two claimed pain of complete right side portion. Out of four male workers interviewed, three men workers which are above 50 years of age were having the knee pain while fourth one, whose age is 40 years don't have any kind of body discomfort. It can be concluded that the body discomfort commonly starts with aging in both men and women workers. Exceptionally a few cases are there showed the body discomfort in young age also. The cause may be some other that the working style in the factory. Out of 26 labours, 46 % showed knee problem. This may be due to the climatic condition also.

The body discomfort of the workers at the M/s Anusaya Cashew Factory, Dapoli was not studied, as the factory is having the seasonal work only. Hence, the labours don't have experience of working continuously.

Light intensity in the scooping and grading rooms:

The light intensity was measured in scooping and the grading rooms at 17.00 hrs. It was 100 lux in the scooping room while it was 85 lux in the grading room. The owner has made an arrangement in the roof of these rooms by placing opaque plastic sheet for some area instead of keeping it full closed. This facilitate sunlight to improve the light levels in the rooms at day time. But the available light levels *i.e.* 100 lux and 85 lux is not sufficient for the crucial work like scooping and grading, respectively. The light intensity might be more in the morning hours. The readings are very less as these were taken at evening hours. But at this time also the workers were doing their job.

Conclusion :

- The time motion study of both gradually expanded factory and the preplanned set factory indicates that the gradually expanded factory has not been expanded with any plan but it was expanded as per availability of space and finance. It also showed that the time and motion required is more in case of gradually expanded factory.
- The suitable layout is proposed as per the actual space available with the owner. The newly proposed layout could save the time and motion.
- The man-hrs required for processing the cashew were determined in all the cases *i.e.* existing layout of the gradually expanded factory, proposed layout of the factory and the preplanned set layout of the factory. It was observed that in the later two cases, the man-hr

requires is comparatively low that ultimately adds to the benefits to the owner.

- The cashew nut processing rate was found in all three cases. It is observed that the preplanned setup is having least processing charges as the set up is having the advanced machineries that saves the electricity, the set up is such that the man-hr is required is minimum. Processing cost is minimum means net profit is maximum.

- The body part discomfort faced by the workers due to working in the industry was found out by interviewing them personally. The shoulder pain is observed in the women workers only who are operating the manual cashew nut shelling machine. The knee pain is observed to be common in both men and women workers. This may be due to climatic condition also. Some women workers also claimed chest, shoulder, backbone and lower back pain. In general, it is observed that the body part discomfort starts with aging as young labours don't have any body part discomfort.

- The light levels were not sufficient for the crucial jobs like scooping or grading. But still the workers were doing in such situations.

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