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Optimisation of Individual Rubber Tapping Labour Supply Using Work-Study Method.

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Abstract
Rubber tree exploitation involve several field activities ranging from tapping and allied operations to field upkeep and security of products. The skill demands of the various operations are essentially similar as they are denominated by physical rather than mental activities. The skills and operations can be combined in one person. Further, the escalating cost of production in the face of stagnant commodity price and the increasing scarcity of experienced and skilled tapers are persuasive facts to argue against the present level of division of labour in crop exploitation. The research adopts the work-study empirical approach to establish the feasibility of tapping job de-specialization and enrichment that optimizes individual tapping labour supply. The present tapping job design was studied, analysed, criticised and alternative method elaborated. Further, structured questionnaire survey method was deployed with personal interview administration to establish the understanding, acceptance and feasibility of the model. This was followed by detail job description of the de-specialised model to render it actionable. Finally, the system was subjected to cost analysis which is the objective interest of all profit oriented organisations. The opinion survey of the tappers supports the applicability and feasibility of tapping job redesign by de-specialisation - willingness to work 74%, unused individual abilities 60%, unfulfilled individual need 59% and spouse labour 61%. The economic return to the organization is 19% while job satisfaction especially worker's income is enhanced (36%).

Key Words: *Work-study, job enrichment, de-specialization, boredom, enlargement.*

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I. Introduction

The scientific study of work has contributed to the operation management field the capabilities to discover the best method of work as a core industrial engineering practice. The scientific management model given impetus by Frederick Taylor [1] forms the theoretical bases of work study. He believed that by properly matching of man, tools and tasks it was possible to increase productivity. He therefore advocated the empirical and experimental approach to the problem of work management with the believe that for every process, every task there is one best way of performance which can be discovered in a Scientific way. However, with the increasing recognition of the complexity of human motivation, many modern theories have argued that specialised and simplified works leads to monotony, boredom and general dissatisfaction which as a consequence manifest themselves in the various forms of undesirable work behaviour in terms of absenteeism, lateness and frequent job changes [2]. As Britton [3] rightly pointed out, the advantage that arises from specialisation while fairly obvious are not supported by much experimental evidence.

The aim of work study is to try to ease the tasks, to eliminate drudgery and thus allows the worker more time to use his specialist skill [4]. Hence job analysis highlights the job content, specific skills called for and the risk and hazards of the job [5]. Approach to such analysis can either focus on the tasks and behaviour needed to produce an output -task oriented approach or on the knowledge and skills believed necessary to carry out the job tasks and the behaviour - person oriented approach. [6]. Job analysis also classifies a post for payment, determine what level of person is required for the post and establish the type and quality of training required by the person attached to the post [7]. Methods includes observation (to gather information through intensive direct study of employees), interviewing the position holder, supervisory conferences, critical incident (record of behaviours of job holders that contributed to particularly successful or unsuccessful job performance), work sampling, questionnaires, checklist etc. [6]. In agriculture however, work study is concentrated on seasonal peaks and repetitive chores such as planting, harvest, tapping etc. The time saved is then translated into cash saving by reducing the size of the establishment or into higher output by enabling the same labour force to cope with more task through job enrichment or enlargement. There is however less scope for work study in agriculture than in industry because of the high proportion of non-peak and non-repetitive task. Furthermore, the variation in conditions makes standardisation difficult [4]. For our case study, for instance, it has been most

difficult to establish standard task for manual weed control and other similar operations due to high variations in working conditions.

The sources of labour for a given farm are both fixed (Operators, family, permanent hired and partnership) and variable - casual and co-operative labour. Both types represent variable cost of production. Amount of labour used in a given period on a particular farm depends on the individuals employed, the number of hours they worked and their rate of work. The individual employed determined the quality of labour (health of the worker, experience, motivation etc.) while the hours of work or work is divided into requisite labour (labour necessary to obtain the final product e.g. walking) and productive labour which has a functional relation with output [8]. Variation in the rate of working is ignored and labour inputs are measured and aggregated in man hours or in man-days [9]. Labour is a major farm cost. Where hired labour is used cost of labour constitute over 70% of the total cost of production [10]. In fact, Okonji and Njoku [11] considered farm labour as the most limiting factor of production in Nigeria. Higher labour efficiency means increase in production and earnings because the increase in the marginal product of labour multiplied by the output price gives greater value of production for any given labour input [12]. Hence agricultural efficiency is taken to be at the maximum when the greatest possible product is achieved from a given stock of resources or conversely when a minimum input or resources is used to produce a given level of output. Brittons [3] in his own view noted that it is the performance of the marginal units not the average performance that is important in measuring agricultural efficiency, a view supported by Levi and Havinden [8]. They asserted that the input of effort on any given day is determined partly by the productivity of that effort and the subjective valuation of the product, where the disutility of an extra unit of effort rises as more effort is put in. Labour productivity may therefore be increased either by producing more with the present labour supply, (work redesign) improving operating technique (motion studies and work simplification), reducing seasonal variation in labour use, or intensifying /increasing product per hectare.

In this case study, an Agricultural Manager heads the Agricultural department. Each plantation is divided into crop production units called divisions each under the charge of a Divisional Manager, assisted by Supervisors and Headmen - in the management of both tapers and field maintenance gangs. Supervision style is essentially controlling rather than supportive, with some 15 workers per gang. At the level of crop exploitation job is fragmented along specialised areas and handled by different groups and workers under different supervisors, headmen and managers. This includes:

(1) Tapping and allied activities-stimulation, panel painting, consumption marking and acidification.
(2) Crop haulage.
(3) Pest and disease control
(4) Chemical row weeding and Mechanical Avenue slashing.
(5) Tapping Quality Control.
(6) Tapping systems and rubber clone experiments.

Each taper puts in some 4 to 5 hours on his task, tapping about 400 to 800 trees a day depending on the age of the trees and the tapping system in place. The limitation on working hours enables the tapers to carry on other private activities.

Taper's wages are usually fixed using the job or piece rate system, which is related to a nationally negotiated wage rate for the agricultural sector between Agricultural and Allied Workers Union of Nigeria (AAWUN) and the National Association of Agricultural and Allied Employers (NAAAE). The incentive offered depends on the efficiency of the taper and are at times calculated on the basis of productivity of the gang and eventually on the profitability of the plantation as a whole.

Plantation workers including tapers and their families reside on the estate that is located far from inhabited centre and constitute a closed entity. Light, Water, recreational, medical, education and other social infrastructures are provided and the cost of all services borne by the company. Also workers and dependant are authorised to grow essential crops e.g. cassava, plantain, yam, vegetables etc. on unused land belonging to the plantation. Located in isolated rural areas as it is, non- company work activity is mostly farming, Others are hawking of goods and services, (e.g. barbing, hairdressing, tailoring), attending church services, town meeting, saving and thrift society meetings, domestic chores, carpentry, little of games and private film shows - video plays, storytelling, etc. Population is skewed toward children and women - working and dependant.

According to Byrns [13] the supply of labour depicts the amount people are willing to work per time period at alternative wage rates. Hence the supplies of labour depend on the decision of individual (or families) to work or not to work and how long to work each week or year [14]. Individuals also decide what sort of work to do - determining the supply of labour to specific occupation and finally decide for whom to work for. The starting point is that individual must choose between work and leisure or work and non-work activities or in our specific case of farming, between farm labour and non-farm labour [8].

1.1 Problem Statement/Justification of the Study

Following the increasing demand for quality product, higher labour efficiency and yield the demand on the tapping labour equally increased necessitating further specialisation and fragmentation of the crop exploitation activities with consequent higher overhead cost. Each worker become detached and nested within a very limited scope in the rubber, production process and job satisfaction declined to low levels. With this increasing division of labour (within the crop exploitation process) into tapping, lump collection, pest and disease control, lump security, washing of cups, tapping quality control, chemical row weeding etc. is the increasing number of workers and their dependants. Therefore, in harvesting a kilogram of rubber the following operations and varying number of persons are involved- Table 1.1.

Table 1.1: Tapping Task Fragmentation for specialized tapping

OPERATIONS	PERSONS
(1) Tapping	1
(2) Collection of lump	1
(3) Stimulation	
(4) Panel painting	
(5) Pest and disease control	1
(6) Row slashing	1
(7) Avenue slashing	
(8) Consumption marking	
(9) Construction of tables	
(10) Lump security	1
(11) Cup washing	
(12) Fertiliser application	1
(13) Lump evacuation	1
(14) Latex overflow control	1

Resources- housing and welfare services are stretched to the limit due to population explosion on the estate. Transport need - to and from work place tripled, while the proportion of dependant to the actual company working labour force quadrupled in favour of dependant - children, spouses, cousins, brothers, mothers, etc. Use of casual labour with its distortion of social and administrative equilibrium (stability) increased. Resources use efficiency reduced since most people catered for by existing facilities make no direct contribution to resource sustenance and company's productive activities.

With limited effective hours of work (4 to 5 hrs out of 24 hrs) on company duties and low income from company work, non-company work activities increased in response to increasing cost of living. Unnecessarily lengthy non-work hours brought with it unintended breeding of children both by single and coupled parenthood in the name of recreation. On the other hand, constant management search for cost effective measures, lead to inadequate provision of conveniences including lavatories, water and disposal of waste coupled with ineffective maintenance of the living environment and crowded accommodation - parasitic infections and intestinal disorders are common. It is therefore the opinion of this study that optimisation of individual tapping labour supply through tapping job redesign will ameliorate the situation and ensure job satisfaction for the tapers, reduction in overhead cost and reduction of pressure on existing accommodation, transport, recreation and medical services.

II. Research Methodology

The research adopts the work-study empirical and experimental approach with the tapping tasks constituting the experimental area viz:

(1) Work simplification involving preliminary study, analysis of the present method, criticising the present method and elaboration of the new method.

(2) Work measurement involving timing the work and establishing the time per unit - T.P.U.

(3) Pay and control which is based on the post or job specification, leading to determination of payment and tariff.

(4) Cost benefit analysis.

Based on the time of each element of work being done an estimate of man-machine-hour required per unit output is arrived at and finally the occupation of the worker - the percent of time the worker is normally occupied during the work cycle is established. The number of timing cycle is determined using

$$Ng \geq \frac{1600N}{(\sum x)^2}(\sum (x - \bar{x})^2 \quad (1)$$

Where Ng = no of group mean and x the elemental time

The process reveals the work and non- work hours of the worker's activity. Some tapping activities to studied include: Tapping + latex + lump, tap only, collection of lump, spraying, pest and disease, security of crop, crop evacuation, avenue slashing, stimulation, panel painting, consumption marking, second collection, row slashing, cup washing, manuring and equipping. The process reveals the work and non- work hours of the worker's activity. Finally, the technique is used to set the piece work rates, incentives scheme and task combinations.

2.3 Survey Study

Further, being also a psychological research bordering on job satisfaction the questionnaire survey method is adopted to tease out the view of tapers on increase labour supply, reward preference and work organisation. As a work design study, the questionnaire is structured to the purpose of assessing potential individual additional labour supply and capacity to undertake other crop exploitation related tasks. This includes pest and disease control, chemical row spraying, lump security, loading of crop into the tractor, avenue slashing etc. Further the possibility of incorporating the family - husband and wife into the company work system is included in the survey as firstly a means of increasing the family income and secondly a way of optimising accommodation and other welfare facilities per working family. A multi-chotomous format is adopted for the questionnaire enabling the taper to choose from several answers the alternative that best approximates his position on the subject. The population consist of the tapers of the Rubber Estate (120) presently on specialised tapping (tap and go). A personal interview method of questionnaire administration was adopted because of the low modal education level of the respondents.

2.3.1 Sample Size Determination

The sample size assumes an accuracy level of 18% at 95% confidence to arrive at thirty using the equation.

$N = (Z/A)^2 (1- P/P)$ [15]. (2)

Where N = Optimum sample size

Z = Standard normal distribution.

= 1 - [1-0.95/2] = 0.95 = 1.96

A = The accuracy desire = 18%.

P = The preliminary positive survey proportion from initial 20 samples is as shown in Table 2.1

Table 2.1 Sample size pilot study

	Score (40 pt.)	Position
1	21	+
2	24	+
3	22	+
4	27	+
5	23	+
6	26	+
7	26	+
8	30	+
9	30	+
10	15	-
11	13	-
12	19	-
13	18	-
14	35	+
15	31	+
16	31	+
17	32	+
18	32	+
19	31	+
20	33	+

16 out of 20 observations favour more labour supply for additional income i.e. 80%.
Therefore, P = 0.8 and optimal sample size
$N = (1.96/0.18)^2 (1 - 0.8/ 0.8) = 29.64 = 30$
The summated scales (Likert) in which the tapers were asked to indicate their disagreement or agreement on a five-point scale; strongly agree (5 pts), agree (4 pts), undecided (3 pts), Disagree (2 pts) and strongly disagree (1 pt.) is employed in the analysis. The individual scores are computed by summing the scores of the tapers responses to each question and finally the mean item score (MIS) is determined.

III. Data Analysis And Result

The objective of the study is the application of work study techniques so as to determine the amount of time necessary for a qualified taper to perform his job and to establish the technical feasibility of de-specialization of tapping job in rubber plantation exploitation. Work design cannot be properly executed without detail job analysis that contains the essentials of the job such as the title of the job, its location, the duties involved: the performance, the mental, physical and skill requirements of the job, the responsibilities and the difficulties of its realisation. [16]. Also important are the issues of communication, security, hierarchical and functional structure and resources used, [7]. Details of the work-study are therefore outlined below:

3.1 PRELIMINARY STUDY - PROBLEM DEFINITION

A. **Investigation**

1. POST: - Tapping without collection
2. Work Place: - Rubber Estate Tapping blocks.
3. Personnel Information: - Tapers of various grades, rates and experience
4. Product: - Rubber lump.
5. Plant - Panel = ½ spiral, ¼ cut, double cut, planting distance 6.5 x 2.5cm, clones- Harbel, PR I07, PB 5/51.
6. Tools and consumable: - Tapping knives, honing stone, cups hanging wire, spout.
7. Safety – Rain boot, cleanliness of lines and avenues
8. Quality: As per Technical not on tapping Quality essentially general defects e.g.
   - ■ Clean cup
   - ■ No dripping away of latex
   - ■ No lump on the ground
   - ■ Bad placement of cups & spouts etc., See Appendix.
9. Post before: - None
10. Storage facilities: - Cup for lump.
11. Tapping Programme: -
    - ■S2D4, S4D4
    - ■ Slaughter tapping
    - ■ Four days' interval throughout the year.
    - ■ Four parts to a taper.

(B) **Purpose of the Job**: -

Post ➔ Tapping without collection
What ➔ Excision of rubber tree bark with tapping knife.
Why ➔ To produce lump.
Benefit ➔ Lump is sold to produce rubber products and to generate income to the Company for salaries, wages and profit.

(C) **Usefulness of the Work**

Table 3.1 Usefulness of Post Activities

(D) **Problem definition**

ACTIVITY	USEFULNESS	ASSIGNMENT	ACTION
Sharp Knife	Useful	Deficient in the initial use of ordinary file	To use honing stone
Tapping	Useful	Deficient in scope of work	To incorporate collection of latex and lump, pest and disease control, chemical row weeding, avenue slashing second collection of latex, lump security and other tapping task related activities
Payment	Useful	Deficient in amount	Enrich job for increase income and job satisfaction

1. Interest - The existing tapping work organisation and specialisation to be redesigned.
2. Opportunity – Re-tasking period.

3. Limit: From crop exploitation activities e.g. slashing, tapping, collection, chemical spraying, pest and disease control, etc. to crop evacuation.

4. Aim:

(i) To optimise available labour supply,
(ii) To reduce cost of production per kilogram of Crop
(iii) To enhance earning per taper
(iv) To remove the negative effect of over specialisation by task variety, task identity (beginning to the end), task significance, autonomy and feedback through in built knowledge of result.
(v) To channel the entire tapping family energy to organisational goal.
(vi) To reduce tapers off company work hours - from 19 hours to 12 hours.
(vii) To reduce overhead cost and demand on social facilities and services.

(E) **Means**: PGO, Agric. Manager, Division Manager, Headmen, tappers and Haulage team

(F) **Conclusion**

Do we do the study? Yes. What study do we do? Optimisation of tapping labour supply through tapping work redesign to achieve higher tapper's income and cost effectiveness.

(G) **Tapping flow chart:** Fig 3.1 and 3.2.

Work definition ➔ Tapping without collection.
Units: ➔ I tree tapped
Limits: ➔ Muster to task.
Accessories ➔ Tapping Knife, cup, honing stone.
Description ➔ Taper reports at muster, sharp tapping knife, move to task, remove tree lace, tap the tree with tapping knife, channel latex properly into the cup.
Taper`s tapping task.

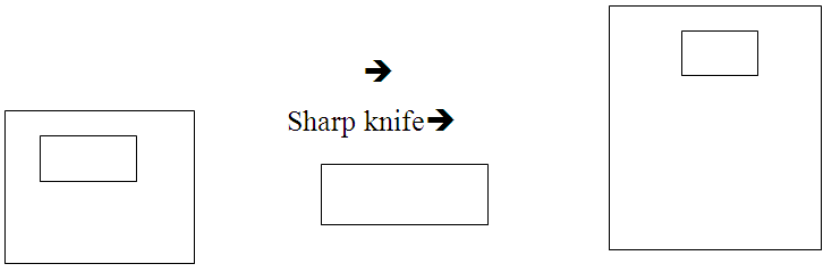

Fig 3.1 Outline Process Chart.

3.2 CRITIQUE

Table 3.2 Criticism of the Method

Criticism	Solution
(1)Too many persons involve in the harvest of 1 kg of Crop (PDC, Tapping Quality, Chemical Spraying, Slashing, Collection of lump, Tapping, Crop security, evacuators etc.)	Combine operation in one person by training , work redesign and enhanced reward.
(2) Nested role of tapers lead to lack of task identity and significance - unfulfilled work life.	Tapers to take responsibility for all operation in his task such as upkeep, security, tapping and crop collection.
(3) Under-utilisation of tapers capacity for work -	Extend working hours
(4) Grossly inadequate tapping income - needs unfulfilled	Increase pay by enlarged tapping activities and fewer workers.
(5) Task variety is lacking leading to boredom	Task enlargement to incorporate more crop exploitation related activities e.g. pest and disease control, chemical row weeding, lump security etc.
(6) Fragmentation of crop exploitation activities result to high overhead, and stretching of welfare facilities e.g. accommodation, medical facilities, transport etc.	Enlarged task ensures fewer employees and optimum use of welfare facilities.
(7) Control supervision result in lack of autonomy and lassie faire attitude to work	Supportive supervision providing only technical advice and involving the largest possible gang size of 30 to 50 tapers to a Headman.

3.3 **TAPPING JOB DESCRIPTION - THE NEW METHOD:**

3.3.1 **POST SITUATION AND SCOPE**

3.3.1.1 **SUMMARY OF POST: TAPPING**

(i) Tapping
(ii) Lump collection
(iii) Latex collection
(iv) Chemical weed control
(vi) Cup washing
(vii) Pest and disease control
(viii) Stimulation
(ix) Consumption marking
(x) Equipping
(xi) Panelling
(xiv) Fertiliser application.

The taper taps the tree bark with tapping knife after removing the tree lace and arranging the equipment for the latex to drip into the cup. He moves to the previously tapped task to wipe the cups and collect lumps and deposit them on the lump tables to be loaded unto the tractor by him after latex evacuation. The taper returns to the tapped task about 12 noon to collect the latex in the cups into his drums and carry the latex to latex reception centres, for latex measure and empty into the latex tank. Later in the day after lunch he may decide to spray herbicide on the rows and wash his latex cup with left over water, to keep the tapping line clean, inspect his trees for disease and treat them by scooping the soil, observing the canopy, and painting the panels, or apply ethrel to the tapping cut in previously tapped task.

The taper may also decide to mark his trees thereby establishing his bark consumption for the next two months and at the same time change any weak cup hanger, spout or bad cup. Twice in the year he panels his trees for new opening by drawing panel demarcation marks on the tree and equipping the trees with cup hangers, cups and spouts. When necessary he apply fertilisers around his trees. Finally, he spends the rest of the time watching over his task and goes for second collection of latex as and when necessary. He leaves the field about 6 p.m.

Tasks maybe combined as follows: on alternate days.

1^{ST} DAY:
- Tapping - breakfast - lump collection - latex collection - lunch.
- Chemical spraying or (fertiliser application) - cup washing or (PDC/Panel painting)
- Second latex collection
- Security when necessary

2^{ND} DAY:
- Tapping - break - lump collection - latex collection - lunch
- Stimulation / consumption marking (equipping /preparation /panel)/ etc -
- Second latex collection.
- Security when necessary.

2 **RESOURCES USED**

Tapping knife	bamboo	fertiliser	
plastic container	counter		bucket
latex cup	machete	ethrel	
drums	brush		markers
lump tables	bafiden	template	
trailer	brush (1/2)		rope
latex tank	tape		tractor
herbicide	volume measure	knapsack	
weighing scale	latex ruler		notebook.

3 NATURE OF JOB

1 **PRINCIPAL POST ACTIVITIES**

A. Tapping
B. Latex collection
C. Lump collection.

(A) **TAPPING**

- Sweep the cup and place back

- Remove tree lace
- Tap front channel
- Check spout
- Tap
- Adjust hanging wire and Cup.

(B) **Latex Collection**

- Lift cup with latex
- Pour latex into bucket
- Replace cup
- Move to another tree
- Empty latex into drum
- Go back to task
- Transport latex to reception centre
- Weigh with headmen
- Empty drum into latex tank

(C) **Lump Collection**

- Collect lump
- Put in drum
- Replace cup
- Take lump to table
- Go back to task
- Measures with overseer
- Empty into trailer.

2 **OCCATIONAL ACTIVITIES OF THE POST**

- Chemical row weeding ➔ 2/yr.
- Cup washing ➔ 3/yr.
- Pest and disease control ➔ 2/yr.
- Stimulation ➔ 8/yr.
- Consumption marking ➔ 6/yr.
- Equipping /panelling ➔ 2/yr.
- Fertiliser application etc. ➔ 1/yr.

3 **COMPLEXICITY OF THE JOB:**

4 **COLLECTION OF INFORMATION:**

Supervisor- Information on work improvement and programme
Frequency = sometimes.

Manager- same as above.

Division Technical Control (DTC)- Tapping quality
Use of chemicals etc.
Frequency 4 times in a month.

.2. **ELABORATION OF PLAN**

- Muster to map out days contingent activities
- State of weather condition
- Pre inform of the periodic tasks.
- Supply lacking material and instruction at the muster

3 **DIFFICULTIES OF REALISATION**

- Rainfall
- Contour
- Weedy and stony rows
- Hard soil.

4 RESPONSIBILIITIES

i **RESPONSIBILITY CONCERNING QUALITY**

- Sanitary state of the trees
- Quality of latex
- Economic life of the tree through pest and disease control (pdc), quality tapping (Depth, wound, consumption etc.)
- Cleanliness of the task (chemical row weeding etc.).

Control is provided by the Headman, Field supervisor and Divisional Technical Control, Department (DTC).

ii **RESPONSIBILITIES REGARDING SECURITY**

- Security of person
- Use of chemicals
- Use of Tools

iii **Responsibility concerning communication**

Communicate state of the tasks, trees and needs.

iv **HIERARCHICAL RESPONSIBILTIES**

Takes no responsibility for any other person's action.

5 TRAINING OF OTHERS.

None but may assist.

6 KNOWLEDGE REQUIRED TO ASSUME DUTY -

i. **PRELIMINARY EXPERIENCE**

Not necessary.

ii. **SPECIFIC COMPLIMENTARY TRAINING - INTERVAL TRAINING**.

This is important on almost all the task.

- Tapping and allied operations
- Pest and disease control
- Use of chemicals
- Panelling.

iii. **PERIOD OF ADAPTATION**

Two-month period is adequate for adaptation.

iv **SCHOOL EQUIVALENCE (GENERAL OR TECHNICAL) -**.

General education.

v **PARTICULAR EXIGENCIES OF THE POST**.

- Honesty
- Punctuality
- Regular to work
- Health, strength and physical energy
- Stable family.
- Tapping speed less than 20 sec/tree
- Patience and perseverance.
- A `Farmer` personality.

The above tasks and responsibilities are scored in relation to other duties to establish the pay and incentive plan.

3.4 Time study

While method study as carried out above is concerned with establishing methods, work measurement deals with establishing the time standard for those methods. Tools deployed include stop watch, data recording sheet and study board and the method adopted is to break the cycle of work into distinct parts. The result is as presented in table 3.3.

Table 3.3: TIME STUDY SUMMARY- OLD AND NEW METHOD.

Operations	Time	MD/HA	Hours of work	Frequency
Tapping + latex + lump	55.63cmn/tree	450 trees/md	6hrs	daily
Tap only	33.9cmn/tree	521trees /md		daily
collection of lump	12.01cmn/tree	1640 trees /md		daily
spraying	2478 cmn /load	0.2 md /ha	1 hr	twice a year
pest and disease	86 cmn /trees	0.5 md /ha	1 hr	twice a year
security of crop		0.2 md /ha	1 hr	daily
crop evacuation		0.1md / taper	30 min	daily
avenue slashing		2md /ha		twice a year

stimulation	14cmn/tree		I hr	8-10/year
panel painting	14cmn/tree		I hr	monthly
consumption marking	21cmn/tree		1.5 hrs	bi- monthly
second collection			40 min	daily
row slashing		2md /ha		once a year
cup washing		2md/task		3 times per year
manuring		0.3md/task		once a year
equipping		3md/ha		once

3.5 Questionnaire Survey Analysis

The summated scale (Likert) method in which the tapers were asked to indicate their disagreement or agreement on a five-point scale is employed in the analysis:

Strongly Agree = 5
Agree = 4
Undecided = 3
Disagree = 2
Strongly disagree = 1.

The individual scores are computed by summing the scores of the tapers responses to each question. Finally, the mean item score (MIS) is determined. The results are as follow: Table 3.4 to 3.11.

Table 3.4 COMPANY RATING

SCALE VALUE	FREQUENCY	SCALE POINT	MULTIPLICAND	MEAN ITEM SCORE
Strongly agree	7	5	35	
Agree	12	4	48	
Undecided	7	3	21	
Disagree	3	2	6	
Strongly disagree	1	1	1	
TOTAL	30	15	111	3.7

Table 3.5 COMMITMENT TO COMPANY

SCALE VALUE	FREQUENCY	SCALE POINT	MULTIPLICAND	MEAN ITEM SCORE
Strongly agree	10	5	50	
Agree	14	4	56	
Undecided	2	3	6	
Disagree	4	2	8	
Strongly disagree	0	1	0	
TOTAL	30	15	120	4

Table 3.6 COMMITMENT TO TAPPING

SCALE VALUE	FREQUENCY	SCALE POINT	MULTIPLICAND	MEAN ITEM SCORE
Strongly agree	9	5	45	
Agree	8	4	32	
Undecided	1	3	3	
Disagree	8	2	16	
Strongly disagree	4	1	4	
TOTAL	30	15	100	3.3

Table 3.7 SATISFACTION WITH REWARD

SCALE VALUE	FREQUENCY	SCALE POINT	MULTIPLICAND	MEAN ITEM SCORE
Strongly agree	0	5	0	
Agree	5	4	20	
Undecided	0	3	0	

Disagree	13	2	26	
Strongly disagree	12	1	12	
TOTAL	30	15	58	1.93

Table 3.8 INCE SATISFIES NEED

SCALE VALUE	FREQUENCY	SCALE POINT	MULTIPLICAND	MEAN ITEM SCORE
Strongly agree	1	5	5	
Agree	7	4	28	
Undecided	0	3	0	
Disagree	10	2	20	
Strongly disagree	12	1	12	
TOTAL	30	15	65	2.17

Table 3.9 CAPACITY FOR ADDITIONAL WORK

SCALE VALUE	FREQUENCY	SCALE POINT	MULTIPLICAND	MEAN ITEM SCORE
Strongly agree	11	5	55	
Agree	4	4	16	
Undecided	1	3	3	
Disagree	6	2	12	
Strongly disagree	8	1	8	
TOTAL	30	15	94	3.13

Table 3.10 WORK TO 5 P.M.

SCALE VALUE	FREQUENCY	SCALE POINT	MULTIPLICAND	MEAN ITEM SCORE
Strongly agree	9	5	45	
Agree	4	4	16	
Undecided	2	3	6	
Disagree	5	2	10	
Strongly disagree	10	1	10	
TOTAL	30	15	87	2.9

Table 3.11 FAMILY LABOUR

SCALE VALUE	FREQUENCY	SCALE POINT	MULTIPLICAND	MEAN ITEM SCORE
Strongly agree	11	5	55	
Agree	4	4	16	
Undecided	0	3	0	
Disagree	5	2	10	
Strongly disagree	10	1	10	
TOTAL	30	15	91	3.03

3. 5. 1 ITEM TOTAL CORRELATION- CONTENT VALIDATION TEST.

The eight predictors (items) provide answers to three criterion measures

(1) How the tapers rate or value their job.
(2) The tapers satisfaction with their income.
(3) The tapers capacity for additional work.

Item - total correlation is therefore based on these three criterion measures of individual tapping labour supply: Table 3.12 to 3.14

Table 3.12 TAPERS RATING OF THEIR JOB

SCALE VALUE	TOTAL SCORE	COMPANY RATING	COMMITMENT TO COMPANY	COMMITMENT TO TAPPING
Strongly agree	130	35	50	45
Agree	136	48	56	32
Undecided	30	21	6	3
Disagree	30	6	8	16
Strongly disagree	5	1	0	4
TOTAL	331	111	120	100

Mean item score	3.68	3.7	4	3.33
Mean item score %	74	74	80	67
Item total correlation		0.94	0.93	0.92

Table 3.13 TAPERS SATISFACTION WITH THEIR INCOME

SCALE VALUE	TOTAL SCORE	SATISFY WITH REWARD	INCOME SATISFIES NEED
Strongly agree	5	0	5
Agree	48	20	28
Undecided	0	0	0
Disagree	46	26	20
Strongly disagree	24	12	12
TOTAL	123	58	65
Mean item score	2.05	1.93	2.17
Mean item score %	41	38.67	43.33
Item total correlation		0.97	0.89

Table 3.14 TAPERS CAPACITY FOR ADDITIONAL WORK

SCALE VALUE	TOTAL SCORE	WILLING TO WORK	WORK TO 5 P.M.	FAMILY LABOUR SUPPLY
Strongly agree	155	55	45	55
Agree	48	16	16	16
Undecided	9	3	6	0
Disagree	32	12	10	10
Strongly disagree	28	8	10	10
TOTAL	272	94	87	91
Mean item score	3.02	3.13	2.9	3.03
Mean item score %	60	63	58	61
Item total correlation		1	1	1

Questionnaire items are good predictors of criterion measures with validity coefficient closer to 1 than 0. Further the three indicators of tapping labour supply are combined to give the grand total mean item score.

3.5.2 POTENTIAL INDIVIDUAL TAPPING LABOUR SUPPLY

It is inferred from Table 3.15 that with a mean item total of 3.03, equivalent to 61% score, it is reasonable to conclude- within the limit of the study, that tapers on specialised tapping favour additional work for additional family income.

Table 3.15 POTENTIAL INDIVIDUAL TAPPING LABOUR SUPPLY

SCALE VALUE	GRAND TOTAL	JOB RATING	SATISFACTION WITH REWARD	CAPACITY FOR ADD WORK
Strongly agree	290	130	5	155
Agree	232	136	48	48
Undecided	39	30	0	9
Disagree	108	30	46	32
Strongly disagree	57	5	24	28
TOTAL	726	331	123	272
Mean item score	3.03	3.68	2.05	3.02
Mean item score %	61	74	41	60

3.5.3 TEST OF SIGNIFICANCE: T TEST: - (STATISTICAL SIGNIFICANCE OF RESULT)

The item analysis is further followed by comparing the 25% respondents who are the highest scorers on the total pool of items with 25% bottom group who scored the lowest so as to eliminate the middle group whose attitude may be less clear, less consistent, less strongly held and less informed.

Table 3.16 FREQUENCY TABLE OF RESPONDENTS:

SCORE	FREQUENCY	25% LOWEST SCORERS	25% HIGHEST SCORERS
13	2	2	30
14	0	2	28
15	1	3	28
16	1	4	27
17	0	4	26

18	1	5	26
19	3	8	25
20	2	100	22
21	2	12	20
22	2	14	18
23	1	15	16
24	1	16	15
25	0	16	14
26	2	18	14
27	1	19	12
28	1	20	11
29	0	20	10
30	2	22	10
31	4	26	8
32	2	28	4
33	1	29	2
34	0	29	1
35	1	30	1

Table 3.17 COMPARISM OF 25% HIGHEST SCORERS WITH 25% LOWEST SCORERS

	25% (8) HIGHEST SCORERS	25% (8) LOWEST SCORERS
	Score (1)	Score (2)
	31	13
	31	13
	31	15
	31	16
	32	18
	32	19
	33	19
	35	19
Total	256	132
Mean score (X)	32	16.5
Standard deviation (S)	1.41	2.62
Sample size (n)	8	8
T TEST	3.05E-08	

Null hypothesis H_0: $MIS1 - MIS2 =< 0$ i.e. tapers disagree
Alternative hypothesis H_1: $MIS1 - MIS2 > 0$ i.e. tapers agree

$$Tc = \frac{\bar{X}_1 - \bar{X}_2}{\sqrt{\frac{S^2_1}{n_1} + \frac{S^2_2}{n_2}}} \quad (3)$$

Where Tc = T calculated
X_1 = Mean item score MIS1 i.e. tapers agree
X_2 = Mean item score MIS2 i.e. tapers disagree
S_1 = Standard deviation of tapers agree
S_2 = Standard deviation of tapers disagree
n_1, n_2 = Sample sizes tapers agree and tapers disagree.

Degree of Freedom $v = n_1 + n_2 - 2$ (4)

Probability of type 1 error $T_{critical} = 2.98$
$T_{calculated} = 14.25 > T_{critical} = 2.98$
Also the P value of 3.0464E-08 is less than $\alpha = 0.01$ the highest type 1 error significant level. The null hypothesis H_0: i.e. no difference is therefore rejected. The conclusion is that the questionnaire items provide enough information for discriminating between the opinion of the opposing group on additional labour supply and that tapers agree to additional labour supply for more income.

3.6 BOREDOM

Indicators of boredom include absenteeism, labour turnover and low tapping quality. The table 3.18 below shows three years' record of these indicators.

Table 3.18 Measure of Boredom

Years	Tapers	Tapping Quality (%)	Absenteeism (%)	Tapers turnover
1996	195	62	10	4
1997	169	64	7	14
1998	177	63	8	13
Average		63	8	10

Source: Personnel & Tapping Quality Record.

3.7 PAYMENT AND INCENTIVE PLAN

Pay and incentive are linked to individual performance and includes salary and cash bonus since crop exploitation and associated activities are measurable and person specific. The level of individual salary reward and bonus plan would therefore depend on performance as measured by productivity (Crop), cost effectiveness (upkeep operation) and supervisors rating (relation with co-workers and technical advisers). Bonus is based on the outcome of tapping quality control and crop production. The two combined with current wage level gives the tapers pay packet. The calculation is as follows:

Operation	Md/ha	Task size	Rounds s2d4	Md/1000ha of 200 tree/ha	Cost of specialised tapping at N47.55(B.S)	Cost of de-specialised tapping	Labour specialised	Labour de-specialised	Rmks
Tapping	0.4	521 trees	75	28791	1369012	0	96		300 work days/yr.
Tap + Latex + lump	0.44	450 trees	75	33333		1585000		111	
Collection of lump	0.12	1640 trees	75	9146	434892	0	30		
PDC	0.4	521 trees	2	768	36507	38040	3		
Manual avenue slashing	2	250 templates	1	800	38040	38040	3		
Manual row slashing	2	250 templates	1	800	38040	38040	3		
Chemical row weeding	0.2	2400 templates	2	167	7941	7941	2		
Manuring	0.1	1840 trees	1	109	5183	5183	1		
Cup washing	0.8	250 trees	1	800	38040	38040	3		
Crop security	0.02	25000	75	600	28530	28530	2		
Crop evacuation	0.04	5000 trees	75	3000	142650	142650	10		
Stimulation	0.08	2500	8	3071	76775	88,889			N25/task
Panel painting	0.08	2500	8	3071	61420	71111			N20/task
Consumption marking	0.1	2000	6	2303	345449	40000			N15/task
Preparation/ equipping	0.8	2500 trees	1	800	38040	38040	3		
Total				87559	2660519	21559504	156	111	

Table 3.19 Financial

3.8 COST - BENEFIT ANALYSIS

Saving on basic salary: =N=501,015 per 1000 ha/annum.
% saving on basic salary = 18.83%
Saving in labour:45 workers per 1000 ha
% saving in labour = 28.84%
Earning/taper: =N=64.85
Percentage increase on earning=36.38%.

The table above is the cost - benefit analysis of optimised tapping, showing a saving of 45 workers amounting to =N=501,015 per 1000 ha tapped area per annum. This represent 19% saving in labour cost (excluding

overhead). Taper's basic daily salary increased from =N=47.55 to =N=64.85 (36% increase). The increment worked out as overtime pay, to avoid income effect on the individual tapping labour supply =N=5.7 per extra hour. Other incentives include the provision of motorbike on loan, crop and Christmas bonus.

IV. Conclusion

Tapping job redesign by de-specialisation is feasible and acceptable (74%). The economic return is enormous (19%) while job satisfaction especially worker income is enhanced (36%) without extra cost. De-staffing and Delayering are effected at the same time achieving genuine commitment to organisation goal. Finally, the company is likely to be more competitive at lower cost of production per kilogram of crumb rubber produced than at the present high production cost of specialised tapping.

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