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LABOUR PROBLEMS IN RHODESIA

On-the-Job Training in S.A.

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ON-THE-JOB TRAINING ON THE ASSEMBLY-PLANT OF A SOUTH AFRICAN MOTOR VEHICLE PRODUCER: A CASE STUDY* **

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A study written under the auspices of The Institute of Social and Economic Research, Rhodes University

1. Introduction

It is the purpose of this paper to report the findings of a study into on-the-job training on a South African motor vehicle assembly-line. The data reported in this paper were collected during the months July, August and September, 1972, when the writer spent some seven weeks on the premises of a major motor car producer of the Eastern Province. In order to preserve the anonymity of those who freely supplied information—managers, workers, and informed outsiders—the plant in question has been called *Company X.*

More than 50 per cent of Company X's employees are Non-White (both Coloured and Bantu). Among the Non-Whites of the whole region there prevails what one might refer to as a *vicious circle of poverty*, and before the specific theme of this paper is developed more fully, it appears appropriate to discuss briefly some features of the typical social environment from which Company X draws its Non-White employees.

The circle of poverty begins in the residential environment. According to a socio-economic study of the Institute for Planning of the University of Port Elizabeth (U.P.E.), roughly 4,3 Coloureds share one bedroom on average (1971, based on a survey of more than 20 000 Coloured households). [1] Unemployment is particularly characteristic of the younger population and of those with relatively low educational standards, and this is aggravated by the fact that about one-quarter of all work seekers have been without a job for more than a year and thus constitute a group of hard-core unemployed. Work stability is low, professional skills are minute (only 2 per cent of the sample hold top status jobs), and the Institute suggests that an investigation "of some of the more distressing features of 'township life', such as hooliganism, crime and misuse of alcohol, would appear to be long overdue". [2]

It is not surprising that the inadequacy of the residential environment is associated with ample evidence of inadequate work performance and work commitment. Labour turnover, absenteeism, and unpunctuality are the most noteworthy evils in this regard. Labour turnover in the transport equipment industry is particularly high for unskilled workers (16 per cent for Whites, 26 per cent for Bantu, and 32 per cent for Coloureds. The respective percentages for semi-skilled workers are 13, 9 and 14.). [3]

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* The writer gratefully acknowledges the unfailing courtesy and co-operation of members of management and workers of the plant studied, without which this study would not have been possible.

** I am also grateful to Professor J. R. de S. Honey who discussed the manuscript with me.

[1] B. D. Phillips, "The Coloured Population of the Port Elizabeth/Uitenhage Region: A Socio-Economic Study," Institute for Planning Research, U.P.E., 1971, pp. 54f.

[2] *Ibid.*

[3] B. D. Phillips, "Secondary Industry in the Port Elizabeth/Uitenhage Region", Institute for Planning Research, University of Port Elizabeth, 1969, p. 122.

With R74,10 per month [4], the mean monthly income of male Coloureds just covers the barest minimum living expenditure of the *Secondary Poverty Datum Line* of R73,68 (1971). [5]

Vocational education would be the obvious means of overcoming the present adverse social and economic environment of Non-Whites in the Eastern Province metropolitan area. Yet in spite of the dearth of skilled labour, firms do very little in terms of running organized training programmes for their Non-White staffs. [6] Nor are the facilities of the region's only *Vocational School for Coloureds* in Bethelsdorp used to any full extent. This excellent educational institution has an annual capacity of 600 students but at present, only about 50 per cent of this capacity is actually used. [7] The writer was told by the Principal of this School that too few Coloureds passed Standard VII (necessary for a career as an artisan) and of those who did, most entertained aspirations beyond the status of artisans.

The above serves to illustrate some features appertaining to the labour force hired by Company X. It is of interest to note that the Company's Personnel Management is convinced that money spent on staff training would consistitute a beneficial investment. In this regard, particular mention should be made of the excellent training facilities provided for White apprentices within the set-up of an independently run Training Centre, where training is given to apprentices for the following trades: tool and jigmaking; fitting (including machining); turning; electrician; motor mechanic; and automotive machining and fitting. Yet comparatively little is spent on in-company training of Non-Whites, for whom there is merely 1 Non-White Training Officer in charge, against 7 full-time White employees directly working for the Training Centre for Whites.

The internal training programme for Non-Whites, run under the control of the Non-White Training Officer, is as follows:

(i) *Induction Training*
All new employees attend a three-hour training session. Instructions include aspects such as general orientation, pay, safety, rules and regulations.

(ii) *Safety Courses*
These are conducted for all safety-observers. Refresher courses are given from time to time.

(iii) *Mobile Transport Courses*
This is the only course which teaches particular skills for a particular job. Theoretical and practical courses cover the following: driving techniques; familiarization with various types of models; obstacle driving lessons; written and oral tests; safety rules; driver's responsibility and maintenance problems.

(iv) *Supervisory Courses*
This interesting avenue of Non-White training is designed to educate Section Leaders. Their syllabus consists of job instruction, job method, job relations, and basic principles of supervision. After successful

[4] Phillips, The Coloured Population . . ., *ibid.*, p. 25.

[5] J. F. Potgieter and D. B. Roger, "The Poverty Datum Line in Port Elizabeth, Uitenhage and Despatch", *Institute for Planning Research*, U.P.E., 1972, p. 22.

[6] Compare Phillips, Secondary Industry . . ., *ibid.*, pp. 113-117.

[7] Information given to the writer by the School Principal.

completion of their courses the candidates are issued with red badges labelled *Section Leader*. At present, they operate as middle-men between the (White) foremen and the (Non-White) workers, and are responsible for the control of absenteeism, punctuality, and, occasionally, quality. This must have a strong claim to be considered as excellent preparation of workers for the assumption of foreman status at a later stage.

Besides the in-company training given under the auspices of the Personnel Department (which can be defined as formal in-company training), there is also a considerable amount of in-company on-the-job training, given to both Whites and Non-Whites. By on-the-job training I understand a training process which takes place while the worker is actually *engaged in producing* the product of the firm. Typically, this type of training is informal, as there is usually no laid-down procedure as to who acts as instructor and who receives instruction. More often than not, on-the-job training will be dictated by the requirements of production. As long as a worker performs his assigned job satisfactorily (irrespective of whether he is a new or an old employee), he is unlikely to be given informal on-the-job training. But when the foreman or supervisor in charge of the production line realizes that he has to transfer workers from one level of skill to another level of skill in order to meet production targets, he will most likely apply methods of on-the-job training in order to achieve this objective. Note that the acquisition of skills through learning-by-doing is not part of the definition of on-the-job training put forward above.

2. Hypotheses to be Tested

On-the-job training will be applied by firms if they gain by substituting firm-trained employees through workers hired in the open market. In contrast, on-the-job training is no economic proposition if a wage differential between firm-trained employees, and workers with the same skill who are hired in the open market, does not exist. Inasmuch as the labour supply curve is completely elastic (so that there is a rate-for-the-job for a particular skill), on-the-job training cannot be an economic proposition as the firm would not be able to recoup training costs. This will particularly be the case when the skill is perfectly general so that the employee could sell his labour at the same rate to different employers. If, however, the labour supply curve is inelastic, the firm will be able to recoup training costs through Robinsonian exploitation.

Workers with little or no formal school-education are obviously worse equipped for industrial jobs than workers with good schooling. Assume, however, that firms know from experience that formal school-training and on-the-job training are substitutive for certain jobs. Assume also that a rate-for-the-job exists. In this case firms will supply on-the-job training to unskilled workers only if the opportunity costs of training are zero. If this condition is not present, firms will hire only employees who already have full command of the required skills.

The demand for trainees depends also on the nature of the skill for which training is supplied. If the skill is perfectly general, i.e. if it is equally useful for many firms, the firm cannot invest in a man's education unless the opportunity costs of training are zero. Otherwise, the firm would not be able to recoup training costs. This is so because (in contrast to tangible assets), the worker does not become the property of the firm. Hence trainees will leave after being given training, unless they receive competitive wages. In contrast, if training were completely specific, the wage that an employee would get elsewhere would be independent of the amount of training he had received. Consequently, it is rational for specific training to be financed by the firm. [8] The firm's demand for trainees therefore is a function of the mobility rate of its employees. The greater the turnover of trained personnel, the lower will be the value of resources devoted to training purposes.

To conclude: the energy spent by the firm on on-the-job training will tend to be great if pay differentials are significant, i.e., when, for a particular skill, the labour supply curve is inelastic; it should also be great when the workers' school-education is minimal if at the same time (i) the training is specific and or if (ii) the opportunity costs of training are neglibiel.

3. The Test Case: On-the-Job Training on the Assembly-Line of a Motor Vehicle Producer

3.1 The Measurement Problem

The desire to measure the occurrence of on-the-job training for a large number of workers raised considerable methodological problems. The writer tested three different methods:

3.1.1 *Observation of Individual Employees*

For some days, several new employees were systematically observed during their first few days of employment, and the proceedings accompanying their induction were noted. Records were made of the following: (i) who inducted the employee in his job? (ii) what was the normal occupation of the man who did the induction? (iii) in what way was the new employee shown how to manipulate tools and equipment? (iv) when was the man able to perform the assigned task without another's help at a reasonable speed?

The disadvantage of this method was that it was time-consuming without being very reliable. During the time that the observer was present, both the department concerned and the trainee made special efforts to demonstrate the induction process in as favourable a light as possible. The mere presence of an observer tended to make all parties alert, and it was because of this obvious bias that this method was soon abandoned (Closed-Circuit Television would have been a means of overcoming the difficulties encountered).

3.1.2 *Use of Questionnaires*

A second means of exploring the training situation was tried with the use of questionnaires, which were completed by employees either during breaks or overnight.

Whilst questionnaires proved a useful tool of information on issues such as date of birth, family status, number of children, and similar quantitative questions, they were of little value for the quantification of training time. If one asked the worker "how long did it take you to learn to do your present job without special supervision?", one might get any reply between one hour and three months. But as a basis of quantification this sort of information is of little value because it is vague and subjective.

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[8] The distinction between specific and general training was first suggested by Gary S. Becker, "Investment in Human Capital", *Journal of Political Economy*, Vol. LXX, Suppl., October 1962, pp. 9-49.

Moreover, any question of the kind mentioned above is crude insofar as the on-the-job training process is usually a gradual one which may take only a few minutes per day, and which amalgamates with the worker's independent acquisition of required skills.

3.1.3 *Work-Sampling*

A third method, work-sampling, was eventually tried and proved acceptable. In Britain and the U.S.A., work-sampling has acquired an increasing status as a tool of industrial research ever since it was first suggested by L. H. C. Tippet during the mid-1930's. [9] Tippet did frequency studies in Textile Research and discovered by statistical evaluation that the percentage of observations recording an object (e.g. a machine or a person) in a given state is a measure of the average percentage of time it is in this state. Heiland and Richardson suggest the following definition: "A Work-Sampling study consists of a large number of observations taken at random intervals; in taking the observations, the state or condition of the object of study is noted, and this state is classified into predefined categories of activity pertinent to the particular work situation. From the proportion of observations in each category, inferences are drawn concerning the total activity under study." [10] Thus, the observer has to note visually, classify into categories, and record the instantaneous state or condition of an object of observation. Work-sampling has proved particularly successful in the study of irregular, non-repetitive, or semi-repetitive, work, where the stop-watch cannot easily be used, such as activities involving walking, reading, attention to gauges, manipulating valves, or work on construction sites or work in hospitals. Borus and Tash suggest that it is a useful tool to measure the productivity of manpower programmes. [11]

From the very nature of this tool I speculated that it might be useful for the measurement of on-the-job training.

In the planning of the design the following factors had to be observed:

(i) the observations must take place at random times;

(ii) the categories of sampling must be clearly and concisely defined and must be recognizable by visual observation. Rating procedures should not be applied, as they are subject to error.

(iii) in contrast to the traditional stop-watch procedures, work-sampling has the advantage of observing a great number of workers simultaneously over a number of days or weeks. Whilst the presence of the observer may irritate the workers at the beginning, the operators tend to get used to the observer if they see him day in and day out.

(iv) The purpose of work-sampling is to establish the percentage occurrence p of the element being observed, expressed as a decimal. If

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[9] L. H. C. Tippet, "Statistical Methods in Textile Research . . . A Snap Reading Method of Marking Time Studies of Machines and Operations in Factory Survey", reprinted in: R. M. Barnes, *Work Sampling*, Wiley, New York, 2nd Ed., 1957.

[10] R. H. Heiland and W. J. Richardson, *Work Sampling*, McGraw Hill, New York, 1957, p. 1. A useful practical guide is C. L. Brisley, "Work Sampling" *Industrial Engineering Handbook*, 2nd Ed., Edited by H. B. Maynard, McGraw-Hill, New York, 1963, pp. 379-398. In South Africa, Work-Sampling appears to be a relatively unknown tool of industrial control. The writer's attention was drawn to this method by the Work Study Engineer of Company X, under whose guidance a detailed study of metal finishing operations had been done.

[11] Michael E. Borus and William R. Tash, "Measuring the impact of Manpower Programs—A Primer", *Institute of Labor and Industrial Relations*, University of Michigan, 1970, p. 14.

samples are drawn randomly and if the composition of the mass does not change, then the probabilities of a sequence of p observations will be distributed by the normal distribution curve. The standard deviation is used as a measure of the dispersion as it encloses, when laid off on both sides of the mean, known portions of the area under the normal distribution curve. The formula for the standard deviation (σ) is—

$$\sigma = \sqrt{\frac{p\,(1\text{-}p)}{n}}$$

where p=percentage occurrence of element observed;
n=number of observations.

The number of work-sampling observations required for a certain statement depends (i) on the accuracy required of the study, and (ii) on the number and dispersion of observed categories. [12]

Before the lay-out and the results of the work-sampling study are described in greater detail, it appears appropriate first to describe some of the basic features of assembly-line work. [13]

3.2 Characteristic Features of a Motor Car Assembly-Line

On the line (as workers describe the assembly-line), the pace of work is controlled by some mechanical means—a conveyor, trolley, or belt. Each man works in a limited area. Operators usually do their work independently of others as the car is carried down the line, although there are a few jobs which require the interaction of two or more than two workers. After finishing his work-cycle on a given car, the operator returns to his station and begins another installation. The men on the line must adjust to its pace, although there may be some room to work back on the line or to drift, and so to make a spurt or take a breather in physical effort. This freedom is limited, however, by the grumbles of fellow-workers who are unwilling to make room for those who do not hold their assigned work-area. On the line, therefore, the rhythm of man is subjected to the rhythm of the machine, and not vice versa.

The line brings the work to the men. In his work process, the discretion of the operator is strictly limited. All parts are standardized and interchangeable, making it unnecessary for the operator to do quality control checks on material parts. Nor does he have any choice in respect of the selection of tools or work methods.

The repetitiveness of the job requires what has been labelled "surface mental attention" as distinct from "attention in depth". [14] That is, the nature of the work operation is such that the full mental identification of the worker with his product is not required. The operation quickly becomes second-nature to an assembler.

[12] A good statistical guidance is given by W. H. Williams and C. A. Johnson, "The Efficiency of Time Slice Work Sampling", *American Statistical Association*, 1965 Proceedings of the Business and Economics Statistics Section, Annual Meeting, pp. 350-362.

[13] Notable references are: Henry Ford, "Mass Production", *Encyclopaedia Britannica*, Vol. XV, 14th Ed.
Charles R. Walker and Robert H. Guest, *The Man on the Assembly Line*, Institute of Human Relations, Yale University, Cambridge, 1952.
Also by Walker and Guest: *The Foreman on the Assembly Line*, Harvard University Press, Cambridge, 1956.

[14] Walker and Guest, The Man . . ., *ibid.*, p. 12.

Because assembly-line jobs are standardized and minutely subdivided, individual jobs usually require little skill, which in most cases can be acquired within a few days or weeks. Nevertheless, it would be wrong to assume that all line jobs can be learned within a few days, if by learning we mean the ability of the operator to perform a prescribed number of operations within the cycle of the line, and without outside assistance.

The following classification of skills (in ascending order of difficulty) is proposed:

(i) *single-operation jobs*
An example of a single-operation job is the fastening of mudguards to the body, done by an air-driven spanner. This task requires the ability to repeat a simple cycle of motions at a given rhythm.

(ii) *Multi-operation jobs*
One operator may be responsible for three to seven different operations, such as inserting screws, fitting a cable, fastening clips, and, say, drilling holes for the installation of the control panel. Whilst the work performance is repetitive during the cycle, it nevertheless shows a certain degree of variety.

(iii) *jobs requiring special skills*
It does occasionally happen that parts do not meet required standards. This will necessarily produce difficulties for the assemblers who must bend or occasionally even file material parts in order to make them fit. [15] I observed on different occasions that the fitting of doorlocks, front lamps, rear licence plate housings, and the adjustment of side doors, fell into the category referred to above. In all cases, considerable skill was required by the assembler to overcome the difficulties.

(iv) *jobs of utility men*
These persons command the skills of most routine jobs. It is their function to assist drifting operators (i.e. those who fail to keep up with the pace of the line); to do the work of men who are absent; and to assist with the repairs of defects reported by inspectors.

(v) *jobs of repairmen*
These persons usually command the "classical" skills in the traditional trade or craft sense.

It follows that although, at first sight, line jobs appear to require little skill, they nevertheless *in toto* exhibit a remarkable variety of skills. Industrial researchers have reminded us of the need to consider as important even minute differences in the operators' work assignments. "Other things being equal", Walker and Guest argue, "the difference between a satisfied and a dissatisfied worker may rest on whether he has a ten-operation or a five-operation job." [16]

3.3 Planning and Evaluation of the Work-Sampling Study

The work-sampling study was done by the writer in co-operation with a research associate. [17] We did our observations on a portion of the final line which extended from where the painted body leaves the Paint Shop to the point

[15] Defects in part fittings are a typical consequence of small scale car production. Compare Board of Trade and Industries, Report No. 613, "Investigation into the Motor Industry in South Africa", 1960, para. 89f.

[16] C. R. Walker and R. H. Guest, "The Man on the Assembly Line", *Harvard Business Review*, Vol. 30, No. 3, 1952, pp. 71-83, here p. 80.

where the chassis is merged with the car body at Body Drop. Thus we observed practically all assembly work on the chassis, such as interior trimming, electrical, window, lamp, and many other accessory installations.

On the line observed, two European foremen were in charge of 7 European artisans, [18] 22 European hourly-rated workers, 40 Bantu and 18 Coloureds. The line was part of an assembly line which was run by a Manager and a Supervisor.

The length of the work cycle was about 6 minutes, which is considerably slower than that of U.S. lines whose run is usually below 2 minutes and has recently been reduced to 90 seconds. Compared with overseas lines the observed South African line would therefore require more versatile operator skills.

Of the 88 operators on the line we drew a stratified sample of 33 men, consisting of:

6 European artisans (Nos. 101 to 106) [19]
6 European hourly-rated workers (Nos. 201 to 206)
10 Coloured hourly-rated workers (Nos. 301 to 310)
11 Bantu hourly-rated workers (Nos. 401 to 411).

Fifteen persons in the sample had been employed during 1972, and of those 6 had served the Company less than 2 months when the study was made.

The work-sampling procedure requires the observer to identify all persons in the sample by name. After the selection of the sample my research associate and I gave the men fictitious names, such as Shakespeare and King Lear, which proved to be a better means of remembering a person's identification than using his real name. We then drew up a *task attribute schedule* for each individual worker, which covered the criteria *object variety*, *motor variety*, *autonomy*, *required interaction*, *learning time*, and *responsibility*. [20] Additional information about the men was extracted from the employment files in the Personnel Department.

Next it was necessary to define categories which would enable the identification of on-the-job training situations in relation to normal work situations. After a considerable number of tests, the following criteria were laid down:

The observation is A_{ijk}, where

i = 1 man works under great pressure
2 normal work performance
3 man idles or slow work performance
4 man not working
5 man not present (*no-work* observation)

j = 1 man is not drifting
2 man drifts
3 man is called to do work over again ("rework")

k = 1 man works independently
2 social contact (e.g. conversation) with fellow-worker(s)
3 social contact with section leader
4 social contact with foreman, supervisor, or manager

[17] A visiting Commerce student employed by Company X.

[18] These men were promoted to artisan status by virtue of their seniority, although they were not artisans in the sense that they held artisan certificates.

[19] All men are numbered by three-digit numbers. The first digit refers to the category and race of the employee, and the second and third digits are in sequence.

[20] See Appendix.

5 man receives or gives instruction or training.
6 man waiting for workplace to become accessible.

The observation A_{211} for instance, would identify the following case: *normal work performance, man is not drifting, man works independently.*

It will be noted that only 1 of 14 categories listed refers actually to a learning situation (Vide k=5). This design was necessary, because it was intended to analyse the *relation of actual learning situations* (i.e., on-the-job training in this case) *to all other possible activities in the plant.* The alternative, i.e., the mere recording of learning situations only, would have given an indication of the absolute length of time allocated to training during the period under consideration, but it would not have provided a basis on which to relate this information. Only by measuring the total spectrum of activities, therefore, was it possible to describe the relation between working and learning time.

The categories were designed in such a way, however, that several of them allowed an ancillary analysis of inadequacies in training. These "critical performance situations" were the following:

i=1
The observation *man worked under great pressure* could result from several causes, such as inadequacy of skill command, too heavy a work-load, or insufficient material supplies at an earlier stage. In all cases the observer therefore noted the actual cause of this observation.

j=2
Drifting on the line could also result either from inadequacy of command of skill, or from other reasons. On several occasions workers drifted intentionally because they wanted to bring themselves to the attention of their foremen in the hope that their workload would be reduced. Again, the observer noted the cause of the drifting.

j=3
The category *man is called to do rework* was in many cases indicative of inadequate operator performance. It was the rule of the line that no assembled body would pass Body Drop before all assembly faults had been repaired. Whilst minor assembly defects were usually directly attended to by the utility or repair men before Body Drop, operators would be called to do rework if it was established that a particular defect occurred repeatedly. This served as an excellent educational device. In a few instances we also observed that the line was stopped because the respective operator did not manage to finish his rework before the last production cycle had come to an end.

k=5
This category describes the incidence of *on-the-job training*. The problem was, however, that the observer could not in all cases clearly identify whether the nature of contact between two or more than two workers was a purely social or a work-orientated one. Although functionally little interaction between workers is actually required on an assembly-line, social interaction is frequent and is used by workers to overcome the monotony of the job. [21] In any case, the observers often listened to talks in order to establish whether they were of a social or work-orientated nature. I believe that we coded the nature of interactions accurately for

[21] Compare R. H. Guest, "Men and Machines, An Assembly Line Worker Looks at his Job", *Personnel*, Vol. 31, No. 6, May 1955, pp. 496-503.

most cases, although the possibility cannot be excluded that occasionally, the category k—5 has been underreported in relation to k—2, 3, 4.

During a period of 12 working days, 5 598 work-sampling observations were made and recorded. I subsequently evaluated the data in the Rhodes University Computing Centre.

For each man in the sample, and for each employee group, the following data were computed:

(i) number of observations of each i, j, k observation;

(ii) relative frequencies;

(iii) relative frequencies of the two most frequent observations, viz., A_{211} and A_{212};

(iv) confidence limits of the above (1 sigma and 2 sigma).

Tables 1 to 4 list the relevant information, and Table 5 shows certain data appertaining to individual employees. The fields of Tables 1 to 4 tabulate the relative frequencies of observations, ± 1 sigma. The information $69{,}28 \pm 3{,}73$ means for instance that in 68,26 per cent of all cases, the true relative frequency of the respective category was between 65,55 and 73,01 per cent, provided that sampling was done on a random basis (compare the left top field of Table 1).

The one fact that emerges with clarity from the consideration of Tables 1 to 4 is the relative infrequency of "critical performance situations", as defined above. The decisive criterion k=5 was observed in less than one-half of one per cent of all cases, when related to the four main employee groups. This leads us to conclude that there is *no noticeable evidence for on-the-job training on the line studied.*

For the following several reasons this is contrary to what I had expected:

(i) note that as much as 18,2 per cent of the sample population had been employed for less than 2 months by the Company when the study was made;

(ii) the formal school-education of the sampled population is minimal, especially in terms of duration. It is of interest in this regard to compare the subjects' years of schooling with the findings of a U.S. assembly-line study:

Table 6: **COMPARISON OF THE GRADES OF SCHOOL ATTENDED BY LINE WORKERS U.S.A. [WALKER AND GUEST, 1952], AND COMPANY X [ALL RACES] [22]**

Years of Schooling	*U.S.A.*		*Company X*	
	numbers	*per cent*	*numbers*	*per cent*
Less than 8	16	8,8	16	48,5
8	17	9,4	12	36,4
9-11	58	32,5	5	15,1
12	79	43,8	—	—
More than 12	10	5,5	—	—
Total	180	100,0	33	100,0

(iii) The production cycle of the South African plant is about 4 times as long as the cycle on plants in industrially more advanced countries.

(iv) Special skills were required by the South African plant because in several instances, parts did not meet required standards and had to be made to fit by the skill of operators.

The fact that, in spite of the small evidence for on-the-job training, the line ran relatively smoothly and that stoppages due to operator faults were rare, can therefore be explained only by the fact that the sum total of the command of skill on the line was acquired by workers basically through what is known as *learning-by-doing*. This does not mean, however, that savings could not have been achieved had the workers' command of skill been higher. But before this point is evaluated in greater detail, it appears appropriate to consider the data listed in Tables 1 to 4 in some greater depth.

3.3.1 *Evaluation of Critical Performance Situations*

The schedule (Table 7) below shows the average relative frequencies of "critical performance situations" by employee groups: [23]

Table 7: "CRITICAL PERFORMANCE SITUATIONS" BY EMPLOYEE GROUPS

Employee Group	$\bar{i}=1$	$\bar{j}=2$	$\bar{j}=3$	$\bar{k}=5$
European Artisans	0,31	0,38	2,81	0,51
European Hourly-Rated ..	1,61	3,52	0,12	0,24
Coloureds	2,40	3,55	0,23	0,58
Bantu	2,71	4,98	0,18	0,47

Note that European artisans, European hourly-rated personnel, Coloureds, and Bantu came out in descending order as far as the evidence of work pressure (i=1) and drifting (i=2) are concerned. The fact that European artisans were heavily engaged in rework was due to the fact that they were the ones who were called on by the inspectors to repair operational defects caused by others. In some cases the artisans in turn called on the particular operators to do the repair job themselves.

It is apparent from the above schedule that, on average, the work organisation was good, as is evidenced by the low number of "critical performance situations". This success can be attributed in large measure to the excellent management abilities of the Supervisor of the line.

For the purpose of this paper it is of interest to analyse separately the "critical performance situations" of those employees who had joined the Company most recently, i.e. during the 4 months preceding the date of the study. [24]

Man No. 205 This worker did part of the door assembly which required considerable manual dexterity. We found that this man was familiar with the job as he had worked for the Company before in a similar capacity.

[22] Walker, The Man . . ., *ibid.*, p. 174.
The name of the plant studied by Walker and Guest remains unknown, but it is said that in 1949, it was "one of the most modern automobile assembly lines in the world".

[23] Source: Tables 1 to 4.

[24] For Personnel Details, compare Table 5.

Man No. 301 It was this worker's job to fit the rubber around the rear windows, to insert the chrome beading into the rubber, and, with the assistance of another operator, to instal the window in the body. The job required considerable skill, as it was difficult to fit the stiff rubber and chrome parts around the glass windows. Carelessness on this job could also easily lead to accidents or breakage.

The personnel files showed that this man did not have experience in assembling work prior to starting with Company X, as he used to do a spray-painting job.

In spite of the difficult work-assignment we did not observe one single training situation for this man. His work load was heavy, as he spent $91{,}53 \pm 2{,}56$ per cent in the A_{211} category (frequency with 1 sigma deviation).

Man No. 305 This man, who did have some assembling experience before he joined Company X, was given training by an artisan in 4,17 per cent of the cases observed. The reason for this high portion of time spent on training was that he was performing a particularly tricky job, i.e., the adjustment of side doors. At the time of our observation, practically no door fitted without significant adjustments, as Body Shop had not met required standards. For a considerable time also, Man No. 305 was assisted by a European utility man in his job.

Man No. 309 This person spent $83{,}58 \pm 2{,}61$ per cent of the observed cases in the A_{211} category. He did not receive any training whatsoever, as he performed a simple job, i.e., the fitting of inside carpets.

Man No. 310 It was this man's job to assemble and instal the housing of the licence plate light. The operations were as follows:

(i) loosen screws which fasten the housing on rear decklid (the housing was fastened in order to ensure that its paint would be identical with that of the decklid);
(ii) clean screws from paint;
(iii) assemble licence plate light;
(iv) screw housing on decklid;
(v) clip cables in decklid.

The job was unpleasant as the housing could not be loosened from the decklid easily because the screws were covered with paint. As a result, this man worked under great pressure for more than 15 per cent of the observed time, and drifted in about 22 per cent of all cases observed.

The induction of man No. 310 was a typical example of bad Personnel Management. Not only was the man given training (which he badly needed) in a mere 0,56 per cent of the observed cases, but also he was given one of the worst jobs right from his first day of employment, i.e., the assembly of a part which did not meet required standards. Note that this man drifted in 22 per cent of the observed cases which, naturally, produced significant frustration.

Man No. 410 This worker assembled installations in the doors. We did not observe any training for him at all and he worked in the A_{211} category during 75,74 per cent of the cases observed.

Man No. 308 This person had joined the Company 4 months before and was responsible for most of the electrical wiring. He was in the 211 category in 92,12 per cent of all cases. No training for him was observed. The quality of his work was particularly important as wiring defects can be rectified only with considerable difficulty.

3.3.2 *Opportunity Costs of Training*

The question which now has to be answered is what the costs of additional on-the-job training would have been. Consider the schedule (Table 8) below, which shows the proportion of time when six European workers were either idle (i=4) or not present at the line (i=5):

Table 8: NON-WORKING SITUATIONS OF EUROPEAN WORKERS [25]

Man number	$\bar{i}=4$	$\bar{i}=5$
102	14,29	9,09
103	25,55	5,11
105	31,63	24,65
106	22,93	17,07
201	6,49	6,49
203	13,64	35,06

The above schedule illustrates that six out of twelve Europeans of our sample could have spent considerable portions of their time on the training of other workers without affecting production in an adverse manner. In other words, *skill could potentially be transferred from workers who command a good all-round level of skills* (i.e. Europeans, and mainly the European artisans) *to workers with lesser command of skill* (i.e. Coloureds and Bantu) *at zero opportunity costs.* In view of the considerable number of observed non-working occasions for European artisans it appears realistic to propose that some of them be promoted into the ranks of *Plant Training Officers* whose sole function it would be to induct new workers into the particular skills of their work, and to re-train old employees so as to make them more versatile. This latter aspect of re-training is of particular importance for an assembly-line with a vexing problem of absenteeism to be overcome. [26]

4. Economic Equilibrium and Disequilibrium

Let us define as equilibrium the situation where any change in the organizational conditions of the work on the line would always produce a deterioration, but under no circumstances an improvement of the line's efficiency (measured in terms of valued input per unit of output). In contrast, disequilibrium would exist if by means of organizational changes, the overall efficiency of the line could be improved.

[25] Only workers whose non-working time exceeded 10 per cent have been listed.
Source: Tables 1 and 2.

[26] On the assembly-line which we studied, the average rate of absenteeism was as follows during the period June, 1971, to July, 1972:

European artisans	7,2 per cent
European hourly-rated personnel	8,5 per cent
Coloureds	4,0 per cent
Bantu	3,2 per cent

It appears from our measurements that the line observed showed significant evidence of disequilibrium. The evidence for this assertion is set out in 4.1 below.

4.1 Disequilibrium in Standards of Education, Task Attribute Scores, and Wage Rates

It can be seen from Table 5 that there is a descending order in the average standard of education and in the allocated task attribute scores between European artisans, European hourly-rated personnel, Coloureds, and, finally, Bantu. Note, however, that the relative differences in average standards of education and task attribute scores are minute, compared with the notable average differences in the hourly-rate of pay received by the four classes of worker. Thus, with R1,32 p. hr., the average wage rate of European artisans is about 76 per cent higher than the average wage rate of White hourly-rated personnel, more than 2,6 times higher than the average wage rate of Coloureds, and about 3,3 times higher than the average wage rate of Bantu. It is of course difficult to make conclusions about the economic rationale of a wage structure and most certainly this must not be done *in vacuo*. But a certain indication of what the tendency of economic forces is under conditions of free markets is given in a study by R. H. Guest entitled "Work Careers and Aspirations of Automobile Workers". [27] Guest reports that in U.S. companies, the wage differential between the lowest and highest paid job on the line is usually small. He finds that "ninety-five per cent of the workers fell into four pay groups, the highest and lowest being 20 cents apart. . . . In other words, advancement for production workers within the hourly ranks was highly restricted." [28] (The above observation was made in 1952 when the starting wage rate was $1,82.) Guest's study also noted that workers were not strongly ambitious and that the lack of vertical mobility was neutralized by the enjoyment of the immediate advantages of good pay and security.

By American standards, therefore, the wage differentials on the South African line must be considered as huge—although it has to be noted that the average pay of the "aristocracy" of the South African line, i.e., that of European artisans, does not even match the pay that American workers received in real terms on average 20 years ago.

The reasons for the wage differentials between European artisans are obviously their greater seniority (note that on average, they served as from May, 1961, against short average employment period of the other workers); their greater skill; slightly superior school education; and, above all, their race. [29]

4.2 Forces Working Towards the Attainment of Equilibrium

The obvious force which would promote the establishment of economic equilibrium would be an all-round enhancement of skills. This could be done by promoting some of the experienced European artisans to the status of *Plant Training Officers* and utilize their experience for the training of lower ranks of workers; by encouraging the younger European hourly-rated workers to do an apprenticeship with the Company and thereby qualify for the considerable income increment of about R1,06/hr. which prevails between their

[27] *American Sociological Review*, Vol. 19, 1954, pp. 155-163.

[28] *Ibid.*, p. 155.

[29] I intend to offer quantification of this statement with the help of multiple correlation and multi-variate analyses at a later date.

present wage rate and the wage rate they would receive after completion of their artisan training; [30] and by raising the general skill level of Non-White plant workers so as to make them more versatile and thus more useful for assembly line work. [31]

The progress in skill acquisition should be combined with greater rationality in the relative wage structure, amongst Non-Whites as well. (Note, for instance, that Man No. 308 with a task attribute score of 2,47, is significantly underpaid relative to others in his race group. The same is true for Men Nos. 408 and 404, the two Bantu Section Leaders.)

5. Conclusion

This study offers evidence that both workers and the Company could derive significant economic benefits if the general employee skill level would be enhanced. Within the South African sociological context it is not permissible, of course, to "replace" Whites by Non-Whites. But the enhancement of productivity through the development of the skills of persons of all race groups is part of official Government policy, and the Company would benefit economically if it fell into line.

It was also shown that on the line which we studied, all economic conditions for intensive on-the-job training were prevailing, viz.,

(i) wage differentials between workers are large (which enables the company to recoup training costs in cases where on-the-job training would be financed by positive opportunity costs);

(ii) educational standards (which are taken as a proxy for skill standards) differ between workers;

(iii) the differences in seniority are noteworthy, hence there exists a core of workers who command considerable experience which they acquired through learning-by-doing;

(iv) much of the training is specific, i.e., it applies directly only within the plant under consideration;

(v) the marginal opportunity costs of on-the-job training are zero.

Thus there are a number of economic arguments which would recommend the introduction of an organized *in-plant on-the-job training scheme*. The fact that this has not as yet been implemented by Company X appears to be indicative of a lack of rationale in the use and development of manpower. We have seen from our introductory remarks to this paper that Company X is not unique in this regard, as in fact the neglect of an economic evaluation of manpower programmes is typical of many South African firms. Within the socio-political structure of the country, there is very considerable potential to improve the well-being of all concerned, firms and employees alike.

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[30] The artisan shortage is so bad that the *Financial Mail* estimated recently that "fewer than 20 years from now the industry as a whole is expected to be short of some 58 000 artisans". Motor Industry: Supplement to the *Financial Mail*, March 13, 1970, p. 49.

[31] This is a particularly important task as line work is a relatively new occupation for Non-Whites. Until very recently, South African motor assembly lines employed Whites only.

Table 1: ACTIVITY ANALYSIS FOR EUROPEAN ARTISANS, 775 OBSERVATIONS

Employee number	$\bar{i}=1 \pm 1\sigma$	$\bar{i}=2 \pm 1\sigma$	$\bar{i}=3 \pm 1\sigma$	$\bar{i}=4 \pm 1\sigma$	$\bar{i}=5 \pm 1\sigma$	$\bar{j}=1 \pm 1\sigma$	$\bar{j}=2 \pm 1\sigma$	$\bar{j}=3 \pm 1\sigma$	$\bar{k}=1 \pm 1\sigma$	$\bar{k}=2 \pm 1\sigma$	$\bar{k}=3 \pm 1\sigma$	$\bar{k}=4 \pm 1\sigma$	$\bar{k}=5 \pm 1\sigma$	$\bar{k}=6 \pm 1\sigma$
101	—	69,28±3,73	1,31±0,92	7,19±2,09	22,22±3,36	99,15±0,84	0,85±0,85	—	81,36±3,59	17,80±3,52	—	—	0,84±0,84	—
102	—	48,70±4,03	27,92±3,62	14,29±2,82	9,09±2,32	100,00±0,0	—	—	69,12±3,96	29,11±3,91	—	1,47±1,03	—	—
103	0,73±0,73	64,96±4,08	3,65±1,60	25,55±3,73	5,11±1,88	99,16±0,84	0,84±0,84	—	70,59±4,18	21,85±3,79	0,84±0,84	3,36±1,65	0,84±0,84	2,52±1,44
104	—	95,69±1,89	—	1,72±1,21	2,59±1,47	100,00±0,0	—	—	96,46±1,74	1,77±1,24	—	—	—	1,77±1,24
105	0,93±0,65	36,74±3,29	6,05±1,63	31,63±3,17	24,65±2,94	91,22±2,33	0,68±0,67	8,11±2,24	54,05±4,10	39,19±4,01	1,35±0,95	2,70±1,33	1,35±0,95	1,35±0,95
106	—	46,83±3,49	13,17±2,36	22,93±2,94	17,07±2,63	93,33±2,04	—	6,67±2,04	89,33±2,52	10,00±2,45	—	—	—	0,67±0,66
Average	0,31±0,18	56,73±1,58	9,18±0,92	18,88±1,25	14,90±1,14	96,81±0,63	0,38±0,22	2,81±0,59	76,25±1,52	20,82±1,45	0,38±0,22	1,28±0,40	0,51±0,25	1,02±0,36

Table 2: ACTIVITY ANALYSIS FOR HOURLY RATED EUROPEANS, 934 OBSERVATIONS

Employee number	$\bar{i}=1 \pm 1\sigma$	$\bar{i}=2 \pm 1\sigma$	$\bar{i}=3 \pm 1\sigma$	$\bar{i}=4 \pm 1\sigma$	$\bar{i}=5 \pm 1\sigma$	$\bar{j}=1 \pm 1\sigma$	$\bar{j}=2 \pm 1\sigma$	$\bar{j}=3 \pm 1\sigma$	$\bar{k}=1 \pm 1\sigma$	$\bar{k}=2 \pm 1\sigma$	$\bar{k}=3 \pm 1\sigma$	$\bar{k}=4 \pm 1\sigma$	$\bar{k}=5 \pm 1\sigma$	$\bar{k}=6 \pm 1\sigma$
201	—	83,77±2,97	3,25±1,43	6,49±1,99	6,49±1,99	98,53±1,03	1,47±1,03	—	93,38±2,13	6,62±2,13	—	—	—	—
202	—	96,58±1,68	0,85±0,85	0,85±0,85	1,71±1,20	99,13±0,87	0,87±0,87	—	96,52±1,71	3,48±1,71	—	—	—	—
203	—	41,56±3,97	9,74±2,39	13,64±2,77	35,06±3,85	98,90±1,09	1,10±1,09	—	79,12±4,26	20,88±4,26	—	—	—	—
204	—	93,51±1,99	—	1,95±1,11	4,55±1,68	99,32±0,68	—	0,68±0,68	89,80±2,50	6,80±2,08	0,68±0,68	1,36±0,96	—	1,36±0,96
205	—	86,45±2,75	5,16±1,78	2,58±1,27	5,81±1,88	97,26±1,35	2,74±1,35	—	94,52±1,88	3,42±1,51	—	—	0,68±0,68	1,37±0,96
206	7,50±1,86	79,00±2,88	2,50±1,10	6,50±1,74	4,50±1,47	88,89±2,29	11,11±2,29	—	89,95±2,19	7,41±1,90	—	0,53±0,53	0,53±0,53	1,59±0,91
Average	1,61±0,41	79,44±1,32	3,46±0,61	5,57±0,75	9,74±0,97	96,36±0,65	3,51±0,64	0,12±0,12	91,02±1,00	7,40±0,91	0,12±0,12	0,36±0,21	0,24±0,17	0,85±0,32

Table 3: ACTIVITY ANALYSIS FOR HOURLY RATED COLOUREDS, 1836 OBSERVATIONS

Employee number	$\bar{i}=1\pm1\sigma$	$\bar{i}=2\pm1\sigma$	$\bar{i}=3\pm1\sigma$	$\bar{i}=4\pm1\sigma$	$\bar{i}=5\pm1\sigma$	$\bar{j}=1\pm1\sigma$	$\bar{j}=2\pm1\sigma$	$\bar{j}=3\pm1\sigma$	$\bar{k}=1\pm1\sigma$	$\bar{k}=2\pm1\sigma$	$\bar{k}=3\pm1\sigma$	$\bar{k}=4\pm1\sigma$	$\bar{k}=5\pm1\sigma$	$\bar{k}=6\pm1\sigma$
301	—	94,07±2,17	—	3,39±1,67	2,54±1,45	99,12±0,88	—	0,88±0,88	97,35±1,51	1,77±1,24	—	—	—	0,88±0,88
302	—	94,81±1,79	—	3,25±1,43	1,95±1,11	100,00±0,0	—	—	94,00±1,94	3,33±1,47	—	—	—	2,67±1,32
303	—	76,04±3,08	9,90±2,16	2,08±1,03	11,98±2,34	100,00±0,0	—	—	92 26±2 06	5,36±1,74	—	—	0,60±0,59	1,79±1,02
304	—	87,06±2,37	6,97±1,80	3,98±1,38	1,99±0,99	99,48±0,51	0,51±0,51	—	96,91±1,24	1,03±0,73	—	—	0,52±0,51	1,55±0,89
305	1,52±0,87	73,23±3,15	2,53±1,11	8,08±1,94	14,65±2,51	98,81±0,84	—	1,19±0,84	85,12±2,75	10,11±2,33	—	—	4,17±1,54	0,60±0,59
306	1,09±0,77	83,61±2,74	1,64±2,74	3,28±1,32	10,38±2,25	99,38±0,62	0,62±0,62	—	95,68±1,60	3,70±1,48	0,62±0,62	—	—	—
307	1,50±0,86	86,50±2,42	1,00±0,70	6,00±1,69	5,00±1,54	93,68±1,76	6,32±1,76	—	88,95±2,27	4,74±1,54	1,58±0,90	1,05±0,74	—	3,68±1,37
308	2,46±1,09	93,10±1,78	1,48±0,85	0,49±0,49	2,46±1,09	97,47±1,11	2,53±1,11	—	98,99±0,71	—	—	—	—	1,01±1,42
309	1 49±0 86	84 58±2 55	1 99±0,99	9,45±2,06	2,49±1,10	98,47±0,88	1,53±0,88	—	89,80±2,16	0,51±0,51	—	0,51±0,51	—	9,18±2,06
310	15,05±2,62	79,03±2,98	1,61±0,92	0,54±0,54	3,76±1,40	77,40±3,14	22,03±3,12	0,56±0,56	97,74±1,12	1,13±0,79	0,56±0,56	—	0,56±0,56	—
Average	2,40±0,36	84,69±0,84	2,89±0,39	4,14±0,46	5,88±0,55	96,21±0,46	3,55±0,45	0,23±0,45	93,59±0,59	3,09±0,42	0,29±0,13	0,17±0,10	0,58±0,18	2,27±0,36

Table 4: ACTIVITY ANALYSIS FOR HOURLY RATED BANTU, 1848 OBSERVATIONS

Employee number	$\bar{i}=1\pm1\sigma$	$\bar{i}=2\pm1\sigma$	$\bar{i}=3\pm1\sigma$	$\bar{i}=4\pm1\sigma$	$\bar{i}=5\pm1\sigma$	$\bar{j}=1\pm1\sigma$	$\bar{j}=2\pm1\sigma$	$\bar{j}=3\pm1\sigma$	$\bar{k}=1\pm1\sigma$	$\bar{k}=2\pm1\sigma$	$\bar{k}=3\pm1\sigma$	$\bar{k}=4\pm1\sigma$	$\bar{k}=5\pm1\sigma$	$\bar{k}=6\pm1\sigma$
401	3,01±1,48	92,48±2,29	0,75±0,75	3,01±1,48	0,75±0,75	85,27±3,12	14,73±3,12	—	96,12±1,70	3,88±1,70	—	—	—	—
402	11,18±2,42	78,24±3,16	—	3,53±1,42	7,06±1,96	82,58±3,05	17,42±3,05	—	94,84±1,78	3,87±1,55	—	—	—	1,29±0,91
403	0,65±0,65	67,32±3,79	3,92±1,57	4,58±1,69	23,53±3,43	97,37±1,50	0,88±0,87	1,75±1,23	91,23±2,65	5,26±2,09	1,75±1,23	—	0,88±0,87	0,88±0,87
404	0,85±0,85	66,67±4,36	7,69±2,46	5,98±2,19	18,80±3,61	98,91±1,08	1,09±1,08	—	84,78±3,74	14,13±3,63	—	1,09±1,08	—	—
405	—	84,48±3,36	4,31±1,89	6,03±2,21	5,17±2,06	100,00±0,0	—	—	85,19±3,42	14,81±3,42	—	—	—	—
406	—	71,05±3,68	15,79±2,96	9,87±2,42	3,29±1,45	97,90±1,20	2,10±1,20	—	82,51±3,18	13,29±2,84	—	0,70±0,70	—	3,50±1,50
407	—	90,91±2,04	4,04±1,40	2,53±1,11	2,53±1,11	100,00±0,0	—	—	93,78±1,74	5,18±1,60	—	0,52±0,52	—	0,52±0,52
408	4,43±1,44	80,79±2,77	—	5,42±1,59	9,36±2,04	92,90±1,90	6,56±1,83	0,55±0,54	87,50±2,44	10,33±2,24	1,09±0,76	0,54±0,54	0,54±0,54	—
409	0,98±0,69	88,73±2,21	0,98±0,69	5,88±1,65	3,43±1,27	96,39±1,34	3,61±1,34	—	82,47±2,73	13,40±2,45	1,55±0,89	—	2,58±1,14	—
410	5,45±1,60	81,68±2,72	2,48±1,09	2,97±1,19	7,34±1,84	92,51±1,92	7,49±1,92	—	91,44±1,05	6,42±1,79	0,53±0,53	—	—	1,60±0,92
411	1,50±0,86	81,50±1,75	8,50±1,97	4,00±1,39	4,50±1,47	100,00±0.0	—	—	88,36±2,33	11,11±2,29	—	—	0,53±0,53	—
Average	2,71±0,38	80,95±0,91	4,17±0,46	4,76±0,50	7,41±0,61	94,84±0,54	4,98±0,53	0,18±0,10	89,03±0,76	9,07±0,70	0,47±0,17	0,24±0,12	0,47±0,17	0.71±0.20

Table 5: EMPLOYMENT DATA OF SAMPLE POPULATION

Employee Group	*Job*	*Wage Rate R/hr.*	*Month and Year of Employment*	*Std. Ed.*	*Task Attribute Score*
EUROPEAN ARTISANS:					
101	Utility Man	1,3250	02,66	5	2,60
102	Utilit Man	1,4900	11,48	6	1,27
103	Utility Man	1,3900	04,55	6	2,87
104	Utility Man	1,3800	01,68	7	1,67
105	Utility Man	1,2600	01,57	6	1,73
106	Repairman	1,0750	10,66	6	1,80
Average		1,3200	05,61	6	1,99
EUROPEAN HR RATED:					
201	Repairman	1,0000	03,71	7	1,60
202	Assembler	0,7300	01,72	6	1,75
203	Utility Man	0,9200	02,68	1	1,40
204	Assembler	0,9250	01,70	6	2,00
205	Assembler	0,9000	08,72	6	1,66
206	Utility Man	0,9200	04,67	4	1,80
Average		0,7492	05,70	5	1,70

Note: HR Rated=Hourly Rated.

COLOUREDS:					
301	Assembler	0,5000	08,72	5	2,00
302	Assembler	0,3450	09,71	5	1,66
303	Labourer	0,5250	07,69	3	1,73
304	Assembler	0,7050	02,69	7	1,67
305	Assembler	0,5500	08,72	5	1,73
306	Assembler	0,3200	01,72	7	1,53
307	Assembler	0,7300	01,72	6	1,33
308	Assembler	0,5000	04,72	8	2,47
309	Assembler	0,3000	08,72	3	1,26
310	Assembler	0,5500	08,72	3	1,33
Average		0,5025	08,71	5,2	1,67
BANTU:					
401	Assembler	0,3450	09,71	5	1,60
402	Assembler	0,3600	09,71	6	1,53
403	Assembler	0,3000	11,71	4	1,67
404	Assembler	0,5650	03,66	3	1,60
405	Assembler	0,3200	02,72	6	1,60
406	Assembler	0,3000	02,72	6	1,73
407	Pask & Sprayer	0,5000	07,64	6	1,40
408	Assembler	0,5000	03,70	5	2,00
409	Assembler	0,6150	01,64	3	1,80
410	Assembler	0,3000	05,72	3	1,40
411	Assembler	0,3500	01,72	5	1,33
Average		0,4050	03,70	4,7	1,61

APPENDIX

Name ....

No. ....

TASK ATTRIBUTES

OBJECT VARIETY	1	2	3	4	5
Number of different kinds of objects, tools and controls worked on	1–4	5–12	13–28	29–60	61–120

MOTOR VARIETY	1	2	3	4	5
Change in work pace	Same for 95% of working time		More than one pace, but variations only at long intervals		Varies considerably during day
Change in physical location	At same place for 95% of work time		Moves in fixed place		Moves most of time to different positions
Change in required physical operations	All of the same physical motions		Some operations differ. But not on large scale		Considerable changes required. Frequent and important

AUTONOMY	1	2	3	4	5
Method Choice	Detailed and specific, determined for job		Partly predetermined. Some leeway given		Wide latitude given in selection of method
Sequence Choice	Predetermined 90% of time or more		Partly predetermined. Some leeway given		Wide latitude given in selection of methods
Pace Choice	Mechanically determined 90% of time		Mechanically predetermined 40-60% of time or predetermined by others in crew		Can set own pace at least 90% of time
Quality of Input Choice	None—completely predetermined		Some. Can occasionally reject sub-standard material or after discussion with external agent		Considerable discretion allowed
Importation of Outside Services Choice	Almost none		Must be discussed with outside agent but S shares in decision making		Initiates discussion and makes or can make veto decision

REQUIRED INTERACTION	1	2	3	4	5
No. of persons with whom job requires interaction	0	1–2	3–4	5–6	7+
Quantity of interaction required. (er cent of work time requiring interaction)	0–5%	6–10%	11–25%	26–50%	51%+

LEARNING TIME	1	2	3	4	5
Time required to master job to satisfaction of management	–2 wks.	–4 wks.	–8 wks.	–16 wks.	–32 wks.

RESPONSIBILITY	1	2	3	4	5
Clarity of remedial action for routine jobs	no ambiguity no choice; no decisions		Some ambiguity. Errors can result from combination of several causes		Great ambiguity. Relation between problems and causes hard to identify
Time span of discretion	less than 2 hrs.	less than 4 hrs.	less than 8 hrs.	less than 2 days	two days and up
Probability of serious error, costing R500 and up or causing personal injury	negligible		unlikely but possible		could easily happen

JOB ATTRIBUTES MEASUREMENT SCALE

OBJECT VARIETY		1	2	3	4	5
MOTOR VARIETY	(a) change in work pace	1	2	3	4	5
	(b) change in physical location	1	2	3	4	5
	(c) change in required physical operations	1	2	3	4	5
AUTONOMY	(a) Methods choice	1	2	3	4	5
	(b) Sequence Choice	1	2	3	4	5
	(c) Pace Choice	1	2	3	4	5
	(d) Quality of Inputs Choice	1	2	3	4	5
	(e) Importation of Outside Services Choice	1	2	3	4	5
REQUIRED INTERACTION						
(a) Number of persons with whom job requires interaction		1	2	3	4	5
(b) Quantity of Interaction (% of work time required)		1	2	3	4	5
LEARNING TIME		1	2	3	4	5
RESPONSIBILITY						
(a) Clarity of remedial action (routine problems)		1	2	3	4	5
(b) Time span of discretion		1	2	3	4	5
(c) Probability of causing serious error or accident		1	2	3	4	5