

## Activity Sampling Based Work and Performance Analysis at a Tourist Services Company in South Africa

N. Myaka<sup>1,a</sup>, C. Mbohwa<sup>2,b</sup> and M. Nemarumane<sup>3,c</sup>

<sup>1,2,3</sup>Department of Quality and Operations Management, University of Johannesburg, P. O. Box 524, APB Campus, Auckland Park 2006, Johannesburg, South Africa

<sup>a</sup>myaka.nonhlanhla@gmail.com, <sup>b</sup>cmbohwa@uj.ac.za; <sup>c</sup>tnemarumane@uj.ac.za

**Keywords:** Activity sampling, Performance analysis, Tourist services

**Abstract:** This paper discusses the application of activity sampling in work and performance analysis in a tourist services company. Abnormal job delays were observed based on mainly employee observation studies at the tourist company in South Africa. A detailed account of the data collected is presented, assessed and analysed for three departments, the administration department, marketing department and the reception. The importance of activity sampling in organizations was demonstrated by its use in identifying idle and ineffective time in these departments. A large number of observations were made over a period of time to afford the results and findings the necessary statistical significance. Observations enabled recording of what was happening at given instances to determine activities undertaken and to capture delays. The study shows the importance of activity sampling in diagnosing problems and supporting decision making and taking in a service organisation.

### Introduction

There is currently very little body of work that discusses the use of activity sampling in improving industrial operations in production and services. There is a tendency to ignore this basic technique for analysing systems and this paper discusses the use of activity sampling in a South African tourism services company that specialises on inbound tourism with a view to demonstrate its use and strength. Activity sampling assists in performance analysis of human-based processes in production and operations. The studies applying activity sampling have tended to focus on health systems [1, 2] and on work sampling and activity-based costing. [3] The study company has over 15 years experience in the travel and tourism industry focusing on South Africa and neighboring countries. The results of the study inform strategies that can be used improve productivity and improve operational functions. This can assist decision makers to improve the competitiveness and the effectiveness of an organisation. Furthermore, the work can inform decision making in other tourist companies and contribute to research work on activity sampling applications.

The study focused on the administration department, marketing department and at the reception sections of the company. The activity sampling results were used to assist the company in finding ways to improve its operations. High or low fractions of certain activities in the calculations indicate areas of problems. The work performance problems in the company were identified and the main ones were to do with excessive idle time, use of improper system procedures and low productivity. The proposition is that activity sampling positively contributes to performance, procedure and activity improvement.

### Methodology

The study approach involved the collection of data using random observation. These were used to determine how activities are carried out by each operator and the length of time to complete each tasks by each worker; the number of delays and the idle time during working hours. The study also employed a quantitative methodology. Activity sampling methods were used to gather all data. Past company records were also used. Time study equipment was used to obtain the time necessary for operators to carry out the task at the defined rate of performance [4]. These are as follows: Stop

watch- This study was performed using a mechanical timing device to measure cumulative time. This was preferred because it is more accurate for measuring short elements of time. Study board; Time study forms; Elements break down sheet; Activity sampling observation sheet; Pilot study sheet; Time study analysis sheet.

The company employs 20 people and for the purpose of this research employees were randomly selected from the three departments for assessment. The results were obtained from studying 12 employees in total from the three departments. Selected employees were screened to determine whether or not they were overloaded with work and also to target those involved in some complex activities that would require simplification. The data were interpreted and results were used to make recommendations for improvements. An analysis was made of the activities carried by each employee, of the performance of the employees and the procedure of carrying out the required tasks. These impacted on work performance and activity sampling techniques were used to analyse the systems in place. The research did not consider the operations of the company's competitors and the relationship between the owner and the employees. It was assumed that the decrease in profits was related to the employees' performance. This was studied based on factors like work overload, bad working conditions, seasonal variations, the impact of the entrance of new competitors and trends in the market. These were assumed to have a greater impact on the gross profit of the company [5]. The research also assumed that the information acquired and the observations made were correct and that the behaviour of the employees was not modified from the Hawthorne effect.

### Findings

A pilot study of 50 observations was conducted for each employee, that is the Administration Clerk, Marketing Manager, Receptionist. This showed both within-person and between-person variation in affect and motivation [6]. The employees were interviewed individually after and before the pilot study and were introduced to the activity sampling data-collection procedure. A feedback session was held after the pilot study. The following table outlines the pilot study of the administration clerk (Table 1). This determined how long it took to complete allocated tasks and was used to identify any existing problems in the function.

**3.1 Data Collection and Analysis:** The first task of the admin clerk was observed by the researcher seven times. This task compared to other tasks, occurs for 14% out of the 100% of the admin clerk's tasks. The level of error that is present within this task is approximately 9.62%. The information is similarly presented for all tasks. Table 2 outlines the pilot study of the marketing manager. The first task was observed by the researcher eight times. This task compared to other tasks, occurred for 16% out of the 100% of the Marketing Manager's tasks. The level of error that is present within this task is approximately 10.16%. Similar results are presented in the table.

**Table 1 Admin clerk pilot study**

SAMPLE NUMBER	ACTIVITY	OBSERVATION	% OCCURANCE	±L % MARGIN OF ERROR
1.	AT	7	14%	9.62
2.	ATC	7	14%	9.62
3.	DCT	9	18%	10.65
4.	REC	7	14%	9.62
5.	RC	10	20%	11.09
6.	IR	7	4%	9.62
7.	I	3	6%	6.58
	Totals	50	100	

**Table 2 Marketing Manager pilot study**

SAMPLE NUMBER	ACTIVITY	OBSERVATION	%OCCURANCE	±L % MARGIN OF ERROR
1.	AT	8	16%	10.16
2.	ATC	8	16%	10.16
3.	DCT	9	18%	10.65
4.	REC	9	18%	10.65
5.	RC	4	8%	7.52
6.	IR	9	18%	10.65
7.	I	3	6%	6.58
	Totals	50	100	

Table 3 outlines pilot study of the receptionist in order to reveal existing problems and to determine how long does it take for her to complete her task.

**Table 3 Receptionist Pilot Study**

SAMPLE NUMBER	ACTIVITY	OBSERVATION	%OCCURANCE	±L % MARGIN OF ERROR
1.	AT	9	18%	10.65
2.	ATC	9	18%	10.65
3.	DCT	10	20%	11.09
4.	REC	4	8%	7.52
5.	RC	5	10%	8.31
6.	IR	9	18%	10.65
7.	I	3	8%	7.52
	Totals	50	100	

The first task of the Receptionist was observed by the researcher nine times. This task compared to other tasks, occurs for 18% out of the 100% of the Receptionist's tasks. The level of error that is present within this task was approximately 10.65%. Similar results are presented in the table. 384 observations for worker one, 354 observations for worker two and 384 for worker three were determined to find the true reflection of each workers performance at 95% confidence level with the margin error of plus or minus 4%. The following are the calculations that reveal the number of observations per worker that were performed

$$\text{Worker 1: } N = \sigma^2 \times P(100-P)/L^2 = 3.84 \times 20 \times (100-20)/4^2 = 8 \text{ days}$$

$$\text{Worker 2: } N = \sigma^2 \times P(100-P)/L^2 = 3.84 \times 18(100-18)/4^2 = 7 \text{ days}$$

$$\text{Worker 3: } N = \sigma^2 \times P(100-P)/L^2 = 3.84 \times 20(100-20)/4^2 = 8 \text{ days}$$

**Table 4 Administration Worker 1 Observation Sheet**

NUMBER	ACTIVITY	DAY1	DAY2	DAY3	DAY4	DAY5	DAY6	DAY7	DAY8	TOTAL
1.	AT	7	5	8	4	10	4	5	9	52
2.	ATC	7	5	8	5	5	10	7	9	56
3.	DCT	9	5	9	7	15	5	7	9	66
4.	REC	7	10	10	8	6	8	5	9	63
5.	RC	10	8	9	10	7	6	7	3	55
6.	IR	7	7	7	9	6	10	10	9	64
7.	I	3	10	5	7	1	7	9	2	44
	Totals	50	50	50	50	50	50	50	50	400

This means worker administration clerk must be observed for 8 days, marketing manager 7 days and 8 days for receptionist. Table 4 shows the observation sheet, which outlines the true reflection of administration clerk, marketing manager and receptionist times. Calculations revealed ineffectiveness which leads to lack of productivity especially on those days where there is too much

idling [7]. This gives a clear picture that there is a serious problem of time ineffectiveness. It is observed that for the first task, the Administration worker will have to be observed 7 times on day 1; 5 times on day 2; 8 times on day 3; 4 times on day 4; 10 times on day 5; 4 times on day 6; 5 times on day 7; and 9 times on 8.

Table 5 illustrates that for the first task, the Marketing Manager will have to be observed 8 times on day 1; 10 times on day 2; 7 times on day 3; 5 times on day 4; 9 times on day 5; 8 times on day 6; and 6 times on day 7.

**Table 5 Marketing Manager observation sheet**

NUMBER	ACTIVITY	DAY1	DAY2	DAY3	DAY4	DAY5	DAY6	DAY7	TOTAL
1.	AT	8	10	7	5	9	8	6	53
2.	ATC	8	5	9	5	8	7	7	49
3.	DCT	9	8	8	9	6	8	6	54
4.	REC	9	9	10	8	7	10	9	62
5.	RC	4	3	8	5	3	4	8	35
6.	IR	9	10	7	8	10	9	12	65
7.	I	3	5	1	10	7	4	2	32
	Totals	50	50	50	50	50	50	50	350

Table 6 illustrates that for the first task, the Receptionist will have to be observed 5 times on day 1; 6 times on day 2; 9 times on day 3; 8 times on day 4; 6 times on day 5; 10 times on day 6; 7 times on day 7; and 7 times on day 8.

**Table 6 Receptionist Observation Sheet**

NUMBER	ACTIVITY	DAY1	DAY2	DAY3	DAY4	DAY5	DAY6	DAY7	DAY8	TOTAL
1.	AT	5	6	9	8	6	10	7	7	59
2.	ATC	5	4	9	7	9	8	7	8	57
3.	DCT	7	10	9	8	9	6	8	9	66
4.	REC	10	8	6	3	8	9	8	8	60
5.	RC	9	8	3	5	8	8	9	4	54
6.	IR	8	9	11	7	9	7	8	9	68
7.	I	6	5	3	12	1	2	3	4	36
	Totals	50	50	50	50	50	50	50	50	400

**Summary of the Results:** According to the summary of the pilot study for each worker, a number of idle times were discovered and less productivity was measured which identified factors of non productivity at the Tourism Company [8]. Table 7 shows the summary of pilot study for three workers. The control Limits for all workers were determined as follows:

**Worker 1:**  $P(\%) = P \pm 3 \sqrt{(P(1-P) \div n)}$ ,  $P \pm 3 \sqrt{(0.11(1-0.11) \div 50)}$ ,  $P \pm 3 \sqrt{(0.11(0.89) \div 50)} = 0.11 + 0.13 = 0.24$  OR  $0.11 - 0.13 = 0.020.02$

**Worker 2:**  $P(\%) = P \pm 3 \sqrt{(P(1-P) \div n)}$ ,  $= P \pm 3 \sqrt{(0.09(1-0.09) \div 50)}$ ,  $= P \pm 3 \sqrt{(0.09(0.91) \div 50)} = 0.09 + 0.12 = 0.21$  OR  $0.09 - 0.12 = 0.03$

**Worker 3:**  $P(\%) = P \pm 3 \sqrt{(P(1-P) \div n)}$ ,  $P \pm 3 \sqrt{(0.09(1-0.09) \div 50)}$ ,  $P \pm 3 \sqrt{(0.09(0.91) \div 50)} = 0.09 + 0.12 = 0.21$  OR  $0.09 - 0.12 = 0.03$

**Table 7 Summary of the pilot study**

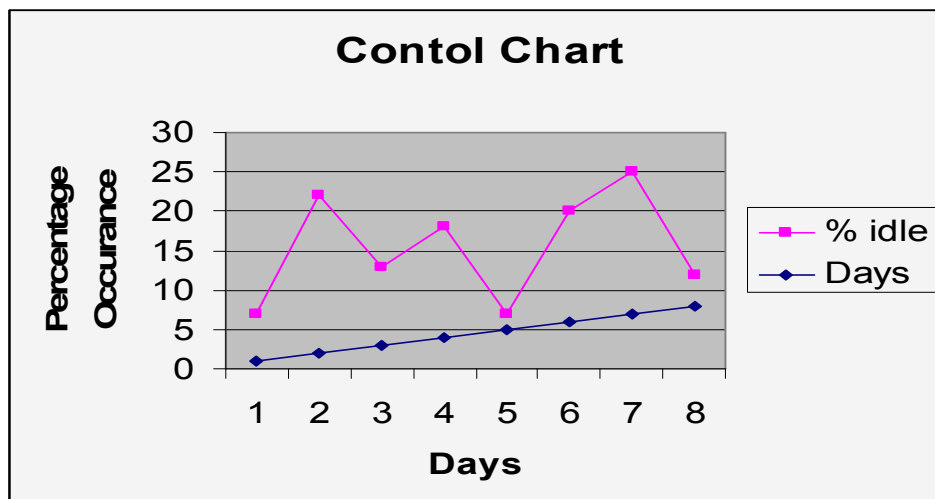
Activities	Worker 1			Worker 2			Worker 3		
	Obs	%Occ	±L%	Obs	%Occ	±L%	Obs	%Occ	±L%
AT	52	13%	3.3	53	15%	3.74	59	14.75%	3.47
ATC	56	14%	3.4	49	14%	3.63	57	14.25%	3.42
DCT	66	16.5%	3.64	54	15%	3.74	66	16.5%	3.64
REC	63	15.75%	3.57	62	18%	4.08	60	15%	3.65
RC	55	13.75%	3.37	35	10%	3.14	54	13.5%	3.35
IR	64	16%	3.60	65	19%	4.11	68	17%	3.68
I	44	11%	3.07	32	9%	3.0	36	9%	2.8
Totals	400	100		350	100		400	100	

**Results for Worker 1:** This worker spent a lot of time idle during day 4 and 7 due to Internet browsing. Time was spent on the facebook social network. The worker was also idle while waiting for the manager to finalise the levels of some prices needed to prepare invoices. The results are shown in Table 8.

**Table 8 Results for Worker One**

Days	Total OBS	No of idle	% idle
1	50	3	6
2	50	10	20
3	50	5	10
4	50	7	14
5	50	1	2
6	50	7	14
7	50	9	18
8	50	2	4
Totals	400	44	

Figure 1 gives a clear picture of the idle time and percentage from day 1 to day 8 when the study was conducted using a control chart. The highest idle time was on day two with 20% followed by day seven by 18%. This is very high and needs attention. This worker had many days with a lot of idle time when compared to the other workers studied. It was recommended that the management address this function in order to optimize the activities of the worker.



**Figure 1 Worker 1 Administration Clerk Idling Time as a Percentage**

**Results for Worker Two:** This worker spent a lot of time idle during days 4 and 5. The results in Table 9 demonstrate this as well as the control chart in Figure 2.

**Table 9 Data collected for Worker 2**

Days	Total obs	No. of idle	% idle
1	50	3	6
2	50	5	20
3	50	1	2
4	50	10	20
5	50	7	14
6	50	4	8
7	50	2	4
Totals	400	44	

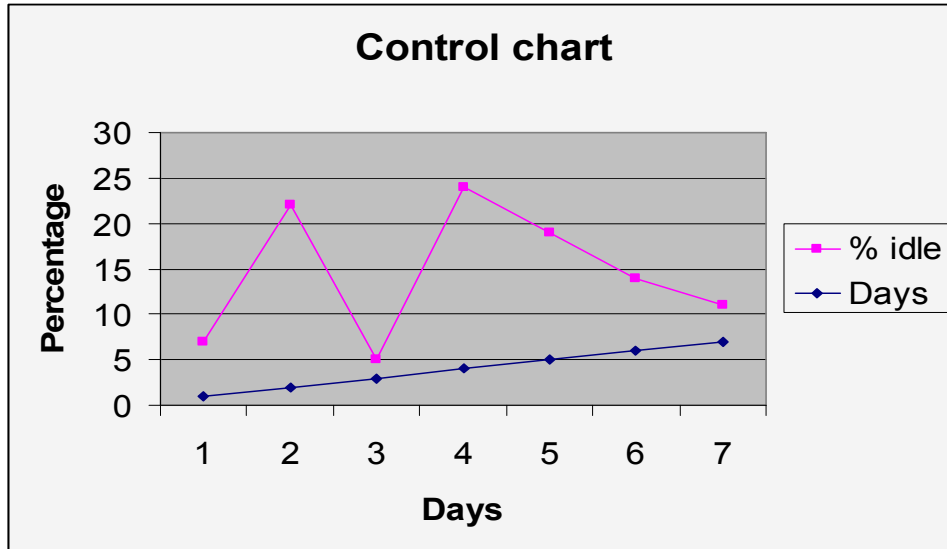


Figure 2 The Control Chart for Worker 2

Attention needs to be paid to reduce in-effective and unproductive time to improve productivity and general work performance.

**Results for Worker Three:** This worker was found to spend a lot of time idling on day 5. Table 10 below shows the full results.

Table 10 Results for Worker Three

Days	Total obs	No. of idle	% idle
1	50	6	12
2	50	5	10
3	50	3	6
4	50	12	14
5	50	1	24
6	50	2	4
7	50	3	6
8	50	4	8
Totals	400	44	

Figure 3 shows the fluctuations of idling time for worker three, the receptionist.

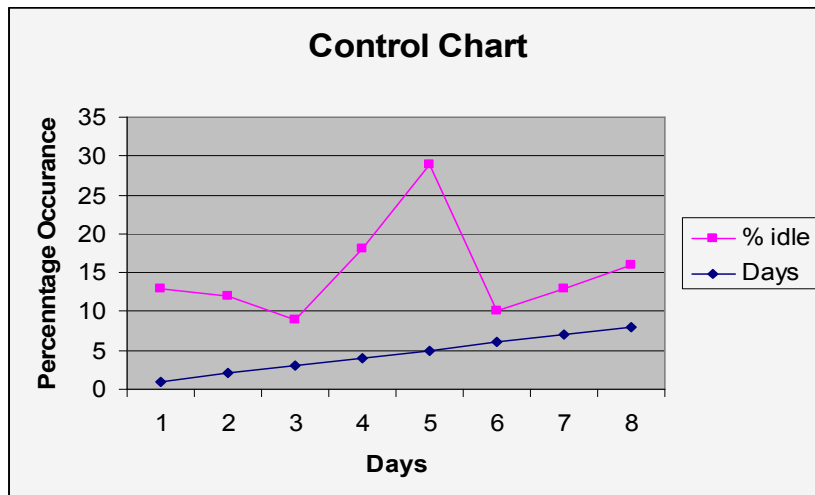


Figure 3 The Control Chart for Worker Three

**General Discussion of Results:** The study covered three departments, which perform different tasks. The main function of Worker One is taking calls and making reservations. The function of Worker Two is collecting debts and fleet management. Worker three's responsibility included hiring drivers either permanent driver or temporally, negotiating with suppliers, hiring tour guides and employees training and induction. It was found out that there are areas of ineffective time that could be reduced substantially through the reduction of idle time. Based on the study findings and results, some recommendations were made.

**Recommendations and Discussion:** The recommendations were made with a view to improve the productivity of the Tourist Services Company. These would need to be sold to the employees to ensure effective change management, employee involvement and success of any initiatives undertaken at the operational, tactical and strategic levels. Activity sampling was found to be very helpful in identifying idle time, problems and areas that can be improved. The identification of time ineffectiveness created the base for more scientific and rigorous treatment of the problems faced by the company. The following information was discerned:

- ❖ The relative magnitudes of the various idle time and ineffective time in different functions
- ❖ Causes of ineffectiveness in the different functions
- ❖ Expected changes in the relative magnitudes over time
- ❖ The identification of effective policies that can be used to correct these causes

The study was done in limited time and with reduced scope. Further studies need to be conducted to determine the percentage occurrence and the limit of accuracy for each worker in each department or section. This will help to make the results and findings more effective, more valid and more verifiable. In addition findings show that employees need more training so that they can do their work efficiently and effectively. The workers need to know what is expected of them and in this regard job specification and descriptions need to be done. Job evaluation of all employees is recommended. The number of observations and measurements done need to be increased in future to get a more true reflection of the performance of the workers in each functional area. Increasing the sample numbers and size in this case helps to improve the results. Extensions can be done to study similar organizations. The current division of work needs to be revisited and multi-skills introduced to reduce idle and ineffective time [9]. This can also reduce costs. The following changes are recommended:

- Workers can be made to be responsible for different tasks and the type of work done can be expanded. For example the administration clerk can do both reservations and the work done by the receptionist.
- To simplify financial assessment and analysis, the Company can buy quick book software for payment, cash reconciliation and balancing the accounts. It will be an expensive technology-based solution and a cost-benefit analysis would need to be done. Retrenchment of current staff will also be an issue
- It is also recommended and advisable for the Company to create a list of suppliers and price lists. This can placed on the document holder in front of the clerk or in an easily accessible electronic file. This has the potential to improve systems, reduce errors and improve productivity.

In using activity sampling, the following advantages were observed and realized:

- It was found to be less costly and to be an easy method for data collection
- It was quick and more flexible used in different work environments to assess weekly and daily variations. The method was not affected by interruption in operations and has low training requirements. It is less invasive and did not require performance rating
- Method highlighted the cause of the problems without focusing on the individuals
- Observations were very efficient since short duration events were measured
- The activities were studied economically, producing statistically significant and accurate data. It was found to be highly feasible for studies of this nature



The main shortcomings were that the method

- Required more time to collect data with statistical significance
- The tasks/ unrelated activities may still need employment of an analyst to interpret correctly
- Skilled analyst are needed to do the calculations

### Conclusion

This paper has defined and identified productivity problem areas at a South African tourist services company and drawn some useful information and conclusions based on the results of the study. It can be concluded that activity sampling is a useful quantitative method for assisting to identify and define productivity problems, idle and ineffective time and to locate the time-scales related. The recommendations made based on the findings can assist management in the improvement and control of effectiveness and efficient working practice at the Company with possible extensions to similar organization and service organizations in other sectors. This will assist in addressing poor productivity problems among many other time-related problems. The study determined the length of time spent by workers performing their functions in the different targeted departments, the factors affecting operatives and issues concerning working practices. The objectives of the study were achieved in this respect. The study focused on three departments, the administration department, marketing department and the reception. This limited the scope of the work. Future studies might need to survey all employees in the company. They can also focus on improving working methods, use more and larger samples, repeat the observations and measurement experiments many times and ensure achievement of higher statistical significance. Comparative studies can be done with other tourism companies of a similar nature with possible extensions to other service sector industries. However the study has been able to successfully demonstrate an application of activity sampling in a service industry in analysing and improving an organisation. The results clearly indicate that activity sampling can be a useful decision support system.

### References

- [1] M. H. Howarth, 1976: Activity Sampling in Nursing, International Journal of Nursing Studies, Volume 13, Issue 1, 1976, 47-53
- [2] M. Silva, C. D. McClung, M. A. dela Rosa, F. J. Dorey and T. P. Schmalzried, 2005, Activity Sampling in the Assessment of Patients With Total Joint Arthroplasty, The Journal of Arthroplasty Vol. 20 No. 4 2005
- [3] W. H. Tsai, 1996, A technical note on using work sampling to estimate the effort on activities under activity-based costing, Int. J. Production Economics 43 (1996) 11-16
- [4] H.R. Thomas and M. Holland: work sampling Programs: Comparative Analysis, Journal of the construction Division. ASCE. Vol.0106 (12/1980):519-534.
- [5] D.F. Rogge and R. Tucker: Foreman Delay Surveys: Work Sampling and output , Journal of the construction Division, Vol.108(12/1983), 592-604
- [6] H. Randolph Thomas and Jeffrey Daily, Crew Performance Measurement via Activity Sampling, Journal of Construction Engineering and Management, ASCE Vol. 109 (9/1983), 309-320
- [7] K.Wilhelm and E. Reiner, Effect of Sample on human blood cholinesterase activity after inhabitation by carbonates, Journal of crew performance measurement via activity, Vol.48 (48/1973), 235-238
- [8] L.M.M Van Den Berg, (2002) work measurement Techniques and Applications, 6<sup>TH</sup>, Pretoria , South Africa
- [9] G. Kanaway, 2005. Work Study. 4<sup>th</sup> Edition. Johannesburg , Pretoria