
The Analysis of the Effect of Motivators on the Performance of Warehouse Employees in Distribution Centers

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Abstract:

Purpose: The aim of this paper is to conduct an analysis of the effect of motivators on the employees' performance in handling system orders at the warehouse of distribution center.

Design/Methodology/Approach: Three employees included in the study were post probationary period, while two employees were on probationary period. In the first stage, a face-to-face interview was conducted with each representative of the study group in order to gain a closer understanding of each individual and then, based on the responses obtained, a decision was made to introduce an appropriate experimental factor into the research process. The moment when the selected motivator was applied to each employee allowed to passively generate relevant data, such as percentage productivity and productivity in pieces of completed items. The printouts of the employees' performance constituted documents that were thoroughly analyzed in order to create the database needed to conduct the performance study and statistical analysis. Statistical analysis was the final stage in the entire project and research process. The analysis consisted of two parametric tests, t-test for independent groups and one-way analysis of variance (ANOVA), supplemented by a multiple comparisons LSD (Least Significant Differences) test.

Findings: The results supported the hypotheses set regarding the effect of motivators on average productivity, on average daily number of items completed, and the form of employment on the work efficiency of warehouse workers.

Practical Implications: The research results have practical implications for every distribution center. Research results can be helpful for managers. Knowing about the motivators of warehouse workers allows you to build an appropriate motivation system.

Originality/Value: The originality of the presented research results from the applied research methods. This analysis consisted of two parametric tests: t-test for independent groups and one-way analysis of variance (ANOVA), supplemented by a multiple comparisons LSD (Least Significant Differences) test.

Keywords: Motivators, performance, warehouse employees.

JEL codes: D91, M12, O15.

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1. Introduction

Global supply chain management is an important issue for many companies warehouse is the primary link between manufacturers and customers in supply chain (Kudelska and Niedbal, 2020). The warehousing process includes activities not only of physical storage, but also of receiving, picking, and issuing along with processing the necessary information about the stored goods (Borowska and Kudelska, 2020).

Modern warehouses face challenges in responding faster to customer orders (Kudelska and Niedbal, 2021). This type of challenge requires higher productivity from warehouse workers. It therefore becomes necessary to motivate warehouse workers by choosing motivators that are appropriate from the worker's point of view, not the employer's. Despite increasing automation and robotization, human labor is still used in many warehouses (Kudelska and Pawlowski, 2019). Human labor still accounts for about half of all non-automated warehouse operations (Bartholdi and Hackman, 2016) De Koster *et al.* (2007) report that in 80% of all warehouses, human labor still accounts for about 60% of total labor costs.

In this paper, we focus on the picking stage in the warehousing process because of its labor intensity and execution time. This process can account for more than 50% of warehouse operating costs (Grosse *et al.*, 2015 ; Frazelle, 2002). Therefore, it is important that this stage is characterized by high labor productivity. There are studies focusing on the importance of human factors in improving the performance of the whole system (Grosse *et al.*, 2015; Larco *et al.*, 2017; Kudelska and Pawlowski, 2019). The aforementioned studies highlight not only the physical fatigue experienced by warehouse workers, but also mental fatigue. Both of these factors can affect process efficiency (Konz, 1998; Rose *et al.*, 2014) and warehouse performance - especially in picking processes.

Despite rapid advances in technological development, manual picking is essential. In manual order picking systems, worker fatigue and workload can have a large impact on picking times and error rates. The large amount of human labor associated with order picking turns this activity into a time-consuming and costly step in the warehouse process (Elbert *et al.*, 2017).

The primary measure for evaluating warehouse performance is the average order completion time (Tarczynski and Jakubiak, 2017). There are five main groups of factors that affect picking time (Yu and De Koster, 2009), warehouse layout (i.e., number and length of aisles, number of cross walks), allocation storage location, order routing, zoning, and order grouping.

To this group of factors, we would like to add one more, related to the system of motivation of warehouse employees who carry out the picking stage.

2. Object and Subject of Research

2.1 Object of Research

The object of the research is a distribution center serving a chain of over 455 supermarkets and 301 general stores located in the UK belonging to the third largest food retailer in the United Kingdom.

In the warehouse under study, the employee recruitment process is carried out by an external company. The newly hired warehouseman during the probationary period is an employee of an employment agency. After this period, he can be hired on a contract of employment by the analyzed distribution center. The probationary period lasts 1 month. During this time, the employee is evaluated primarily in terms of work performance. According to the philosophy of the distribution center, the productivity achieved by the employee is a reflection of the employee's commitment to his/her tasks. The productivity level for a worker contracted directly by the distribution center is 75% of the standard and for a worker contracted by a staffing agency is 95% of the standard. The standard indicates the number of recommendations required to be completed in a unit of time. The productivity rate of 75% for workers contracted by the distribution center gives them a certain privilege, but it is also a motivator for workers contracted by the staffing agency

2.2 Subject of Research

In the presented research, the subject of the study is the system of motivation of employees realizing the picking process in the distribution center and their influence on work efficiency. The type of motivators used and their characteristics are presented in Table 1.

Table 1. *Motivators in the surveyed distribution center*

<i>Motivators</i>	<i>Characteristics</i>
<i>Promotion</i>	Change of position to a higher one according to the organizational structure with the possibility of indicating the preferred working hours
<i>Financial bonus</i>	Additional remuneration in the form of a bonus
<i>Overtime</i>	Opportunity to work overtime at a higher hourly rate
<i>Stable employment</i>	Employment contract with the distribution center

Source: *Own study.*

The aim of this study was to determine whether, and if so how, the use of different motivators can affect employee performance. Data on the performance of 5 employees during 20 days of their work were analyzed. A total of 100 observations were analyzed. Productivity was expressed by two dependent variables, daily number of items completed (in units) and daily productivity (in %).

Four different ways of motivation were applied to employees, promotion (20 observations), financial bonus (20 observations), overtime (40 observations), stable position (20 observations) - which was the first independent variable. The second independent variable was the form of employment - two employees were on probation (40 observations) and three were employed permanently - after the probation period (60 observations).

3. Discussion and Results

Two parametric tests were used to statistically analyze the results, Student's t-test for independent groups and one-way analysis of variance (ANOVA) supplemented with the NIR (Least Significant Difference) test. The Student's t-test for independent groups is used to determine whether two groups are statistically significantly different in terms of variables measured at the quotient level. The performance of 2 groups of workers was compared, probationary and post probationary workers. A statistical significance level of $p < 0.05$ was assumed.

One-way analysis of variance (ANOVA) is used to determine whether more than two groups are statistically significantly different in terms of variables measured at the quotient level, A level of statistical significance of $p < 0.05$ was adopted, which is denoted by *. With this test, it is necessary to determine exactly which groups are statistically significantly different - as long as the test shows a difference that is significant at least at the $p < 0.05$ level. For this purpose, the NIR multiple comparisons test was performed.

3.1 Effect of Motivators on Average Daily Productivity (%)

To test whether type of motivator differentiates mean daily productivity (%), a one-way analysis of variance was conducted in a between-group design. The dependent variable was daily productivity. The factor was the type of motivator (promotion, financial bonus, overtime, stable position). The results are presented in Table 2.

Table 2. Comparison of motivators in terms of average daily productivity expressed in % - \bar{x}_{DW}

Groups	\bar{x}_{DW} [%]	Variance
Promotion	$\bar{x}_{DW1}=80,30$	212,75
Financial bonus	$\bar{x}_{2DW}=104,50$	16,47
Overtime	$\bar{x}_{DW3}=76,45$	402,25
Stable position	$\bar{x}_{DW4}= 96,75$	165,36

Source: Own study.

The effect proved to be significant, $F(3, 96) = 18,46$, $p < 0,001^*$, which can be read from Table 3.

Table 3. Results of one-way ANOVA test of variance

Source of variance	SS	df	MS	F	Value -p
Between groups	13 374,94	3	4 458,31	18,46	0,000
Within groups	23 184,85	96	241,51		
Total	36 559,79	99			

Note: SS – sum of squares of deviations, df – number of degrees of freedom , MS – average square of deviations, p - probability

Source: Own study.

Post-hoc comparisons were conducted using the NIR test. Mean daily productivity when offered a financial bonus was significantly higher than when offered a promotion - equation 1:

$$\begin{aligned}
 |\bar{x}_{DW1} - \bar{x}_{DW2}| &= 24,20 \\
 \text{NIR} &= 9,75 \\
 |\bar{x}_{DW1} - \bar{x}_{DW2}| &> \text{NIR}
 \end{aligned}
 \tag{1}$$

Average daily productivity when offered a financial bonus was also significantly higher than when offered overtime - equation 2:

$$\begin{aligned}
 |\bar{x}_{DW1} - \bar{x}_{DW3}| &= 3,85 \\
 \text{NIR} &= 8,45 \\
 |\bar{x}_{DW1} - \bar{x}_{DW3}| &< \text{NIR}
 \end{aligned}
 \tag{2}$$

Average daily productivity when offered a stable position was significantly higher than when offered a promotion - equation 3:

$$\begin{aligned}
 |\bar{x}_{DW1} - \bar{x}_{DW4}| &= 16,45 \\
 \text{NIR} &= 9,75 \\
 |\bar{x}_{DW1} - \bar{x}_{DW4}| &> \text{NIR}
 \end{aligned}
 \tag{3}$$

Average daily productivity when offered a stable position was also significantly higher than when offered overtime-equation 4:

$$\begin{aligned}
 |\bar{x}_{DW3} - \bar{x}_{DW4}| &= 20,30 \\
 \text{NIR} &= 8,45 \\
 |\bar{x}_{DW3} - \bar{x}_{DW4}| &> \text{NIR}
 \end{aligned}
 \tag{4}$$

There was no significant difference between average daily productivity when offered a financial bonus and when offered a stable position - equation 5:

$$\begin{aligned}
 |\bar{x}_{DW2} - \bar{x}_{DW4}| &= 7,75 \\
 \text{NIR} &= 9,75 \\
 |\bar{x}_{DW2} - \bar{x}_{DW4}| &< \text{NIR}
 \end{aligned}
 \tag{5}$$

There was no significant difference between average daily productivity when offered a promotion and when offered overtime - equation 6:

$$\begin{aligned} |\bar{x}_{DW 1} - \bar{x}_{DW 3}| &= 3,85 \\ NIR &= 8,45 \\ |\bar{x}_{DW 1} - \bar{x}_{DW 3}| &< NIR. \end{aligned} \tag{6}$$

3.2 Effect of Motivators on Average Daily Number of Items Completed (pcs)

To test whether the type of motivator differentiates the daily number of items completed, a one-way analysis of variance was conducted in a between-group design. The dependent variable was the daily number of items completed. The factor was the type of motivator (better offer, bonus, overtime, stable position). The results of the analysis are presented in Table 4.

Table 4. Comparison of motivators in terms of daily number of items completed - \bar{x}_{DIS}

Groups	\bar{x}_{DIS} [pcs.]	Variance
Promotion	$\bar{x}_{DIS 1} = 1\ 025,35$	31 996,03
Financial bonus	$\bar{x}_{DIS 2} = 1\ 322,95$	47 044,89
Overtime	$\bar{x}_{DIS 3} = 1\ 024,30$	109 669,50
Stable position	$\bar{x}_{DIS 4} = 536,35$	61 180,77

Source: Own study.

Based on one-way analysis of variance (ANOVA), the effect was found to be significant, $F(3, 96) = 29.52$, $p < 0.001^*$, which can be read from Table 5.

Table 5. Results of one-way ANOVA test of variance

Source of variance	SS	df	MS	F	Value -p
Between groups	6 404 010,30	3	2 134 670,10	29,52	0,000
Within groups	6 941 322,45	96	72 305,44		
Tota	1,33E+07	99			

Source: Own study.

Post-hoc comparisons were conducted using the NIR test. The average daily number of items completed when offered a financial bonus was significantly higher than when offered a better job offer - equation 7:

$$\begin{aligned} |\bar{x}_{DIS 1} - \bar{x}_{DIS 2}| &= 297,60 \\ NIR &= 168,9 \\ |\bar{x}_{DIS 1} - \bar{x}_{DIS 2}| &> NIR \end{aligned} \tag{7}$$

The average daily number of items completed when a financial bonus was offered was significantly higher than when overtime was offered - equation 8:

$$\begin{aligned} |\bar{x}_{DIS\ 2} - \bar{x}_{DIS\ 3}| &= 298,65 \\ NIR &= 146,18 \\ |\bar{x}_{DIS\ 2} - \bar{x}_{DIS\ 3}| &> NIR \end{aligned} \tag{8}$$

The average daily number of items completed when offered a financial bonus was significantly higher than when offered a stable position - equation 9:

$$\begin{aligned} \bar{x}_{DIS\ 2} - \bar{x}_{DIS\ 4}| &= 786,00 \\ NIR &= 168,79 \\ |\bar{x}_{DIS\ 2} - \bar{x}_{DIS\ 4}| &> NIR \end{aligned} \tag{9}$$

The average daily number of items completed when offered a promotion was significantly higher than when offered a stable position as shown by a post-hoc comparison using the NIR test - equation 10:

$$\begin{aligned} |\bar{x}_{DIS\ 1} - \bar{x}_{DIS\ 4}| &= 489,00 \\ NIR &= 168,79 \\ |\bar{x}_{DIS\ 1} - \bar{x}_{DIS\ 4}| &> NIR \end{aligned} \tag{10}$$

The average daily number of items completed when overtime was offered was significantly higher than when a stable position was offered, as indicated by the results of the NIR test - equation 11:

$$\begin{aligned} |\bar{x}_{DIS\ 3} - \bar{x}_{DIS\ 4}| &= 487,95 \\ NIR &= 146,18 \\ |\bar{x}_{DIS\ 3} - \bar{x}_{DIS\ 4}| &> NIR \end{aligned} \tag{11}$$

There was no significant difference between the average daily number of items completed when offered a promotion and when offered overtime-equation 12:

$$\begin{aligned} |\bar{x}_{DIS\ 1} - \bar{x}_{DIS\ 3}| &= 1,05 \\ NIR &= 146,18 \\ |\bar{x}_{DIS\ 1} - \bar{x}_{DIS\ 3}| &< NIR \end{aligned} \tag{12}$$

3.3 The Influence of the Form of Employment on the Work Efficiency of Warehouse Workers

A t-test for independent samples was conducted to test whether the trial period differentiates daily yield in terms of percentage and quantity. The dependent variable was daily productivity (%) and (pcs). The factor was the form of employment (probationary period, post probationary period). The results are presented in Tables 6 and 7. The difference turned out to be significant, $t(98) = -8.32$, $p < 0.001^*$, which can be read from the results of the t-test below, assuming equal variances (Table 6).

Table 6. Results of t-test assuming equal variances

	During the trial period	After the trial period
Average daily productivity [%]	71,83	96,93
Variance	299,79	165,05
Observations	40	60
Total variance	218,67	
Difference of means according to hypothesis	0	
df	98	
t Stat	-8,32	
P(T<=t) one-sided	0,000	
T-test one-sided	1,66	
P(T<=T) two-sided	0,000	
Two-sided t-test	1,98	

Source: Own study.

Mean daily output after the trial period was significantly higher than during the trial period. The difference was found to be non-significant, $t(98) = -0.15$, $p = 0.882$ (Table 7).

Table 7. Results of t-test assuming equal variances

	During the trial period	After the trial period
Average daily quantity of completed items (pcs)	979,90	991,15
Variance	88 442,86	167 678,37
Observations	40	60
Total variance	136 145,87	
Difference of means according to Hypothesis	0	
df	98	
t Stat	-0,15	
P(T<=) one-sided	0,441	
One-sided T-test	1,66	
P(T<=) two-sided	0,882	
Two-sided t-test	1,98	

Source: Own study.

There was no significant difference between the average daily number of items completed during the trial period and after the trial period.

4. Conclusions

The results of the study allow us to conclude that the level of motivation of Distribution Center employees is significantly related to working and employment conditions. It was observed that the type of motivator used significantly differentiated both the level of daily efficiency of Distribution Center employees

and the daily number of items they completed. Among the most important factors that increased the level of daily productivity of the employees were the financial bonus offered and the stable position. It also seems that the impact of these motivators on employee performance, is more significant than offering a promotion or overtime.

It was found that the financial bonus applied, was a factor that significantly increased the efficiency of employees, also in the context of the daily number of completed articles. A higher level of daily productivity of Distribution Center employees was also associated with the end of probationary period and obtaining employment. Maintaining and improving employee productivity will be possible with proper management by employers, based on an appropriately selected incentive system.

In light of the increasing number of warehouse spaces in CEE (Werner-Lewandowska and Golinska-Dawson, 2021), this research provides an important contribution to the design of motivation systems for warehouse personnel.

5. Conflict of Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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