

Par, Inc.: Case Study

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Executive Summary

Par Inc. is a major manufacturer of golf equipment. Management believes that Par's market share could be increased with the introduction of a cut-resistant, longer-lasting golf ball. The company recently reached out to our team to prepare a managerial report addressing, but not limited to, the following issues: the rationale for the hypothesis test that par could use to compare the driving distances of the current and new golf balls, descriptive statistical summaries of the data for each model, and population mean of each one if confident interval is 95%. The purpose of this managerial report is to address the concerns of the management at increased with the introduction of a cut-resistant, longer-lasting golf ball and also to provide a recommended whether the company need to make the larger sample sizes and more testing with the golf balls.

New Cut-Resistant Ball

The research group at Par has been investigating a new golf ball coating designed to resist cuts and provide a more durable golfs. This research is concern about the effect of the new coating on driving distances. Par would like the new cut-resistant ball to offer driving distances comparable to those of the current-model golf ball. To compare the driving distances for the two balls, 40 balls of both the new and current models were subjected to distance tests. The testing was performed with a mechanical hitting machine so that any difference between the mean distanced for the two models could be attributed to a difference in the two models. The results of the tests, with distances measured to the nearest yard.

Hypothesis Testing

The first thing to do is to formulate and present the rationale for a hypothesis test that Par, Inc. could use to compare the driving distance of the current and new golf balls. The result of test on the durability of the improved product another issue has been raised and this is the effect of the new coating on driving distances. 40 balls of both the new and current models were subjected to distance test. They are independent sample and test follows a large sample case (developed test). By formulation of these hypothesis there is assumed that the new and current golf balls show no significant difference to each other. The hypothesis and alternative hypothesis are formulated as follow:

Mean distance of current-model balls: μ_1 .

Mean distance of new cut-resistant balls: μ_2 .

- $H_0: \mu_1 = \mu_2$ (Mean distance of current balls equals mean distance of new balls).
- $H_1: \mu_1 \neq \mu_2$ (Mean distance of current balls is not equal mean distance of new balls)

Specify the level of significance. $\alpha = 0.05$ so $z = 1.96$

P- Value Approach

To test further hypothesis, we set α at .05 and our rejection criteria is Reject H_0 and accept H_a if $F > F_c$ or $P < \alpha$ (.05) (1 - 0.95) (according to Fisher theory). Since hypothesis test done thru statistic tools doesn't indicate F_c , we will use the P-value approach.

Current	New	
270.28	267.50	mean
8.75	9.90	std. dev.
40	40	n
	78	df
	2.775	difference (Current - New)
	87.282	pooled variance
	9.342	pooled std. dev.
	2.089	standard error of difference
	0	hypothesized difference

1.33 t
.1879 p-value (two-tailed)

F-test for equality of variance

97.95 variance: New
76.61 variance: Current
1.28 F
.4465 p-value

Looking at the descriptive statistics for each model, we can initially conclude that Current model has a longer range of distance based on the 40 samples with a mean of 270.275 (calculated in excel) compare to 267.500 for new model. Beside, standard deviation of current is 8.75 and of new is 9.89. Although, two value of mean is different but Sd also is quite large so we can say they are quite same.

P-value $i=0.1879 > 0.05=\alpha$. Our decision rule for this problem is:

- Do not reject H_0
- Mean distance of cut-resistant balls equals mean distance of current-model balls
- The new cut-resistant balls have no difference in distance compared to the current-model one

Therefore, we **recommend** for Par, Inc.: they should not launch this new product because the new model is not an improvement in distance compared to the old model.

Descriptive Statistical Summaries

Descriptive statistics

	<i>Current</i>	<i>New</i>
count	40	40
mean	270.28	267.50
sample variance	76.61	97.95
sample standard deviation	8.75	9.90
minimum	255	250

maximum	289	289
range	34	39

Population mean with 95% confidence interval

For current model:

Confidence interval – mean

95%	confidence level
270.275	mean
8.752984839	std. dev.
40	n
1.960	z
2.713	half-width
	upper confidence
272.988	limit
	lower confidence
267.562	limit

For new model:

Confidence interval – mean

95%	confidence level
267.5	mean
9.896904463	std. dev.
40	n
1.960	z
3.067	half-width
	upper confidence
270.567	limit
	lower confidence
264.433	limit

There is 95%probability that the true population mean is between 267.562 and 272.988 in current model while 264.433 and 270.567 in new model.

And by their confidence intervals, we can say that there is no significance difference between the driving distances of Current Model and New Model.

Recommendations

P-Value for this two tailed test is 0.1879, which is greater than level of significance α (0.05). Hence, H_0 will not be rejected which shows that Par, Inc. should not take a new ball in production as the P value indicates that there is no significant difference between estimated population mean of current as well new sample model. The 95% confidence interval for the population mean of the current model is 267.52 to 272.988 and of the new model is 264.433 to 270.567. It means that the estimated population mean for Par, Inc. should lie within this range for consistent result. However, the 95% confidence interval for the difference between the means of the two populations is 2.775. The calculated test statistic value is far from the rejection area. The larger the sample size the smaller the standard deviations which means point estimator of mean will become more precise. Hence there is no need to take larger sample size.

Our recommendation for the company (Par, Inc.) is to continue with further study of the improved cut-resistant. However, besides testing the driving distance, Par Inc. should also consider other factors like costing, availability of suppliers and the like before finalizing and launching the product. This project will be costly so much money, so the company have to analyze carefully not only about efficiency, but also effectiveness.

The purpose of this project is to increased market share. However, increasing market share is the secondary. The primary thing is increased profit to develop stably. Therefore, Management Director should consider which things they should focus on.