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ALL-RUSSIAN SCIENTIFIC RESEARCH INSTITUTE OF
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STATISTICAL QUALITY CONTROL IN FOREST PRODUCT INDUSTRY: A CASE STUDY

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Introduction

In the economic system that mostly depends on rivalry, the management has to develop the quality of the goods and service continuously. High quality production is so much beneficial for the productivity, the pleasure of doing the job in the best way, acquired time by doing the job once accurately.

The globalization of the industry has changed the behavior for the consumers. The quality of the good is much more important than in which country it is produced. This rapid change in market forced the producers to adapt to the specific quality & standards of ISO (International Standard Organization).

Some techniques have been used in quality control to provide the consumers' quality demands. The most common of them are sampling plans.

In this study, single and double sampling plans and a sample statistical quality control application was done at the parquet unit of Ardesen Timber Plant.

A computer program (by using Delphi v3.0) was coded for the application. The data provided in this study were given as input and assessment was done according to the outcomes. As material parquets were selected that have been produced in Ardesen Timber Plant. Ardesen Timber Plant produces timber and parquet in Ardesen, Rize. Annual timber production capacity is 30.000 m^3 and also 50.000 m parquet. During the process at first parquet drafts are prepared after that they are dried to the moisture content kiln dry. After drying process parquet drafts are processed in the tonguing and grooving machine packaged and they are ready to put up for sale. For the study at first, parquet (30 days-a hundred items for each day) was selected at random. And the samples were subject to total (100%) inspection. The result in this period is as follows; 4 days-1 defected item, 9 days-2 defected items, 12 days-3 defected items, 3 days-4 defected items and 2 days-5 defected items. According to the results, the permitted defected item number for Single Sampling Plan (SSP); c=3, the permitted defected item numbers for Double Sampling Plan (DSP); (c_i=3, C_2=5) was accepted.

Then by using single and double sampling, the quality control was done. This was achieved by following steps and formulas in the chart below. At the same time Operating Characteristics (OC), Average Outgoing Quality (AOQ), Average Sample Size (ASS) and Average Total Inspection (ATI) curve were drawn. Binom, Hipergeometric and Poisson distributions are used in the single and double sampling plans. These distributions are likely for the results. Here, for the application convenience Poisson distribution is selected during the preparation of the computer program. As known, Poisson distribution is formulated as follows;

N : Main group, n : Sample group, d : The number of defected items of the sample N. Main group, n_1 : First sample group, n_2 : Second sample group, d_1 : The number of defected items of the first sample group, C_1 : Permitted defected item number, d_2 : The number of defected items of the second sample group, c_2: Permitted defected item number;

	Operating Characteristics	Average Outgoing Quality	Average Sample Size	Average Total Inspection
Single	Pa(p')	p'xPa(p')	n	Pa(p')xn+(l-Pa(p')xN)
Double	Pa(p')	p'xPa(p')	n_1+n_2 x P(2.sample)	ASS+(N-ni)xP(d>ci)+(N-ni-n2)x(l-Pa(p')-P(d>C2))

Results and Evaluation

In order to meet the need of finding four different curves for SSP and DSP, a program was created using Delphi. For the selected N=1000, n=100, c=3 plan, when what quality of parties with the probability of being accepted and/or rejected is observed (this plan is suppose to be sifter nature), according to the plan since the permitted defected item number is c=3 on n=100 sample and for the total P probability low, the probability of the acceptance of the incoming N=1000 is to be P=Po+Pi+P2+P3. Here for the n=l00 itemized sample group, PO shows the probability of not having any defected parquets (d=0), PI is for d=l, P2 for d=2 and finally P3 for d=3. Probabilities varies according to the rate of P defected items in the delivered party.

When the prepared program is started up, the plan, which is going to be applied first, has to be selected from the main menu (SSP and DSP). After the selection of the plan in SSP, N=1000 (main group), n=100 (sample group), and c=3 (permitted defected item number) and also in DSP, N=1000, ni=100, n;=150, Ci=3 and c;=5 values are input.

As the program is started up and the data for SSP is input, the values of OC, AOQ ASS and ATI are found for different p' values. After that in every situation the graphics

with regard of these values are drawn with the help of function keys (F2=OC, F3=AOQ, F4=ASS, F5=ATI).

As seen in graphic 1 for p'=0.01, the probability of acceptability of parquets in Ardesen Timber Plant is Pa(p')=0.981. The accepted probabilities for p' values are given under the graphics. According to graphic 2, Average Outgoing Quality Limit (AOQL) for parquets is p'=0.03 and AOQ is found as 0.019. For SSP, ASS is constant and is equal to 100 (See graphic 3). Graphic 4 shows the (p') of ATI number change due to party qualities. At the beginning as ATI curve raises at a low-pace, it shows a high-pace from p'=0.02 to 0.06 and after that until 1000 a low-pace.

As the program is started up and the data for DSP is input, the values of OC, AOQ, ASS and ATI are found for different p' values. After that in every situation the graphics with regard of these values are drawn with the help of function keys (F2=OC, F3=AOQ, F4=ASS, F5=ATI).

As seen in graphic 5 for p'=0.01, the probability of acceptability of parquets is Pa(p')=0.990. The accepted probabilities for p' values are given under the graphics. According to graphic 6, Average Outgoing Quality Limit (AOQL) for parquets is p'=0.026 and AOQ is found as 0.020. For DSP, ASS is maximum (=153) for p'=0.04 and 0.05 (See graphic 7). Graphic 8 shows the (p') of ATI number change due to party qualities. At the beginning as ATI curve raises at a low-pace, it shows a high-pace from p'=0.02 to 0.07 and after that until 1000 a low-pace.

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THE EFFECT OF MOLIBDEN AND 6-BENZILAMINOPURIN IN NACl MEDIUM ON THE ACTIVITY OF VIGNA SINENSIS NITRATE REDUCTASE ENZYME

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Introduction:

One of the problems for researchers in agricultural studies in these days and near future, is to reduce the cost of manuring by nitrogen fertilizers without any decrease in agricultural rates The increase in the cost of fertilizers and also the aim of minimizing environmental pollution forces people to use mineral fertilizers in a more rational path-

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STATISTICAL QUALITY CONTROL
IN FOREST PRODUCT INDUSTRY: A CASE STUDY

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**Mugla University, Faculty of Business and Administration, MUGLA, TURKIYE

Introduction

In the economic system that mostly depends on rivalry, the management had to develop the quality of the goods and service continuously. High quality production is so much beneficial for the productivity, the pleasure of doing job in the best way, acquired time by doing the job once accurately.

The globalization of the industry has changed the behavior for the consumers. The quality of the good is much more important than in which country it is produced. This rapid change in market forced the producers to adapt to the specific quality & standards of ISO (International Standard Organization).

Some techniques have been used in quality control to provide the consumers' quality demands. The most common of them is sampling plans.

In this study, single and double sampling plans and a sample statistical quality control application was done at the parquet unit of Ardeşen timber factory.

A computer program (by using Delphi v3.0) was coded for the application. The data provided in this study were given as input and assessment was done according to the outcomes. As material parquets were selected that have been produced in Ardeşen Timber Factory. Ardeşen Timber Factory produces timber and parquet in Ardeşen, Rize. Annual timber production capacity is 30.000 m^3 and also 50.000 m^3 parquet. During the process, at firs parquet drafts are prepared after that they are dried to the moisture content kiln dry. After drying process parquet drafts are processed in the tonguing and grooving machine packaged and they are ready to put up for sale. For the study at first parquet (30 days-a hundred items for each day) was selected at random. And the samples were subject to total (100%) inspection. The result in this period is as follows; 4 days-1 defected item, 9 days-2 defected items, 12 days-3 defected item, 3 days-4 defected item and 2 days-5 defected item. According to the results, the permitted defected item number for Single Sampling Plan (SSP); c=3, the permitted defected item numbers for Double Sampling Plan (DSP); ($c_1=3$, $c_2=5$) was accepted.

Then by using single and double sampling the quality control was done. This was achieved by following steps and formulas in the chart below. At the same time Operating Characteristics (OC), Average Outgoing Quality (AOQ), Average Sample Size (ASS) and Average Total Inspection (ATI) curve were drawn. Binom, Hipergeometric and Poisson distributions are used in the single and double sampling plans. These distributions are likely for the results. Here, for the application convenience Poisson distribution is selected during the preparation of the computer program. As known, Poisson distribution is formulated as follows;

$$P = \frac{e^{-\lambda}.\lambda^x}{x!}$$

$d \leq c$ then   "YES", The probability of defected item among parquets (N-n) with spesific defected rate quarantee is given.

$d > c$ then   "NO" or (N-n) parquets are inspected. The defected parquets are replaced with the new ones.

N : Main group, n : Sample group, d : The number of defected items of the sample group, c : Permitted defected item number.

	$d_1 \leq c_1$	Then	YES
I. STAGE	$d_1 > c_2$	Then	NO
	$c_1 < d_1 \leq c_2$	then	II. SAMPLE
II. STAGE	$d_1 + d_2 \leq c_2$	then	YES (accepted)
	$d_1 + d_2 > c_2$	then	NO (rejected)

N: Main group, n_1 : First sample group, n_2 : Second sample group, d_1 : The number of defected items of the first sample group, c_1 : Permitted defected item number, d_2 : The number of defected items of the second sample group, c_2 : Permitted defected item number;

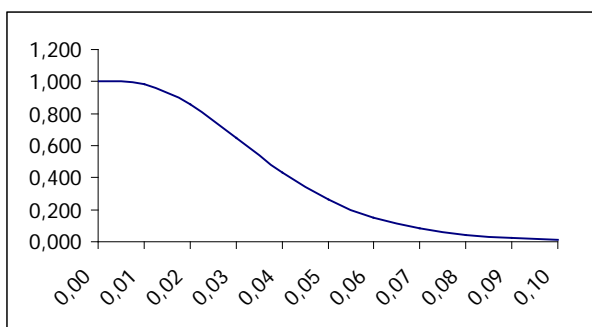|	Operating Characteristics	Average Outgoing Quality	Average Sample Size	Average Total Inspection
Single	$Pa(p´)$	$p´ \times Pa(p´)$	n	$Pa(p´) \times n + (1 - Pa(p´) \times N)$
Double	$Pa(p´)$	$p´ \times Pa(p´)$	$n_1 + n_2 \times P(2.sample))$	$ASS + (N - n_1) \times P(d > c_1) + (N - n_1 - n_2) \times (1 - Pa(p') - P(d > c_2))$

Results and Evaluation

In order to meet the need of finding four different curves for SSP and DSP, a program was created using Delphi. For the selected N=1000, n=100, c=3 plan, when what quality of parties with the probability of being accepted and/or rejected is observed (this plan is suppose to be sifter nature), according to the plan since the permitted defected item number is c=3 on n=100 sample and for the total P probability low, the probability of the acceptance of the incoming N=1000 is to be $P = P_0 + P_1 + P_2 + P_3$. Here for the n=100 itemized sample group, P0 shows the probability of not having any defected parquets (d=0), P1 is for d=1, P2 for d=2 and finally P3 for d=3. Probabilities varies according to the rate of P defected items in the delivered party.

When the prepared program is started up, the plan, which is going to be applied first, has to be selected from the main menu (SSP and DSP). After the selection of the plan in SSP, N=1000 (main group), n=100 (sample group), and c=3 (permitted defected item number) and also in DSP, N=1000, n_1=100, n_2=150, c_1=3 and c_2=5 values are input.

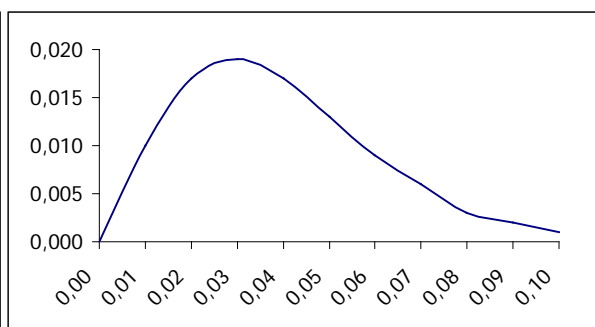| **Single Sampling Plan**				
p´	Pa(p´)	AOQ	ASS	ATI
0,00	1,000	0,000	100	100
0,01	0,981	0,010	100	117
0,02	0,857	0,017	100	229
0,03	0,647	0,019	100	417
0,04	0,433	0,017	100	610
0,05	0,265	0,013	100	761
0,06	0,151	0,009	100	864
0,07	0,082	0,006	100	926
0,08	0,042	0,003	100	962
0,09	0,021	0,002	100	981
0,10	0,010	0,001	100	991

AOQ : Average Outgoing Quality
ASS : Average Sample Size
ATI : Average Total Inspection

Figure 1. Single Sampling Plan Results
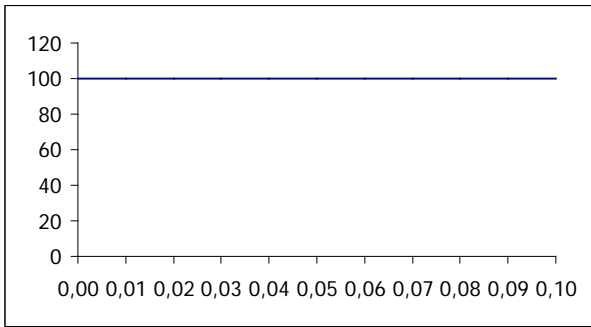
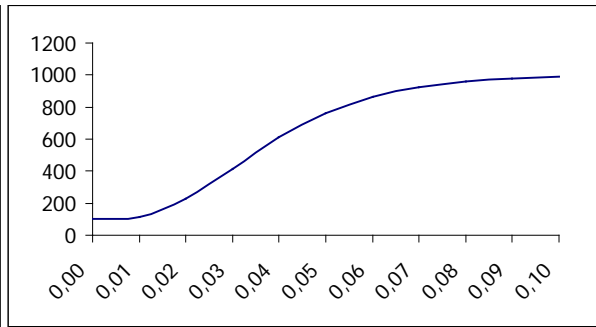Graph 1. Operating Characteristic Curve   Graph 2. Average Outgoing Quality Curve

Graph 3. Average Sample Size Curve

Graph 4. Average Total Inspection Curve

As the program is started up and the data for SSP is input, the values of OC, AOQ, ASS and ATI are found for different p´ values. After that in every situation the graphics with regard of these values are drawn with the help of function keys (F2=OC, F3=AOQ, F4=ASS, F5=ATI).
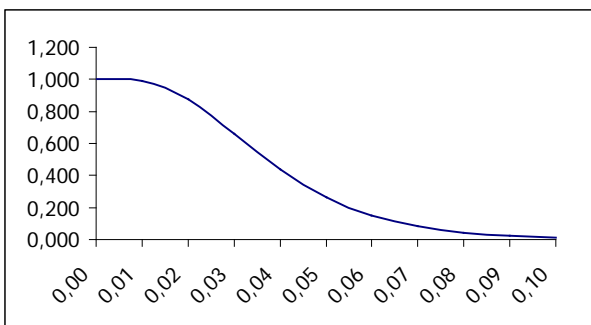
As seen in graphic 1 for p´=0.01, the probability of acceptability of parquets in Ardesen Timber Management is Pa(p´)=0.981. The accepted probabilities for p´ values are given under the graphics. According to graphic 2, Average Outgoing Quality Limit (AOQL) for parquets is p´=0.03 and AOQ is found as 0.019. For SSP, ASS is constant and is equal to 100 (See graphic 3). Graphic 4 shows the (p´) of ATI number change due to party qualities. At the beginning as ATI curve raises at a low-pace, it shows a high-pace from p´=0.02 to 0.06 and after that until 1000 a low-pace.

Double Sampling Plan _ □ ×

| p´	Pa(p´)	AOQ	ASS	ATI
0,00	1,000	0,000	100	100
▶ 0,01	0,990	0,010	103	110
0,02	0,877	0,018	119	214
0,03	0,659	0,020	140	409
0,04	0,437	0,017	153	607
0,05	0,266	0,013	153	761
0,06	0,151	0,009	144	864
0,07	0,082	0,006	133	926
0,08	0,042	0,003	122	962
0,09	0,021	0,002	114	981
0,10	0,010	0,001	109	991

AOQ : Average Outgoing Quality
ASS : Average Sample Size
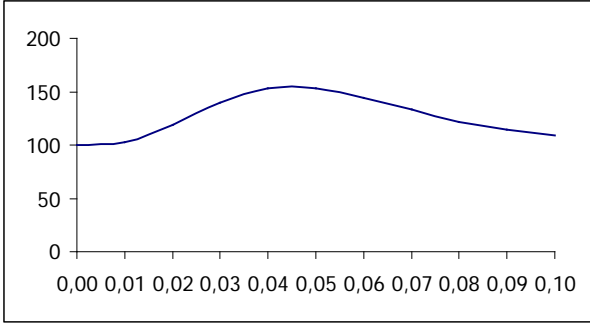ATI : Average Total Inspection

Figure 2. Double Sampling Plan Results

As the program is started up and the data for DSP is input, the values of OC, AOQ, ASS and ATI are found for different p´ values. After that in every situation the graphics with regard of these values are drawn with the help of function keys (F2=OC, F3=AOQ, F4=ASS, F5=ATI).
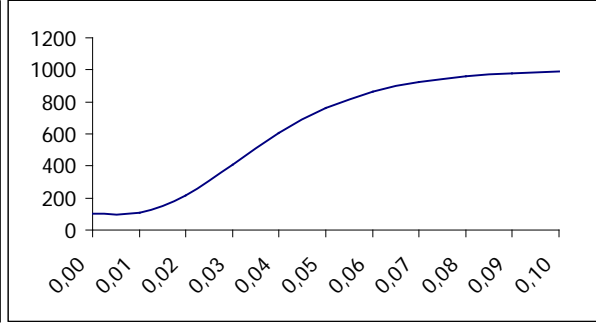

Graph 5. Operating Characteristic Curve
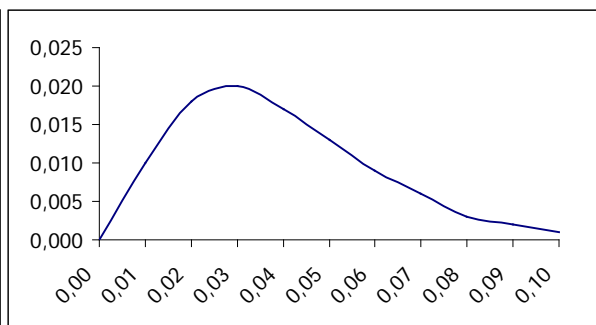
Graph 6. Average Outgoing Quality Curve

Graph 7. Average Sample Size Curve

Graph 8. Average Total Inspection Curve

As seen in graphic 5 for $p´=0.01$, the probability of acceptability of parquets is $Pa(p´)=0.990$. The accepted probabilities for $p´$ values are given under the graphics. According to graphic 6, Average Outgoing Quality Limit (AOQL) for parquets is $p´=0.026$ and AOQ is found as 0.020. For DSP, ASS is maximum ($=153$) for $p´=0.04$ and 0.05 (See graphic 7). Graphic 8 shows the ($p´$) of ATI number change due to party qualities. At the beginning as ATI curve raises at a low-pace, it shows a high-pace from $p´=0.02$ to 0.07 and after that until 1000 a low-pace.

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ANS., TSE-ISO 9000 Kalite Broşürü, 1996, Ankara.
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