QUALITY MANAGEMENT IN FURNITURE MANUFACTURING

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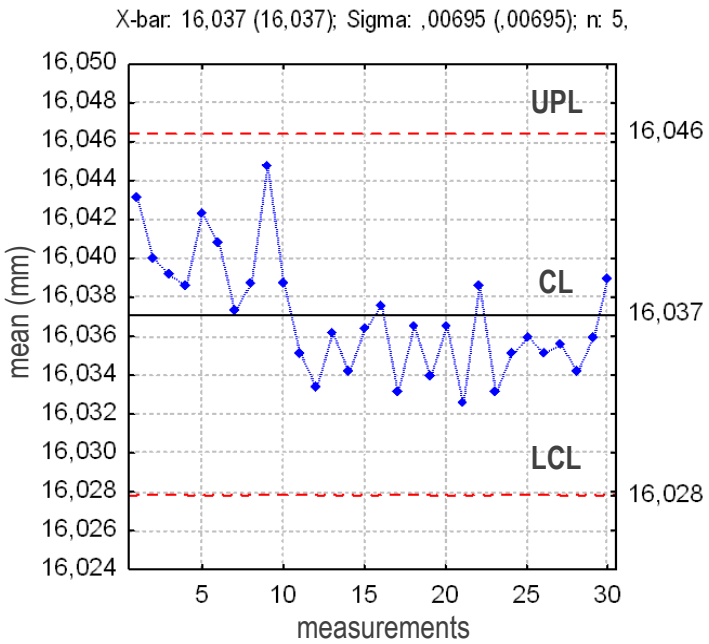
RESEARCH OBJECT

- The study was conducted in TVIN Ltd, Virovitica timber industry. Tvin is a leading furniture manufacturer in Croatia with over 1 000 employees. 90 % of its production is for export. In Croatia it is well-known for its office furniture and hotels furnishing. Besides the headquarters located in Virovitica, TVIN has factories in Županja, Pitomača and Grubišno polje.
- Measurements were carried out in two factories (factory I and factory II) at the same checkpoint, on a multiple-spindle drill. The depth of the drilled holes on two similar products on the same material was measured. The study was conducted under normal production conditions, which are typical for the object of the study. Only data obtained under normal conditions can be compared in the analysis and used to make conclusions (Lazić, 2009).

METHODS

- After data collection the results were analysed by methods of statistical quality control, using control charts and process capability measurements.
- For statistical evaluation statistical software package Statisica was used, namely module Industrial Statistics & Six Sigma.
- For the analysis of the obtained results X bar and R control chart was used that tracks mean and ranges of samples.
- Sample size of 5 pieces was selected and 30 measurements were made at the research facility.
- To track the measured data in greater detail the individual X - bar control chart was used that shows the movement of individual values in relation to the central line and control limits.

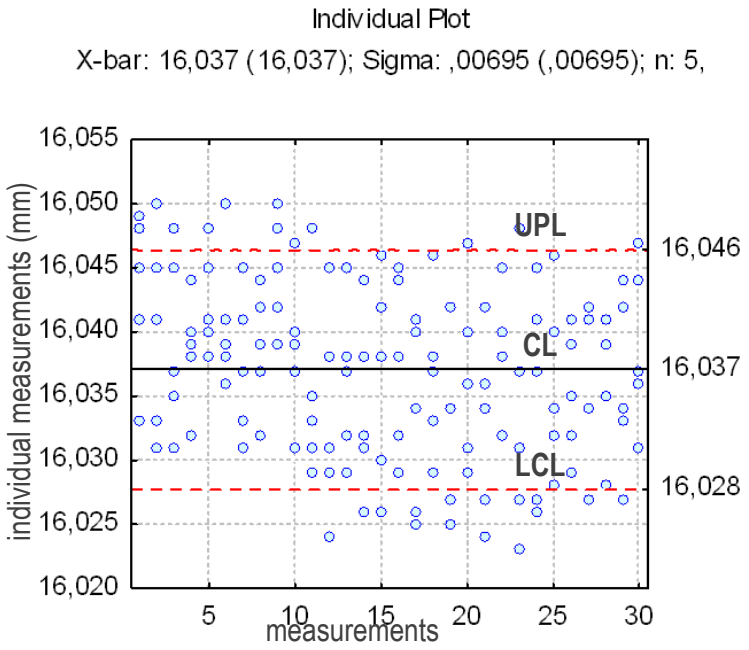
RESULTS – research polygon 1



From the analysis of X-bar chart of mean can be seen that the mean values of samples follow normal distribution and do not fall outside the control limits.

More than 2/3 of mean values is in the area 1 σ away from the central line on the X bar chart (70% mean values).

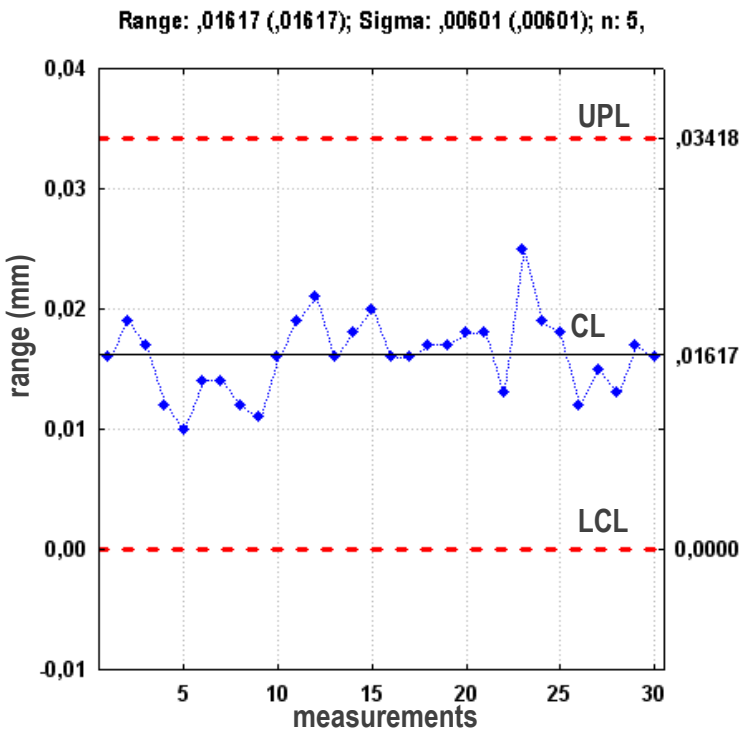
On the X-bar chart of individual measurements, it is evident that more measured values deviate from the upper and lower control limits, indicating the need for setting the machine.



Above the upper control limit there are 13 measured values, and below the lower control limit value there are 15 of them.

If the space between the control limits is divided into three zones A, B and C, (A = 1 σ, B = 2 σ, and C = 3 σ) which start from the centre line of the control limits, it can be seen that 59 values (39 %, more than 1/3 of values) are located in zones B and C, i.e. in areas below the curve of normal distribution of 2 σ and 3 σ, and this can be understood as a warning that changes may occur in the process.

RESULTS – research polygon 1

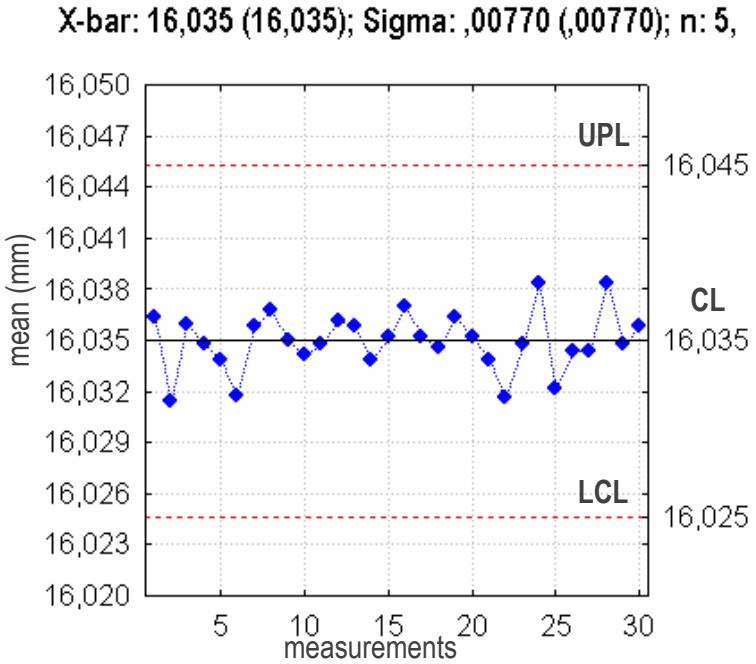


- From R-bar chart can be seen that ranges do not fall outside the control limits.

  More than 2/3 of values is in the area 1 σ away from the central line on the R chart of ranges (73%).

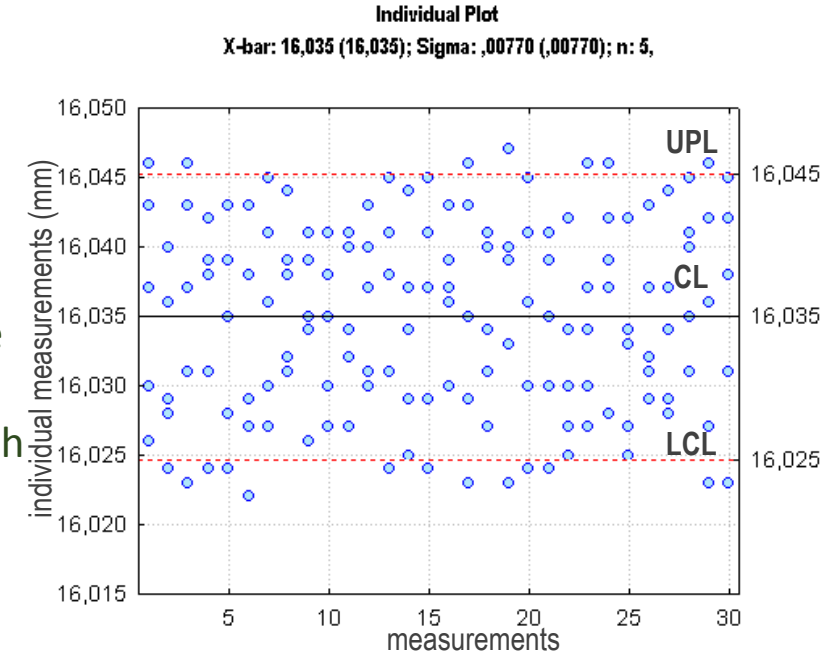
- Index of process potential C_p=0.32 indicates an inefficient process and the performance index C_{pk}=0.32 to an unconfigured process.
- As a corrective measure it is proposed to stop and adjust the process.

RESULTS – research polygon 2

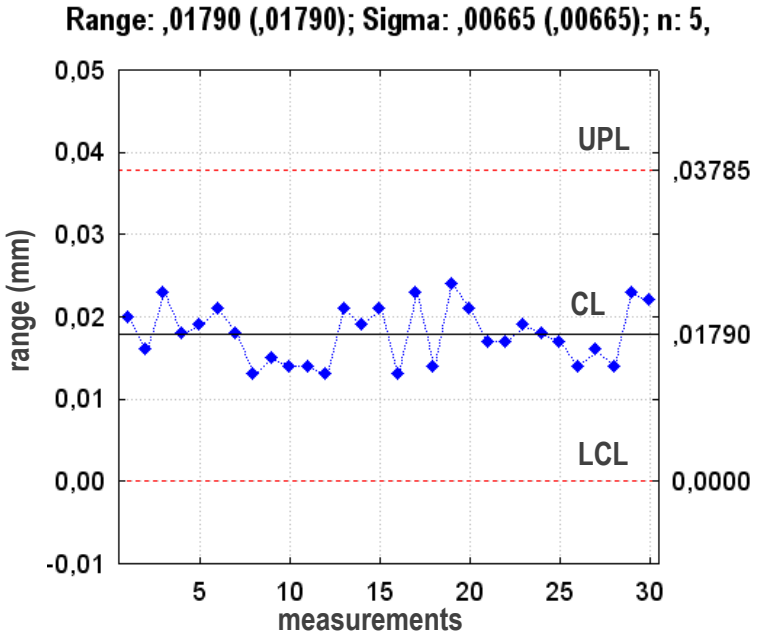


On the X bar chart we can observe minor deviations of mean values of the centre line. 1/3 or 33% of mean values is located in zones B and C, which indicates that changes in the process could happen and cause a decline in the product quality.

Individual measurements indicate to significant deviations. Above the upper control limit (16.045) there are 7 of the measured values, while below the lower control limit (16.025) there are 13 values. 41% of the values are located in zones B and C, which exceeds 2/3 of total values and signals us that we must perform process correction.



RESULTS – research polygon 2



- Samples range move at periodic intervals above and below the central line (0,179). The ranges move in cyclic intervals around the central line and do not go beyond the control limits.

- On the basis of the value of capability indicator (capability indices $C_{p=}$0.29 and C_{pk}=0.29), it is evident that the process of drilling holes on the multiple-spindle drill belongs to the group of imprecise and unconfigured processes.

CONCLUSION

- Statistical analysis showed that on X bar and R control charts there is a certain deviation from the central line, but there is no value that is outside the control limits. By measuring the process capability, values that were obtained indicate that processes are inefficient and unconfigured, and that should be approached for further analysis.
- Control charts are a basic instrument for the implementation of statistical control of a product or a production process. The main role of control charts is detecting and visualizing product quality disorder. Statistical quality control with its tools, especially control charts can greatly help improve the quality of products and processes.
- As is evident from the results, using the X bar and R control chart it is possible to find out how the process behaves, to determine whether there are variations in the process and to what extent, after which with further analysis we can search for causes of errors.

CONCLUSION

- This control chart has been proved as a suitable tool for systematic monitoring and improvement in the process of furniture production, and in this specific case for monitoring the performance quality of multiple – spindle drills.
- Using X – bar chart for individual values we have come to the conclusion that there are multiple measurements that are outside the control limits, and that it is necessary to stop the process and remove all causes of difusion.
- Using the conventional X bar and R control chart to monitor the mean and range of samples variations in the process are not always apparent. Although all mean and ranges of samples were within the control limits, process capability indices showed that the processes are unconfigured and imprecise (smaller than 1). When the process capability index is smaller than 1, it means that the process deviation exceeds the tolerance limits of the process and a significant percentage of scrap can be expected (Oslić, 2008).

CONCLUSION

- Only with the use of an X – bar control chart for individual values we found greater variations in the processes and deviations outside control limits.
- Control charts, with special emphasis on the ones for individual values, proved to be a suitable tool for the systematic monitoring and improving the quality of furniture production processes.

THANK YOU

FOR YOUR ATTENTION!