



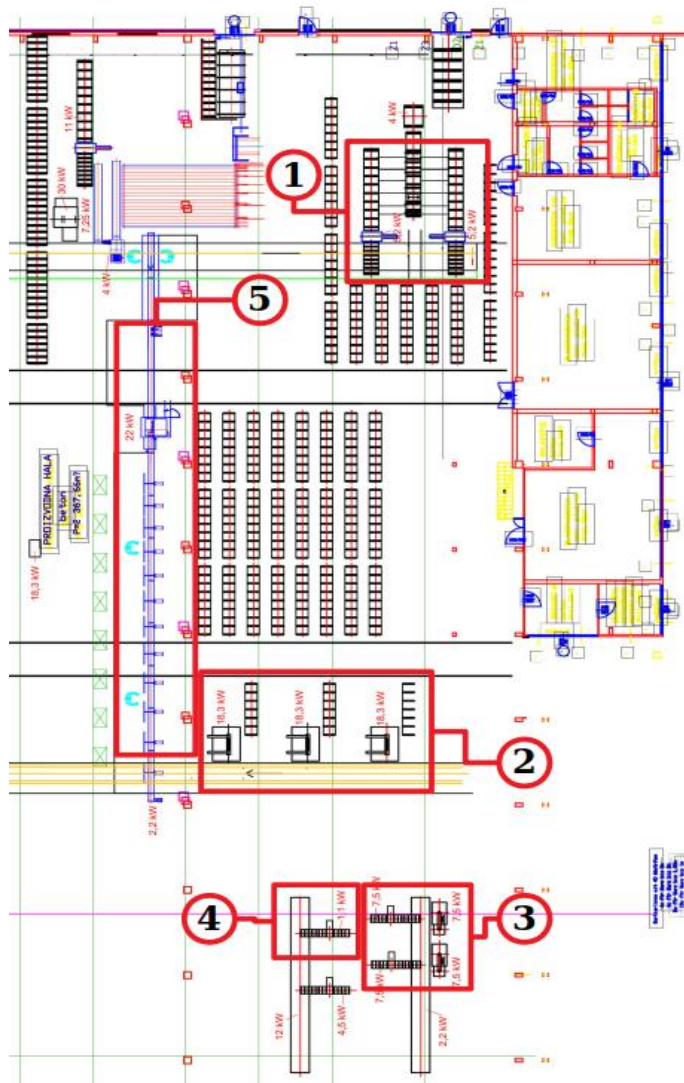
ENERGY EFFICIENCY OF WOODWORKING MACHINES AND SURFACE ROUGHNESS OF MACHINED SURFACES IN THE SECONDARY PROCESSING PLANT OF SPAČVA D.D., VINKOVCI

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INTRODUCTION

- part of the IRI project “Research in the company Spačva d.d. for the purpose of developing innovative massive doors made of Slavonian oak” - KK.01.2.1.01.0117. supported by the European Structural and Investment Funds
- the goal of our activity is to compare machinability parameters, e.g. cutting power, cutting force, machined surface roughness, tool life ... between the old and newly installed machines in the secondary part of primary processing plant of Spačva d.d., and to help in the process optimization on the newly installed manufacturing line



The “old” technological line:

1. radial arm saws (PKP)
2. single-blade circular saws for edging and ripping (AC)
3. bandsaws (TP9)
4. pendulum saw (BKP)
5. optimizing cross-cutting saw (OPC)

Machinability

- according to Astakhov (2014) new concept of machinability was proposed, which has a dual meaning:
 - **machinability of work material**, which is directly related to the properties of work material (quantified through some material property) and
 - **process machinability**, which is related to specific machining process (depends on a lot of variables (cutting speed, feed speed, tool geometry, tool material, etc.) and can be used as a measure of machining economy).
- it is suggested the specific cutting energy (E_n) can be used as a quantity that represents process machinability
- specific cutting energy directly correlates to specific cutting pressure



- in order to determine energy efficiency of the whole machine, the total energy required for machining of given unit production (E_b) can be used
- the combination of specific cutting energy and total energy required for unit production can be used for comparison of energy efficiency of different types of machines

Surface roughness

- in accordance with ISO 4287: *Geometrical Product Specifications (GPS) - Surface texture: Profile method - Terms, definitions and surface texture parameters*
- roughness and waviness parameters - mostly used (R_a , R_q , R_z , W_a , W_q and W_z)
- Is this a good measure of "machined surface quality"?

MATERIALS AND METHODS

- cutting power measurements

$$P_c = P_{\text{tot}} - P_0$$

, where P_{tot} - average power during cutting, P_0 - average power required for idling of the machine.

- calculated from measured electrical active power



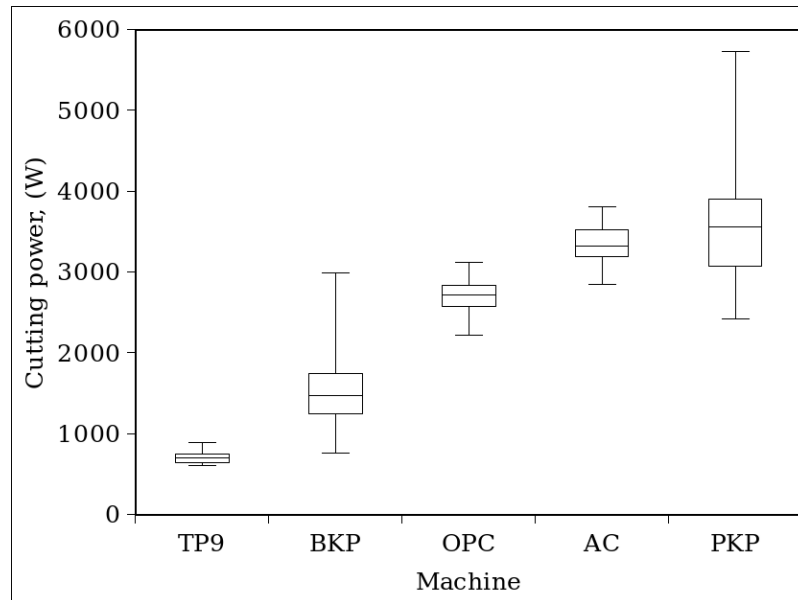
- the electrical power was measured with Fluke 435-II Three Phase Power Quality and Energy Analyzers

- roughness and waviness of machined surfaces were measured with surface roughness tester Mitutoyo SurfTest SJ-500

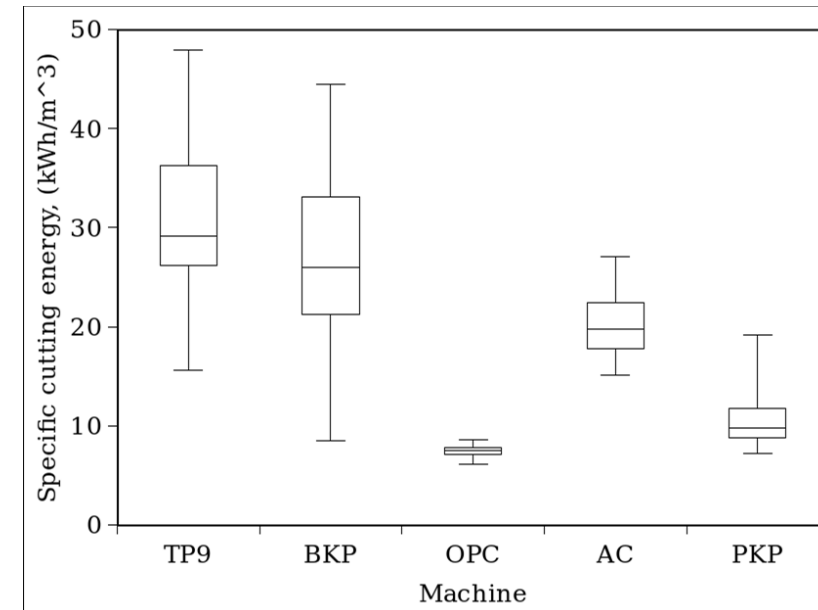


RESULTS

Average cutting power (P_c) required for machining



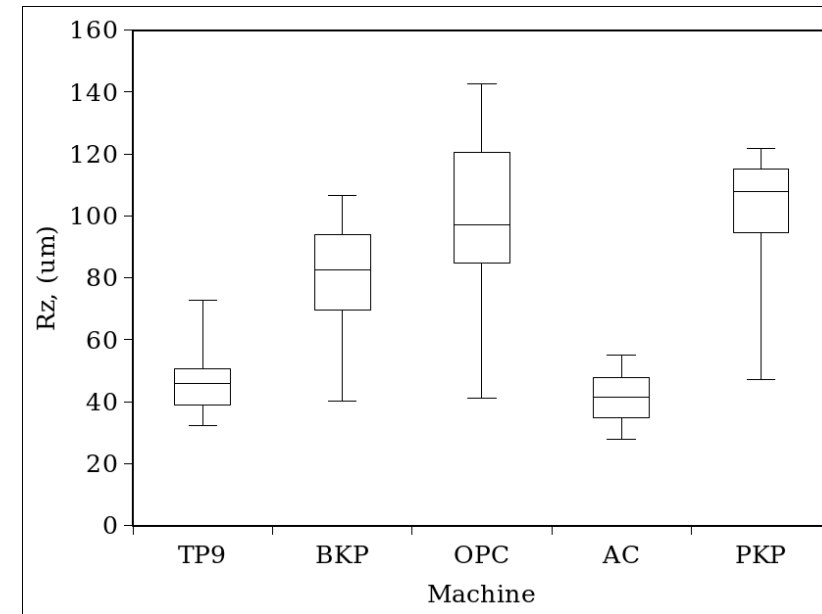
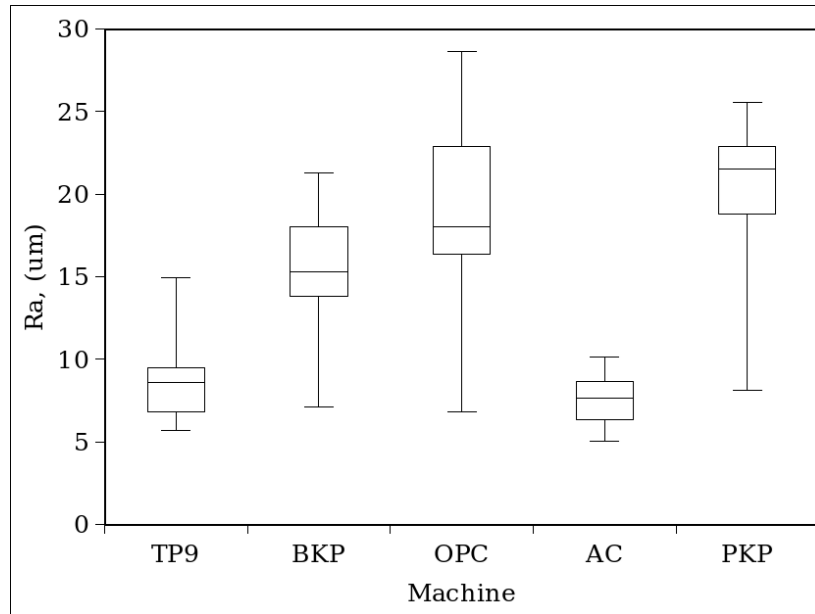
Specific cutting energy (E_n)



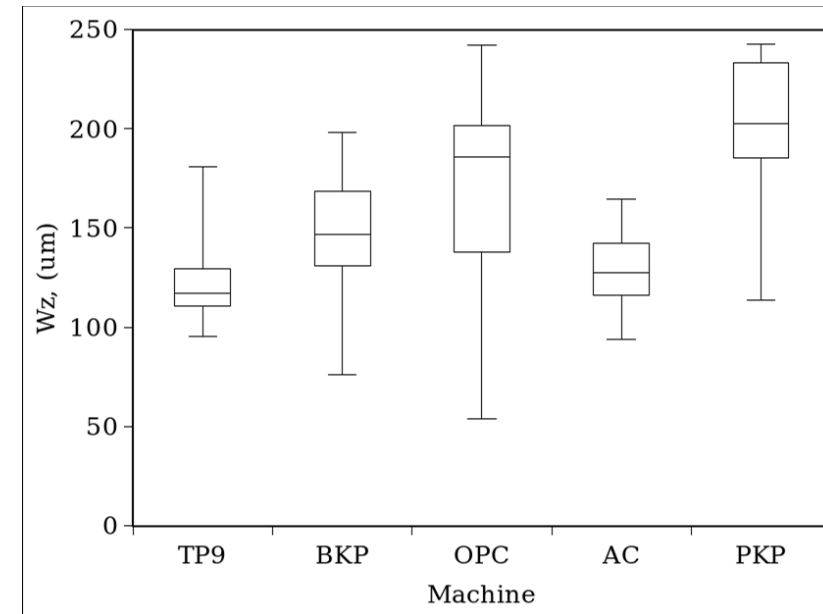
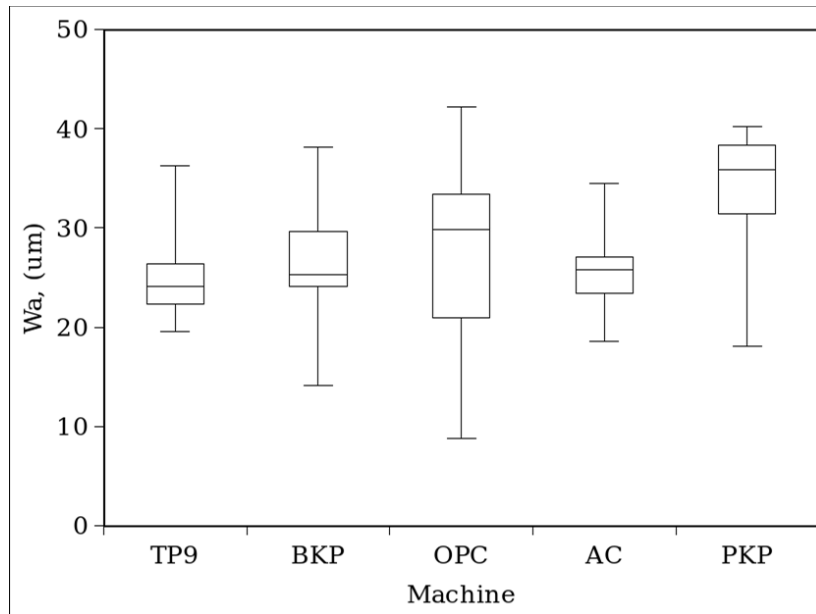
- the ratios of specific cutting energy and total energy required for machining of given unit production for every machine group tested

Machine	Machine efficiency in given machining conditions
TP9	0,3
BKP	0,8
OPC	0,5
AC	0,7
PKP	0,7

- machined surface quality for all inspected machine groups expressed through roughness parameters R_a and R_z



- machined surface quality for all inspected machine groups expressed through waviness parameters W_a and W_z





Thank you for your attention.