# Customer Behavior on the Slovakian Roundwood Market: A Case Study

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Fast-changing market conditions of consumer goods, influenced by customer needs, impact forest enterprises. Thus, management of forest enterprises requires customer-oriented marketing. This paper explores the preliminary issues of customer behavior in the roundwood segment of the selected oligopoly state forest enterprise in Central Europe, Slovakia. This research was carried out by the gualitative approach using standardized interview by means of structured questionnaire. According to research requirements, significant roundwood customers were identified by portfolio analysis of the chosen forest enterprise. Regarding the small rate of significant respondents (customers), non-parametric statistical methods like Spearman's correlation coefficient and Wilcoxon test were used for the evaluation of customer behavior, or to identify significant correlation among qualitative signs of customer conduct. This paper gives further instructions for the assessment of the results regarding the wood trade manners on the Slovakian market. Additionally, this research presents a special contribution to the achievement of substantial results based on the small rate of respondents, which supports short-term marketing decision-making in trading with wood assortments on the regional trade level in practice.

Keywords: Roundwood; Forest enterprise; Customer; Behavior

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## INTRODUCTION

Marketing is a social and management process by which individuals or organizations obtain what they need and want through creating and exchanging products and values with others (Evans and Berman 1990; Kotler and Armstrong 2010). The application of marketing in the management process (marketing management) has been thoroughly investigated (Miles and Snow 1978; Meffert 1991; Becker 2000; Gonzalez *et al.* 2008).

In the 1960s and 1970s, professional forestry literature began to suggest that wood sales could be improved by the application of marketing tools. The concept of marketing was exclusively related to the function of wood sales (Speidl 1972). Most forestry work dealt with enterprise in operatively established marketing (Eisele 1994). In the past, marketing was poorly understood in the sense of the strategically oriented management (Bergen 1995; Borowski and Becker 1995; Becker 1998). However, Gally (1972) saw the implementation of marketing methods as a way to gain an overview of sales possibilities and consolidation of the production alternatives of the forests with the requirements of the customers. He recommended managing forest enterprises based on wood market surveys. Case studies in the context of the behavior assessment of roundwood customers and

application of marketing management on selected forest enterprises have been studied (Schadendorf 1994; Borowski 1996).

Marketing in the forestry sector in developed countries (namely in Scandinavia) is now designated by the term Improved Marketing (Owari *et al.* 2006). Theory and implementation of marketing management in the forestry as well as forest enterprises are the subject matter of several studies (Becker 1998, 2000; Ok 2005; Hansen and Juslin 2011; Bruin *et al.* 2017; Hansen *et al.* 2017; Groening *et al.* 2018).

Šulek (2004) reported that only low-level marketing is applied in the Slovak forest enterprises, *i.e.*, it should receive more attention. However, marketing options are very extensive not only in the area of market realization of wood and other forest products, but also within the analysis and management of roundwood sales. Forest enterprises, as roundwood producers, stay at the end of the chain with the derived demand on wood. The fast-changing market conditions of consumer goods indirectly impact forest enterprises throughout the change of customers' needs. Therefore, this situation requires strategically oriented marketing so that the forest enterprise could quickly and flexibly react to market changes as well as respond to opportunities in new markets (Aghazadeh 2015).

Implementation of strategic marketing management in the forest enterprise presents most of all the utilization of the marketing mix, which is: product, price, place, promotion, people, processes, and physical evidence (Rafiq and Ahmed 1995; Abril and Rodriguez-Cánovas 2016). For instance Halaj (2011), Halaj and Brodrechtova (2014), Parobek *et al.* (2014), and Kaputa *et al.* (2016) have dealt with the application of marketing mix tools in the forestry or with the assessment of the behavior of the market players with wood and wood products in Slovakia. These tools should increase revenues from wood because it has an 85% share on the total revenues of the forest enterprises (Ministry of Agriculture and Rural Development of the Slovak Republic 2017), by means of effective wood assortments manipulation or an increase of the yield (processes), loyal business policy (price, people), optimization of the logistics of forestry, such as commercialization of the ecosystem services (Aguilar and Vlosky 2007).

In the forestry sector, roundwood customers are mostly connected with the wood industry and pulp-paper industry customers (Faletar *et al.* 2016). Roundwood customer behavior in Slovakia has been described previously (Brodrechtova 2008; Parobek *et al.* 2014; Gejdoš and Danihelová 2015; Loučanová *et al.* 2017; Paluš *et al.* 2017).

Forest industry and wood demand currently depends on the market (Kumar 1985; Price 1989), as well as many non-market factors and specifications, such that forest enterprises require the special application of marketing management. Some of the factors are a high share of accidental logging, production possibilities of the forests in relation to the soil structure, climate changes, and insect pests (Ministry of Agriculture and Rural Development of the Slovak Republic 2017). Wood is a commodity product, and therefore the market players behave according to the business models of the commodity market (Šatanová *et al.* 2015). Thus, the roundwood market is characterized by big transaction volumes because there are big numbers of participants in the market relationships and relatively high transaction cost (including storage cost) (Mala *et al.* 2017). Roundwood offers have a random character throughout the year, as there are long-term relationships among producers and customers and their specific needs have not been exactly identified; the marketing planning is oriented on mass production of individual products (Shobana *et al.* 2012). Price decision making is the most important decision-making tool within the

marketing mix. Competing advantages focus mostly on the producer image (Sinclair 1992), production technologies, and cost effectiveness.

Wood offer on the market is established by factors that can be influenced only in the long-term horizons that are not elastic but are determined for several decades. The demand for wood and wood products is a derived demand (Cooper 1990; Knauf 2015; Bikar *et al.* 2018; Paluš *et al.* 2018). Wood demand depends on the structure of the customer production programs; ultimately it is determined by the final products demand (Price 1989; Hansen *et al.* 2014; Gosselin *et al.* 2017). This means that orientation on the needs and requirements of the customer is inevitable (Mala *et al.* 2017). Regarding natural and market characteristics of the forest industry, marketing management can often be applied only in a limited way on the enterprise level considering the availability of the tools.

This case study was carried out for the selected oligopoly state forest enterprise and used the long-term experience of the management in the area of marketing, sales, and logistics. It applied the method of standardized interview by means of structured questionnaire. It dealt with the assessment of the statistical significance of the difference between the qualitative markers in individual questions and its subsequent interpretations with respect to the rules of the wood trade.

The aim of the paper was to identify the preliminary results of the customers' behavior on the roundwood market in Slovakia, as well as the methodology for assessing their behavior as a significant support for short-term decision making of forest management.

## EXPERIMENTAL

The research methodology consisted of three phases. In the first phase, the most important roundwood customers of the selected forest enterprise were identified. In the second phase, the structured questionnaire was elaborated on to carry out standardized interviews and to gain primary empirical data about the behavior of the major roundwood customers in Slovakia. To evaluate the results of the research, the statistical program SPSS Statistics 19 (IBM, Armonk, USA) and non-parametric statistical methods were used. In the third phase, the behavioral characteristics of the customers were identified and interpreted, as well as the strategic marketing management steps proposed for the selected forest enterprise.

## **Data Collection**

The subject of the survey of customer behavior on the roundwood market was the target group of coniferous wood purchasers. This was due to their dominant position in this market and a low number of broadleaved wood processors in Slovakia (Gejdoš and Danihelová 2015). This situation resulted mainly from the historical context of the forest management strategy with the aim of dominant spruce forest lands for the production of construction sawnwood.

In 2016, the selected forest enterprise reached an annual volume of roundwood production of approximately 4.8 million m<sup>3</sup>, out of which the random production reached 2.2 million m<sup>3</sup> with coniferous wood prevalence in the share of 35.4% (Ministry of Agriculture and Rural Development of the Slovak Republic 2017). The volume of the produced wood presented was half of the total roundwood production in Slovakia, which

was more than 9 million m<sup>3</sup> of wood. This forest enterprise manages more than 50% of the total forest area in Slovakia. The wood-processing industry, as well as the pulp and paper industry represents the oligopoly structure in Slovakia (SARIO 2011). In the target customer group of this enterprise, five major sawmills and one dominant pulp processor were identified for sawn wood, pulp, and paper production in Slovakia. The analyzed sawmills (customers) reached a capacity of the processed coniferous wood mass in the volume of 100 thousand m<sup>3</sup>/year to 300 thousand m<sup>3</sup>/year and the revenue was more than 20 million  $\in$  per year. Pulp and paper production reached the capacity of processed coniferous pulp with a volume of more than 1 mil. m<sup>3</sup>/year and an annual revenue of more than 700 million  $\in$  (Mondi SCP 2016).

Each roundwood customer was interviewed in a standardized interview approximately 60 min long using a structured questionnaire (Krott and Suda 2001; Silverman 2006). First, interviews were held with experts in this field in order to obtain data on the peculiarities of the coniferous wood market and to adapt the questions for the interview. The set of topics or questions for the standardized interview were determined together with wood trade specialists (Technical University and National Forestry Centre in Zvolen, Slovakia, and Georg-August-University in Göttingen, Germany) and in cooperation with the selected state enterprise. To obtain comprehensive data and validate the optimal length of the questionnaire, the applicability was tested once again by a pretest on the selected roundwood customer. Emphasis was placed on the comprehensiveness of the questions and in terms of the form of the content, several criteria were taken into consideration to eliminate technical errors from answers (Schnell *et al.* 1995). The simplest questions were placed at the beginning, and difficult evaluation questions were asked at the end of the interview (Silverman 2006).

To analyze the behavior of the roundwood market customers, questions in the questionnaire were divided into two parts:

Part A – 5 questions: Characteristic of the selected customers Part B – 7 questions: Behavior of the customers (A1-A8; B; C1-C10; D; E1-E9; F1-F14; G1-G15; H1-H16; I1-I8).

Part A handled the basic characteristics of the selected roundwood customers: production of coniferous wood products, roundwood processing capacity, export share, sales volume, and structure of their customers (furniture and building industry, woodworking, *etc.*).

The aim of part B was to identify the behavior of the roundwood customers in the wood trade, their requirements for quality of wood processing, terms and conditions in commercial contracts, *etc*. The questions were marked with alphabet letters (from A to I) to create groups with individual qualitative markers. Identification with the letters helped to follow easily the surveyed behavioral markers and respective questions. The numbers (*e.g.* A1-A8) expressed the criterion position (rated behavioral marker) for each question.

#### **Used Indicators**

The major roundwood customers of the selected enterprise were identified by a growth and share matrix, the BCG matrix, in 2015 and 2016 (Meffert 1991; Kotler and Armstrong 2010; Kotler and Keller 2015). Growth-share BCG matrix is one of the most often used portfolio matrices, which is used for marketing analysis of the business portfolio to evaluate the attractiveness of strategic business units (SBUs). Business portfolio analysis

is a method of assessing the SBU for deciding on investing in individual SBUs. It serves as a basis for identifying individual strategies for each SBU. It can be a specific product, product line, division, or the whole enterprise.

The BCG growth-share matrix as a decision model was used to evaluate the attractiveness of the SBU. This information is, according to the BCG method, necessary to determine for all SBUs (Kotler and Armstrong 2010). The relative share of revenues was determined according to the following relationship,

Relative share<sub>n</sub> = revenues 
$$SBU_n$$
 / total revenues<sub>n</sub> (1)

where relative share<sub>n</sub> is the relative share of the  $SBU_n$  (strategic business unit) on the total revenues, revenues  $SBU_n$  is the sales revenue of the  $SBU_n$  of the analyzed enterprise in the current year, and total revenues<sub>i</sub> is the total revenue from the sale of all SBUs of the analyzed enterprise in the current year.

Revenue growth index was calculated as follows,

$$i_n = revenues SBU_n current year / revenues SBU_n previous year$$
 (2)

where "i<sub>n</sub>" is the revenues growth index of the  $SBU_n$ , "revenues  $SBU_n$  current year" is the sales revenue of the  $SBU_n$  in the current year, and "revenues  $SBU_n$ " is the sales revenue of the  $SBU_n$  in the previous year.

The relative revenues share in the BCG matrix presents the horizontal axis (x). The median value of the achieved shares of SBUs in total revenues represented a limit between high and low relative shares. The vertical axis (y) is the revenue growth index, where value 1 is considered as the limit between high and low growth index. Based on the limit values of the relative revenues share and revenues growth index, the BCG matrix is divided into four quadrants: cash cows, dogs, question marks, and stars. In general, all SBUs placed in the quadrants cash cows and stars achieved positive cash flow and were perspective for the enterprise. On the other hand, the SBUs in the quadrants question marks and dogs required significant cash and may achieve low profits or even losses (Evans and Berman 1990).

#### Methods of the Research Evaluation

Qualitative analysis of the evaluation of the customer behavior on the central European roundwood market was conducted using a case study approach. The value of the selected case study approach is based on the possibility to join empirical phenomena with an explanation by theoretical logic (Lamnek 1993). Furthermore, the case study approach aimed to illuminate a decision or set of decisions: why they were taken, how they were implemented, and with what result (Yin 2003).

From the reason of the identification of the most remarkable roundwood customers at the biggest roundwood producer in Slovakia, the BCG matrix analysis of customers' portfolio went before the statically testing. Mathematical-statistical methods were used for qualitative evaluation of the customer behavior. Interpretation of the dependencies of the qualitative markers pointed to the behavioral tendencies of the customers at the wood trade in the selected areas. Combinations of the individual areas (questions) for the interpretation were chosen based on their practical meaning.

To determine the importance of the criteria in the questionnaire questions for the part B (*e.g.* A1-A8), the Likert rating scale was applied, as shown in Table 1 (Silverman 2006).

			-		
Rating scale	very high	high	average	little	very little
	importance	importance	importance	importance	importance
Points	1	2	3	4	5

**Table 1.** Rating Scale for the Criteria of the Surveyed Areas

The sample size was limited by the number of the major customers of the selected forest enterprise. Therefore, non-parametric statistical methods were used for the evaluation of the structured interview data. These are used in case of small sample sizes (Wackerly *et al.* 2001). For this reason, it was suitable to apply these statistical methods.

Within the non-parametric methods, the one-sample Wilcoxon test and Spearman's correlation coefficient were applied (Clauss and Ebner 1988; Wackerly *et al.* 2001). Both methods based on the table values were realized with six sample sets at the significance level  $\alpha = 0.05$ , *i.e.* that the sample value N = 6 with the chosen accuracy level was sufficient to generalize the individual results of the statistical survey. Based on different respondents' statements (N = 6), this set was considered to be an equivalent random selection set.

For the one-sample Wilcoxon test, a simple mathematical-statistical procedure was used. The variables X1, ..., Xn were sorted in increasing sequence according to their value, as shown in Eq. 3,

$$|\mathbf{X}|^{(1)} < |\mathbf{X}|^{(2)} < \dots < |\mathbf{X}|^{(n)}$$
 (3)

If there is  $R_i^+$  of the order  $X_i$  at the sorting, the following variables will be introduced (Wackerly *et al.* 2001):

$$S^{+} = \sum_{x_{i} \ge 0} R_{i}^{+}$$
,  $S^{-} = \sum_{x_{i} < 0} R_{i}^{+}$  (4)

In other words, the variable "R" represents the differences order of assessed variables. These differences can reach the positive or negative values. The numbers are lined up according to size of their absolute values in this order, whereby the difference with the smallest absolute value will be first in this order. The sum of positive values is presented by  $S^+$  and the sum of negative values is marked as  $S^-$ . At the same time,  $S^+ + S^- = n(n+1)/2$  applies, which can be used for the verification. If the number min  $(S^+, S^-)$  is lower or equal to the table critical value, the hypothesis is rejected. The mean value of the differences between two signs  $\leq 1$  was considered to be the statistically significant difference (chosen accuracy level).

The second applied non-parametric method was the Spearman's correlation coefficient. Statistically significant dependence between the qualitative markers in the semantically related questions was evaluated by this test. Having two random variables X and Y, whose probability distribution is not known, the *n* arrangement of their values was based on the sizes, and serial numbers  $p_i$  and  $q_i$  were assigned. The value of the coefficient was described as follows,

$$\rho = 1 - \frac{6\sum_{i}(p_{i} - q_{i})^{2}}{n(n^{2} - 1)}$$
(5)

where  $\rho$  took the values from the interval (-1, 1).

The results of the Spearman's correlation coefficient on the significance level  $\alpha = 0.05$  were calculated by a correlation matrix. The correlation matrices thus obtained showed a statistically significant relationship between the questions and their qualitative markers (criteria). To calculate Spearman's correlation coefficient, it was necessary to process the data matrix that contained point ratings of the defined qualitative markers by individual respondents. The interpretation used the resulting final profiles of their behavior and the established dependences between the qualitative behavioral markers.

The research methodology applied quantitative statistics to present the connection between qualitative markers (displaying the tendencies of their changes); the figures of the formal context of the answers corresponded to the results of the qualitative statistical analysis. Thus, the quantitative statistics were used for the graphical representation of the Spearman's correlation coefficient results (Figs. 2 to 5).

If it is necessary to find out whether there is a statistically significant difference in the assessment of the level of importance of other qualitative markers (criteria), a random sample should be extended by the number of professionally suitable respondents (Klein et al. 1997) to achieve more comprehensive test results. Even with an extended sample set it may not be possible to statistically prove the significant correlation between other qualitative markers at the significance level  $\alpha = 0.05$ . However, the identified customers of the largest forest enterprise are among the most important on the roundwood market in Slovakia, both in wood processing volumes and revenues (Ministry of Agriculture and Rural Development of the Slovak Republic 2017). Therefore, despite the low sample size, the results of the case study can be considered sufficiently relevant and reflect the behavior of the majority of customers in the selected market.

## **RESULTS AND DISCUSSION**

By means of the growth-share matrix, six major roundwood customers were identified, specifically in the quadrants stars (Customer 1, 6, and 11) and cash cows (Customers 8, 10, and 3). The customers 1, 6, 11, 8, and 10 were roundwood purchasers for the production of sawnwood, and the Customer 3 was the pulp purchaser for the paper and pulp production (Fig. 1). The selected forest enterprise has concluded long-term contracts with these customers (for the period of 1 to 3 years) for the delivery of the roundwood, considering their dominant market position. It included only short-term contracts with the other customers, mostly quarterly or a maximum of up to one year. The method of the portfolio analysis (BCG matrix) to evaluate the customer behavior was similarly applied by *e.g.* Radulescu and Cetina (2012) or Torquati *et al.* (2018). Moreover, the result of the analysis of the customer portfolio of the largest forest enterprise in the Slovak Republic represented the volume of deliveries and the flow of individual roundwood assortments to its processors, as it was also confirmed by the results of the survey of Parobek *et al.* (2014).



Relative share on total revenues (%)

Fig. 1. BCG matrix of the major roundwood customers

The sales amount of the biggest six companies covered in average more than 80% from the whole market in Slovakia (Ministry of Agriculture and Rural Development of the Slovak Republic 2017). Therefore, we focused our next inquiry only on these six companies. The results of the assessment of the roundwood customer behavior (Customers 1, 3, 6, 8, 10, and 11) were divided according to applied statistical methods. The results of the survey were a combination of significant correlation coefficient values between the examined qualitative markers and a guarantee of their logical interpretation with respect to the aim of the survey.

The most important results of one-sample Wilcoxon test pointed at the statistically significant relation among the following qualitative variables F1-F14; F9-F14; F9-F8 and F9- F12. It means that we rejected the null hypothesis at a significance level of  $\alpha = 0.05$  in the given cases. We considered the average of differences between the two variables  $\geq 1$  (accuracy ratio) for statistically significant. Concretely, we found the following results with the rating scale of their importance (Table 1). Customers attributed high importance (2) to the criterion "characteristics (quality) of wood mass - F1" and little importance (3.8) to the criterion "certified enterprise (FSC, PEFC) - F14", *i.e.* they preferred the quality instead of the forest enterprise certification when deciding about the wood mass supplier. Customers attributed high importance (1.3) to the criterion "payment terms - F9" and little importance (3.8) to the criterion "certified enterprise (FSC, PEFC) - F14", *i.e.* the customers were more interested in the business policy setting (payment terms) than in the forest enterprise

certification. Customers attributed very high importance (1.3) to the criterion "payment terms - F9" and average importance (2.5) to the criterion "quick delivery of the wood mass - F8", *i.e.* the business policy was for the customers more important than the roundwood delivery time, the distribution policy. Customers attributed very high importance (1.3) to the criterion "payment terms - F9" and average importance (2.5) to the criterion "image of the supplier - F12", which proved that the image of an enterprise is made or represents the correct configuration of the business contracts terms and loyalty of the business partners.

By means of the Spearman's correlation coefficient, the most significant characteristics of the roundwood customer behavior were identified. In general, they achieved the significance level  $\alpha = 0.05$  with at least 95% probability. Frequent changes of the contractual requirements of the customers (E5) led to changes in taking over the roundwood deliveries (A 3). A tendency can be applied, that the increase of the customer requirements in terms of goods deliveries, causes a frequent change of the contractual requirements as well as a rise of dissatisfaction of the forest enterprises (R = 0.85: Fig. 2).



**Fig. 2.** Correlation between frequent change of contractual requirements of the customers (E5) and options for taking over the goods (A3)



**Fig. 3.** Correlation between direct control of delivered goods by the customer at loading (E7) and option of the claim (A4)





The increase of the direct controls of the supplied goods by the customers during the loading (E7) caused an increased claims rate (A4). A tendency can be applied, that by increasing the direct control of the supplied goods by the customers, the claims number increases as well (R=0.72; Fig. 3). With higher quality of the logging and skidding (C7), lesser importance of the forest enterprise certification (F14) is given by the customer. This meant that if the forest enterprise provides the logging correctly, the enterprise does not have to be certified to sell high-quality wood for the customer (R = 0.91; Fig. 4).



**Fig. 5.** Correlation between non-conform sorting (C4) and acceptance of customer requirements (H6)

When the dissatisfaction with the non-conform wood sorting (C4) decreased, the competitive advantage of the supplier rose regarding the customer requirements acceptance (H6). A tendency can be applied, that when the non-conform wood sorting of the forest enterprise increased, its competitive advantage as well as customer evaluation decreased (R = -0.86; Fig. 5).

In general, it can be stated that the quantity and quality of wood (its processing and yield) and the setting of payment terms (the price of wood assortments, invoice maturity, and discount options) have the highest value for customers (wood purchasers) and present priority in concluding business contracts, as well as the supplier's choice.

The results of the case study pointed to the fact that the importance of the forestry business and production strategy is more important to their customers than the distribution policy. This fact was supported by several results of scientific work in Central Europe and other European countries in concluding business contracts as well as in the supplier's choice (Giertl *et al.* 2015; Francois *et al.* 2017; Pelli 2017), when the prevailing part of roundwood distribution has been covered by the supplier services in the form of outsourcing as well as reducing overheads and total transaction costs. Roundwood customers usually transport the wood at their own cost, mostly loading it at transport points (Gejdoš and Danihelova 2015; Ministry of Agriculture and Rural Development of the Slovak Republic 2017).

Unlike some survey results, for example, Paluš *et al.* (2018), this case study did not confirm the impact of the certification scheme (DEFC, FSC) on the image of the forest enterprise as well as its guarantee of quality management, performance, or wood sale increase (Fig. 4). The certification scheme itself does not guarantee for customers the loyalty of the forest enterprise, the guarantee of supplies, the quality of the processing of wood, *etc.* On the other hand, the result of the case study was confirmed by the fact that customers, the roundwood purchasers, perceive certification of forest enterprises only as an external image of the enterprise (Paluš *et al.* 2017).

The case study also highlighted the high demands of customers on the roundwood

and the frequent change of customer's contractual requirements related to the possibilities of taking over the goods. In this context, as Šafařík and Hlaváčková (2015) point out, the difference between the values of the wood volume measured by the seller (forest enterprise) and the purchaser (wood processor) is a significant phenomenon. These are caused by differences in the methods used to determine the wood volume. In most cases, the pressure of the customer prevails, resulting in wood volume determination according to the customer. There is also considerable pressure on the sale of associated roundwood assortments when added value is lost from the sale of already processed wood assortments for the forest enterprise. Nevertheless, major wood processors considered contracts with the state-owned forest enterprise as a quality guarantor of the services and the number of products sold on the market under survey (Fig. 1).

The results of the behavior of the selected roundwood customers in Central Europe can be distinguished and generalized with regard to their position in the BCG matrix (Fig. 1). Customers in the quadrants of stars and cash cows showed more balanced behavioral performance in the long run (time span of approximately one decade), reflecting the results of the performance and competitiveness survey of the wood-processing industry in Slovakia (Paluš et al. 2015). This was the result of their investments in the production programs, size of their processing capacities, the share of foreign capital in company assets, etc. Of course, all these behavioral patterns reflected the situation of the derived demand for roundwood, as well as offers in the form of current and, particularly, future stocks and the possibilities of availability of various roundwood assortments in the forests (Gejdoš and Suchomel 2016). This fact is documented by the development of the woodworking industry. In the 1970s and 1980s, there were sufficient processing capacities in Slovakia for both commodities such as broadleaved and coniferous wood. On the contrary, the gradual privatization of large forest enterprises in 1990s, the entry of foreign capital, and the global economic crisis at the end of the first decade of this century, caused the lack of processing capacities for broadleaved wood and the downfall of some previously prosperous large-scale operations, mostly for veneer and furniture production (Brodrechtova et al. 2014). This situation is also influenced by the current significant impact of roundwood processing for energetic use in the form of chips or pellets (Ilavský and Oravec 2000; Selkimäki et al. 2010; Díaz-Yáñez et al. 2013). The price of energetic wood is often competitive with the prices of quality roundwood assortments (Moiseyev et al. 2014; Jonsson and Rinaldi 2017) and impacts the strategy of the roundwood customers.

In contrast, forest enterprises of smaller production capacity situated in the BCG matrix in the quadrants of question marks and dogs (Fig. 1) present customer orientation on traditions and values. Portfolios of their demands are more diverse and cover the characteristics of the products and efficiency of the production processes. It appears that for these customers it is just a random activity instead of a systematic organizational corporate culture, which is also confirmed by the survey results of Makkonen and Sundqvist-Andberg (2017).

# CONCLUSIONS

1. The results of the one-sample Wilcoxon test and Spearman's correlation coefficient confirmed, with a probability of 95%, that the roundwood customers were not primarily concerned with the forest enterprise certification (Fig. 4). When selecting a supplier, priorities were focused on the areas such as the professional wood sales management

or the content and adherence to the commercial contracts (delivery times, price sessions, volumes guarantees, and sales support in form of discounts or rebates). Regarding the quality of the products and associated services, the customers attached only a little importance to the certification of the forest enterprise. The management level of the enterprise was more important for them.

- 2. Qualitative behavioral analysis of the roundwood customers revealed that neither longterm business relationships nor image or the goodwill of the forest enterprise affects the choice of the roundwood supplier. The quality of production is decisive for customers, *i.e.*, the quality of roundwood processing (logging, skidding, yield at sorting and stocking).
- 3. In addition, customers responded very rapidly to the changes in the market environment in terms of derived wood demand. They imposed rigid requirements on the roundwood supplier, which was evidenced by the high correlation between frequent changes of the contractual conditions and possibilities of taking over the goods (R = 0.85: Fig. 2).
- 4. This case study affirmed that forest enterprises should permanently monitor individual behavioral markers of the customers on domestic as well as foreign market and accelerate reaction time to the changes of the roundwood market conditions, *i.e.* increase the marketing management rate of the forest enterprises, as the results of Brodrechtova (2008) confirm. Individual behavioral patterns shall be included in the negotiation psychology as well as trading strategies of the forest enterprises. It is recommended to analyze sales policy strategies and adjust the sales policy to the customer requirements with the aim to maintain or increase revenues and consider particularities of forest land management (economic rotation time, climatic changes, insect pests, *etc.*), as well as differential land rent (Susaeta *et al.* 2014; Gejdoš and Danihelova 2015; Andersson and Keskitalo 2018).
- 5. The presented statistical methods of the customer behavior assessment in terms of their statistical capacity shall be included in management approach and considered to be the major contribution for the implementation of marketing management in forest enterprises.

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