Assessment of the competition level in the sector of bicycle manufacturers in the Slovak Republic

Vladimír Hojdik[1*], *Monika* Raková[1]

[1]University of Economics in Bratislava, Faculty of Business Management, Department of Business Economy, 852 35 Bratislava, Slovakia (EU)

Abstract. Bicycle industry has recorded significant boom recently, mainly as a consequence of global pandemic situation, but also as a result of green policies of countries. The popularity of cycling is on its all-time high, which also transferred to rising sales of bicycles worldwide. This paper evaluates current situation of bicycle industry in Slovak republic, mainly with the objection on performance of Slovak bicycle producers. With use of appropriate indicators, the paper aims to assess the rate of competitiveness among Slovak bicycle producers. For this purpose, relevant indicators as market share, concentration ratio CR_3, CR_5, and Herfindahl index are calculated and evaluated. The aim of this paper is to analyze financial results of Slovak bicycle industry producers, then measure the degree of concentration of whole industry in order to explain industry competitiveness in context of Slovak economy.

1 Introduction

The bicycle industry (known as cycling industry) is the sector of economy, which is concerned by bicycles and cycling. Within the industry, many different subjects execute their activities. The industry includes especially following groups of business entities [4] :

- o bicycle manufacturers,
- o component/part manufacturers,
- o accesory manufacturers.

However, not only these subjects are interested in the operation of bicycle industry. Very important for the overall industry functioning are also other business groups [4] :

- o distributors,
- o retailers,
- o bicycle organizations,
- o bicycle event promoters,
- o bicycle service providers.

Businesses operating in this sector are cooperating together and create complex supply chains. Such cooperation is very important and any disturbance in the supply chain will

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* Corresponding author : Ing. Vladimír Hojdik, PhD. : vladimir.hojdik@euba. ORCID : 0000-0001-6955-1677.

result in the lack of final products (bicycles) on the market – the phenomenon that is present during the times of COVID-19 pandemic.

Sector of bicycle industry has recorded growing tendency in Slovak economy. Bicycle manufacturing complies to industry manufacture and it is also subcategory of manufacture of other transport equipment. It is registered by SK NACE as autonomic business activity under the statistical code SK NACE 30.92.0, which represents not only bicycle manufacture, but also wheelchair manufacture. According to data of Statistical Office of Slovakia, following key indicators are related to subjects classified as SK NACE 30.92.0 businesses [21].

Table 1. Basic information about SK NACE 30.92.0 industry (Manufacture of other transport equipment) for years 2017-2019

	2019	**2018**	**2017**
Number of businesses	19	19	17
Total revenues (mil. EUR)	514,7	406,6	312,3
Number of employees	3872	3651	3385

By the end of 2020, seven businesses in Slovak Republic were engaged in bicycle manufacturing. These businesses differ significantly in many aspects. This research analyses differences especially from revenues perspective, and then it discusses how it influences market structure and industry competition level. All in all, this paper aims to enrich the knowledge base of this research area with new findings from Slovak bicycle manufacturing industry.

2 Methods

The aim of the paper is to assess the dynamics of Slovak bicycle industry, with special focus on bicycle manufacturers. Particularly, it measures industry concentration, based on relevant indicators. During the research process, we used the combination of general and specific research methods. General methods (especially analysis, comparison or synthesis) were predominantly used for purposes of theoretical explanation of the topic in the introductory part of the paper. Introductory part had mainly descriptive character as it outlines current situation among Slovak bicycle manufacturing sector. However, the use of specific methods was the main part of the research to achieve the aim of the paper.

Among the specific research methods, following were used:
- o mathematical and statistic methods,
- o data processing with use of MS Excel interface,
- o calculation and implementation of key indicators relevant for the research: concentration ratio and Herfindahl index.

Mathematical and statistical methods enabled the quantification of indicators that measure the competitiveness level of business sector – in this case bicycle manufacturers sector. First, market share of businesses (expressed in %) was calculated, based on total revenues of reviewed subjects. From market share values we later proceeded to quantification of another important indicator – concentration ratio.

Concentration ratio depends on market shares of businesses within the industry, and most often is identified for three (CR_3), five (CR_5) and ten (CR_{10}) businesses with highest market share (also expressed in %). In our research, we used CR_3 and CR_5 values.

The final indicator was Herfindahl index (also known as Herfindahl-Hirschmann index) which measures absolute concentration of industry. Concentration ratio and Herfindahl index are two most frequently used indicators which evaluate the level of industry competitiveness [3]. Results obtained from CR_3, CR_5 and Herfindahl index quantification became the basis for evaluation of competitiveness among bicycle manufacturers in Slovak republic. In the following table, there are basic information about the research sample – Slovak bicycle manufacturers.

Table 2. Basic information about Slovak bicycle manufacturers

Business name	Brand of bikes	Number of employees	Base
Kenzel, s.r.o.	Kenzel	20-24	Hurbanovo
ISTRO – HGA, spol s r.o.	Vedora	5-9	Hurbanovo
DEMA Senica, a.s.	Dema	25-49	Senica
Belve, s.r.o.	CTM	50-99	Stará Turá
LIBERTY TRADE, s.r.o.	Mayo, Liberty	2	Trenčín
KELLYS BICYCLES, s.r.o.	Kellys	150-199	Veľké Orvište
Cyclision s.r.o.	Cyclision	1	Piešťany

3 Results and discussion

3.1 Current situation among Slovak bicycle manufacturers

Considering the Slovak bicycle market as a whole, there is wide variety of bicycle brands available for potential customers. These bicycle brands are made especially by manufacturers from Germany, USA, Italy, Czech Republic or China. However, only seven manufacturing companies which are currently operating on the Slovak bicycle market are from Slovakia.

With the use of website finstat.sk, we summarized financial data needed to execute the research. For the purposes of the paper, business revenues represented the most important financial metric. In the Table 2, we present total revenues of bicycle manufacturers during the five-year period between 2016-2020. Among the manufacturers with the highest revenue we can include Belve, Kellys Bicycles and Dema Senica [8]. For fiscal year 2020. data were not yet available for all companies, so in the research we later worked with estimated values.

The data in the Table 3 show the development of revenues among the observed businesses. Total revenues of Belve for 2020 have not been reported for all year (12 months), but only for nine months (*). Three manufacturers: Istro – Hga, Kenzel and Liberty Trade have not reported financial data for 2020 yet.

Table 3. Revenues of Slovak bicycle manufacturers in years 2016-2020 (EUR thousand)

Business name	2020	2019	2018	2017	2016
BELVE, s.r.o.	17 433*	11 155	10 799	9 890	9 993
Cyclision s.r.o.	568	245	171	-	-
DEMA Senica, a.s.	11 880	15 537	10 492	9 647	11 192
ISTRO – HGA, spol s r.o.	230**	230	284	316	372
KELLYS BICYCLES s.r.o.	44 655	32 094	34 657	30 305	2 674
Kenzel, s.r.o.	712**	712	504	532	459
LIBERTY TRADE, s.r.o.	939**	939	993	937	1 057

* estimated value, revenues reported only for 9 months

** revenues for 2020 still not reported, so we used values from previous year

The revenues progression of bicycle manufacturers remains steady during analyzed period, without any radical change in the dynamics. Kellys Bicycles holds leading position in the whole industry asi it controls approximately half of the market. For the dataset in the Table 3 we also present descriptive statistics in the Table 4 for all of observed years.

Table 4. Descriptive statistics for total revenues in years 2016-2020

Variable: revenues (EUR thousand)	2020	2019	2018	2017	2016
N	7	7	7	6	6
Mean	10 917	8 702	8 271	8 605	4 615
Standard deviation	16 364	12 023	12 585	11 544	5 480
Minimum	230	230	171	316	372
Maximum	44 655	32 094	34 657	30 305	11 192

3.2 Key indicators for the research (chapter processed according to [14])

Market competitiveness and its changes indicates what is the quality of competition in the economy. Measurement and assessment of market concentration indicators give institutions an opportunity to monitor the competitiveness of businesses which operate in specific sector of economy [16].

The literature is home to numerous methods that evaluate the degree of competitiveness within the industry. To follow the aim of this paper, indicators of absolute concentration were calculated (these indicators quantify the degree of concentration in all subjects). Among absolute concentration indicators we include concentration ratio and Herfindahl index [10]. Both indicators are based on the calculation of market share. Therefore, the fundamental data for quantification of selected indicators are total revenues of individual businesses.

3.2.1 Market share

Market share is the basic indicator of concentration ratio. It represents the share of the individual enterprise revenues on the revenues of whole sector. Market share allows to determine, how the manufacturer performs in comparison to the other market participants – other competing businesses. Analytically, it is possible to quantify market share by the following formula [10]:

$$r_k = \frac{q_k}{q} = \frac{q_k}{\sum_{j=1}^{n} q_j}$$

(1)

where n – number of companies operating in the sector,
q_k – revenues of k company, $k = 1, ..., n$,
q – total revenues for whole sector,
r_k – market share of k company.

Market share can be expressed as relative or as percentage result. It takes values from the interval <0; 1> for the first, and <0; 100> for the latter. Extreme values indicate either full concentration of the industry – monopoly for $r_k=1$, or the absence of market operators in the sector for $r_k = 0$ [10].

3.2.2 Concentration ratio (CR)

Concentration ratio is an indicator of the market share sum held by few of the strongest industry businesses. Formula of the concentration ratio quantification is as follows [10]:

$$CR_\psi = \frac{1}{q} * \sum_{k=1}^{\psi} q_k$$

(2)

in which ψ lays in the interval <1;n> and $CR\psi$ takes values from range <0;1> when calculated in relative numbers, or <0,100> if we calculate percentage results. In practice, the concentration ratio is commonly quantified for three, five or ten strongest companies in the industry (quantification of indicators CR_3, CR_5 and CR_{10}). In some other studies, authors prefer indicators CR_4 and CR_8 quantified for four and eight strongest subjects [13, 17, 18].

3.2.3 Herfindahl index

Herfindahl index measures the absolute concentration in the industry. In the literature we may also find the concept of the Herfindahl-Hirschmann index [11]. It is widely used for sector analysis and it is well-known and commonly accepted indicator of market competitiveness [6]. It explains, how financial power (business revenues) of individual subjects impacts the concentration of whole industry. Herfindahl index quantifies the square of the market share of each subject in the industry and sums up the resulting numbers [7].

Analytical expression of Herfindahl index is as follows [10]:

$$H = \sum_{k=1}^{n} \left(\frac{q_k}{q}\right)^2$$

(3)

and the meaning of the variables remains identical, as in the previously defined formulas.

Herfindahl index H takes values from <1/n, 1>. Extreme low value $H = 1/n$ means that every company has equal market share in the industry. For extreme upper level, for which $H = 1$ there is a pure monopoly on the market – one company produces 100% of whole industry production [5].

In practice, the Herfindahl index may not be used as a number of the interval mentioned above – because in sectors with a higher number of enterprises we would operate with very low numbers. Therefore, the value of H tends to be adjusted by the appropriate multiplier, most commonly used multiplier is 10,000. Depending on what is the value H after conversion, we can classify the degree of concentration of the industry, according to the following criteria defined by the US Federal Trade Commission (FTC) :

- for *H* <1500, the industry is not concentrated,
- for *H* is in the range of <1500; 2500>, the industry is moderately concentrated,
- for *H*> = 2500, the industry is concentrated [22]. Herfindahl index values also impact how government sets and enforces competition policy [16].

The Herfindahl index as used currently was firstly applied in 1950 in dissertation thesis of O. C. Herfindahl. Later, in 1959 he used it in a study about international copper industry [12]. The similar concept (sum of squared market shares), however is known since 1940 when A. O. Hirshmann executed a trade study. Hirschmann in his paper suggests that original idea of index belongs to him [13]. Therefore, in the literature we can find concepts of Herfindahl index or Hirchmann-Herfindahl index, but both of them represent the same indicator.

Herfindahl index has been used in multiple studies to consider competition level in variety of industries, for example in banking, insurance, automotive or creative industry [1, 5, 9, 14, 15, 19, 20, 23]. Its construction, however, has some limitations – it can measure concentration only on geographically isolated markets, but cannot be applied for international companies, as the results may be misleading [2].

3.3 Quantification of selected indicators

This chapter presents and discusses calculated results, which are listed in following tables separately for different indicators – market share, concentration ratio and Herfindahl index. Table 2, Table 3 and Table 4 complete all data needed for the research purposes.

3.3.1 Quantification of market share

According to revenues data listed in Table 3, it was possible to calculate the market share of observed businesses. Market share is expressed in % and following table (Table 5) illustrates the relative strenght of businesses based on the amount of revenues.

Table 5. Market share of Slovak bicycle manufacturers during observed period 2020-2016 (%)

		2020	**2019**	**2018**	**2017**	**2016**
1.	KELLYS BICYCLES s.r.o.	58,43	52,69	59,86	58,70	-
2.	BELVE, s.r.o.	22,81	18,31	18,65	19,16	43,31
3.	DEMA Senica, a.s.	15,54	25,51	18,12	18,69	48,51
4.	LIBERTY TRADE, s.r.o.	1,23	1,54	1,72	1,81	4,58
5.	Kenzel, s.r.o.	0,93	1,17	0,87	1,03	1,99
6.	Cyclision s.r.o.	0,74	0,40	0,29	-	-
7.	ISTRO – HGA, spol s r.o	0,30	0,38	0,49	0,61	1,61

The power distribution between bicycle manufacturers reflects that three businesses (Kellys Bicycles, Belve and Dema Senica) keep the distance from other four (Liberty Trade, Kenzel, Cyclision and Istro-Hga), as the leading trio control almost 97% of the market. The leading company – Kellys Bicycles clearly holds top position during observed period with approximately 58% of market share.

Second strongest business is Belve, as it covers almost 23% of the market, while Dema Senica holds third place with more than 15% of market share. Data also show changes in power balance within the industry. In 2016, only five manufacturers were on the market and Dema Senica possessed almost one half of the market. However, during next four years

Kellys Bicycles and Belve gained momentum and Dema Senica was subsequently squeezed from the first to the third position.

Among the four weakest players, there are not any significant changes between 2016 and 2020. All businesses together – Liberty Trade, Kenzel, Cyclision and Istro-Hga are currently accounting for approximately 3% of the market, therefore their impact on the sector is almost negligible. Trinity of top manufacturers clearly dictate conditions of the Slovak bicycle manufacturing sector. Production among other four businesses is significantly fragmented and none of them comes close to the revenues level of top three producers.

3.3.2 Quantification of concentration ratio

Concentration ratio of industry is dependant on market share values. As already mentioned before, concentration ratio in the industry is most often calculated for three, five and ten strongest companies in the industry. As we analyze the sector with only seven businesses, CR_{10} quantification is not relevant. Table 6 contains already calculated concentration levels CR_3 and CR_5 for the bicycle manufacturing industry in Slovakia, based on revenues achieved by enterprises in the relevant period.

Table 6. Concentration Ratio CR_3, CR_5 and of Slovak bicycle manufacturing industry (%)

	2020	**2019**	**2018**	**2017**	**2016**
CR_3	96,78	96,51	96,63	96,55	96,4
CR_5	98,94	99,22	99,22	99,39	100

The results show stable development of concentration ratio during the period. Concentration ratio CR_3 represents the share of three strongest manufacturers which constantly control almost 97% of local bicycle manufacturing industry. Their position remained absolutely dominant even during COVID-19 recession and probably anything can threaten it in the near future. Moreover, their hegemony is not short-term at all – top three businesses dominate the market throughout whole monitored period .

Concentration ratio CR_5 reaches similar values as CR_3. This is caused by the fact, that fourth and fifth strongest business (Liberty Trade and Kenzel) account only for 2,16% of the market. As we stated above, the dynamics of the whole industry is influenced by three biggest players and four remaining companies have only minimal impact on the market operation.

Concentration ratios CR_3 and $CR5$ did not record any fluctuations between years 2016 and 2020. Comparison of both indicators makes it possible to state that Slovak bicycle manufacturing industry shows signs of oligopolistic market structure – with three very strong and four very small companies operating within the sector.

3.3.3 Herfindahl index quantification

A first step before Herfindahl index quantification, a key metric evaluating a degree of industry concentration, we determined the number of businesses in the sector to 7 (n = 7). Despite the number of industry participants is relatively low, it is still possible to execute Herfindahl index quantification. Based on the business revenues and market share, values of Herfindahl index were calculated and then collected in Table 7.

Table 7. Herfindahl index of Slovak bicycle manufacturing industry in years 2016-2020

	2020	**2019**	**2018**	**2017**	**2016**

Herfindahl index H	4179,9	3766,2	4263,1	4166,6	4390,6

Herfindahl index as a complex indicator assesses the degree of industry concentration. During the analyzed period, values of Herfindahl index stay in the range of <3766,2; 4390,6>. According to generally accepted methodology of the Federal Trade Commission (FTC), the industry can be classified as concentrated (because values of Herfindahl index sigbificantly exceed 2500) [22]. This suggestion is supported by other criterion where Herfindahl index for concentrated industry takes values which are higher than 1800 [5, 10].

Herfindahl index values calculated for Slovak bicycle manufacturing industry classify it as concentrated industry. Based on the quantified results, it could be also defined as highly concentrated industry. Currently, only seven subjects are operating within the industry while three of them have dominant position in the sector as they account for 97% of the total industry revenue, what underlines the thesis of a highly concentrated industry. Three strongest entities possess such a power that makes it very difficult for other competitors to expand their market activities.

4 Summary/Conclusion

Results obtained from the research prove that Slovak bicycle manufacturing industry is almost exclusively dependent on performance of three strongest producers. Analysis and explanation of quantified indicator values enable us to state that sector of bicycle manufacturers in Slovakia undoubtly shows signs of highly concentrated industry. According to methodology for Herfindahl index calculation, Slovak bicycle manufacturing industry ranks in the category of highly concentrated industries what means relatively low competition level and unsuitable conditions for enterpreneurship within the sector.

However, the industry in the Slovak Republic has recorded succesful development in past years, which was caused mainly by increased demand for bicycles. Moreover, sales of bicycles also increased during the COVID-19 crisis and global bicycle industry was one of few sectors not affected by economic slump.

As global trends favor a healthy lifestyle, ecological solutions, green mobility and environmental sustainability, further expansion can be expected for bicycle industry, even in the conditions of Slovak Republic.

Acknowledgement

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