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## INFLUENCE OF SALT PRODUCTION ON DEVELOPMENT OF INDUSTRY IN THE TUZLA VALLEY

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**Abstract:** This paper analyses influence of salt production on development of industry in the Tuzla valley. Industry is the most developed economic activity in the Tuzla valley, which employs the highest number of workers and has influenced for the most part on development of the region. In the Tuzla valley, two major mineral deposits of rock salt have been discovered and researched to date. The first deposit of salt water and rock salt was found in the centre of Tuzla, and the other was found on the slopes of Majeвица Mountain (Tetima). For such a complex development in the Tuzla valley were considered the elements of social, economic and physiognomic nature that were special and significant for the transformation, respectively for changes of the space, with its orientation of spatial development of economic activities, social and technical infrastructure.

**Key words:** Natural-geographic conditions, industrial salt production, the Tuzla valley, work force and economic development.

### Introduction

This paper analyses influence of salt production on development of industry in the Tuzla valley. Natural-geographic conditions enabled a very fast economic development of the Tuzla valley. Also, rich salt deposits conditioned a rapid development of industry and settlements. Industrial salt production started in Salt Factory in the settlement of Simin Han, in the Tuzla valley, in 1885. It worked on principle of boiling of salt water in the salt pans which were heated on fire. Annual salt production in that period was 4.500 tons. Due to increased application of salt in chemical industry, a new salt factory, which produced annually 5.000 tons of edible salt, was constructed in Kreka in 1891. Reserves of salt in deposit of the salt mine "Tušanj" were estimated at about 4.5 million of tons and about 1.5 million of tons in salt wells. In a new salt deposit of Tetima, reserves of rock salt were estimated at about 336 million of tons (Buljugać, Fejzić, 1985).

Today, industry of Tuzla is spreading towards the western part of the Tuzla valley and along the salt and coal deposits. At the end of 1989, reserves of salt in a deposit

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of the salt mine “Tušanj” were estimated at about 4.5 million of tons and about 1.5 million of tons in salt wells. In a new salt deposit of Tetima, the reserves of rock salt were estimated at about 336 million of tons. Along with the town sprawl, the industry and other activities developed rapidly, thus increasing the land value in vicinity of the industrial zone and in the centre of town as well. Nowadays, the central part of the Tuzla town occupies 5.026 hectares or 16.6% of total area of the municipality. This land became one of the highest values in the Tuzla valley, as the biggest industrial firms and housing structures were constructed on it. The land value becomes higher and higher in suburban settlements along the traffic routes in the Tuzla valley (Jovanović, 1987).

### **Industrial salt production in the Salt factory in Tuzla**

Industrial salt production covers the period since 1918, when construction of the first more significant industrial firms started. It was during the Austrian-Hungarian monarchy, at the end of 19<sup>th</sup> century, when industrialization in the area of the Tuzla valley started. Economic and cultural progress has started rapidly owing to the capitalist mode of production in the state, which had a strong economic, military and technical organisation (Nurković, 2001). Most of the facilities had predominantly manufacturing and artisan significance. In the Tuzla valley, the first industrial salt factory was opened in Simin Han, which was put into operation on 25<sup>th</sup> March 1885. In the first year of the work, the salt factory produced about 2.000 tons of rock salt, and only a few years later, production of rock salt was 5.000 tons. According to previous research of quality and quantity of deposits of rock salt in the Tuzla valley, the Austrian-Hungarian government decided to construct a new salt factory in settlement of Kreka, in 1886. The Salt factory in Kreka was put into operation in 1891 and had two production boilers. It was more modern than the salt factory in the settlement of Simin Han and produced significantly more salt per boiler. The annual salt production was about 2.000 tons. However, in the same year, facility for production of the briquetted salt for human food and animal feed was opened. In the period from 1884 to 1918, 507 workers were employed in the salt factory (Vujović, Stojković, 1985).

Important precondition of the first industrialization and the capitalist economy in the Tuzla valley was a construction of road network (railways and roads). The first rail track was constructed in direction Tuzla-Doboj, in 1886, at length of 57 km (Klapić, 2000). Establishment of Rock Salt Mine in Tušanj, as well as establishment of the Soda Factory in Lukavac, in 1893, was important for establishment and development of the salt factory in Simin Han. Most of the industrial firms, such as the Salt Factory and the Soda factory, were connected with deposits of rock salt,

coal, wood and a favourable communication in the Tuzla valley. Development of industrial firms was based on existing natural resources, which may be ascertained also for other industrial branches, whose programmes of development are related to that period, respectively those branches that were founded by the first industrialisation. Industry in the Tuzla valley was predominantly processing. The industrial facilities were distant and poorly connected. The Salt Factory and the Soda factory in the Tuzla valley in this period were raised with Austro-Hungarian capital (Vrišer, 1980).

Economic development in the Tuzla valley entirely changed after 1919. During the Kingdom of Yugoslavia, the mode of salt industrial production in Kreka changed, as well as the market. Domestic capital gained higher importance as there were no major foreign investments, and with such “nationalization of industry” foreign capital was partially reduced, which impeded domestic entrepreneurs (Veljković, 1980). Along with development of new industrial firms a number of workers in the Salt factory, who represented decisive factor in social-economic development of the Tuzla valley, also increased. According to Statistical yearbook from 1920, there were 18 industrial firms with 4.229 of employees in the Tuzla valley, in 1940. The highest number of the employed people was in mines 2.675 or 63.2%, respectively, followed by the Soda factory with 642 or 15.1%, respectively, in the Salt factory 618 or 14.6%, and in other minor facilities 70 or 1.6%, respectively (Klemenčič, 1980).

In the period from 1930 to 1945, the number of industrial workers in the Tuzla valley increased to 5.675. Contrary to slow development of industry, in general, in this period of the industrialisation a rapid increase in population in the Tuzla valley was evident. Slow economic and industrial development reflects also in a slow change of economic structure of population. In 1931, there were 83% of agricultural population in the area of the Tuzla valley, while in 1910 that percentage was 87%. This means that both the Tuzla valley and the whole Bosnia and Herzegovina met World War II with about 4/5 of agricultural population, having all characteristics of an agricultural area, with a low productivity and a low consumption, as main characteristics of economy and society of the time.

Since 1956, a technological process of the salt production has been continually modernized. The existing factory was restructured by “Energoinvest” Sarajevo in 1968, and with this the planned production increased from 75.000 to 185.000 tons of salt annually. The technological process of salt production in Salt Factory in Tuzla, has been developing in three phases. From the salt water, which is carried by pipes to the factory from the salt wells, firstly all scale settling particles must be

removed by special evaporators. After filtering the purified salt, water gases and gaseous oxygen are removed. This procedure is called degassing. The degassed salt water is carried to pre-heaters where it is heated up to a certain temperature. The heated salt water is transported into the first evaporator where it is kept until the beginning of salt crystallization. After that, it overflows into the second and third evaporator. By passing through evaporators, the salt water is steamed for five times, so that every hour 10 tons of table salt is produced (Vujić, Stojković, 1985).

The Salt Factory started creating a wide network of its sales and service outlets across the entire area of ex SFRJ during 1970s (Feletar 1986, 85-97). For less than five years of work in a new salt factory in Tuzla (1970-1974), the planned production of 185.000 tons of salt was achieved, while in 1982, maximum production was 194.000 tons, which represented increase in salt production by 5%. In the Salt factory, a wide assortment of products was achieved until 1984: table salt, industrial salt, road salt for ice melting, salt for leather industry, small-grained salt, pharmaceutical salt, tablet salt, salt for methane explosives, salt as an agent for water softening, cream soups, beef concentrates and detergent for washing hands (Table 1).

Table 1. Production of single products in the Salt Mine of Tuzla, 1999-2003

Type of Product	Units of measurement	1999.	2000.	2001.	2002.	2003.
Salt	t	45.670	64.780	64.980	71.190	76.000
Spices	t	50	170	200	210	230
Olba	t	4	7	8	8	10
Distilled water	t	11.000	19.000	22.000	23.000	25.000
Cream soup	kg	1.000	1.900	1.900	2.000	2.000
Soups	kg	1.900	2.300	2.500	3.000	3.100
Beef Concentrate	kg	13.400	11.800	14.100	14.300	14.500

Source: The Archives of the Salt Factory Tuzla ("Solana" dd Tuzla), 2005

The increased production of the products based on salt, as well as the work force related to it, required opening of new industrial facilities in that period. Therefore, in vicinity of the Salt factory "Tuzla", two new industrial facilities: "Dita" for production of detergents, and "Polihem" for production of petrochemical products, were established. In the Salt Factory of Tuzla, in 1985, over 400 million of the then dinars were invested into investment works and construction of new industrial facilities. In that period the first phase of reconstruction of the facilities was finished by installing a new evaporator for salt production. Reconstruction of other key facilities of the production programme for obtaining new types of salt

has been designed. Until 1991, the Salt Factory Tuzla covered the market of ex Yugoslavia with 80% of table salt. In 1991, 208.000 tons of salt were produced for the needs of ex Yugoslavia market. Number of employed workers in the Salt Factory was permanently changing until 1991. In the period from 1992 to 1999, number of employees in the Salt Factory reduced to 1.854, and production of all types of salt dropped to about 21.000 tons (Table 2, Figures 1 and 2).

Table 2. Production of rock salt in the Salt Mine “Tušanj”, 1967-2000

Year	Production in tons	Year	Production in tons
1967.	20.356	1992.	31.910
1970.	85.287	1993.	2.950
1971.	85.531	1994.	2.064
1975.	78.466	1995.	6.069
1980.	92.422	1996.	11.414
1981.	113.579	1997.	17.197
1985.	149.457	1998.	20.238
1990.	99.747	1999.	32.000
1991.	140.766	2000.	32.646

Source: Archives of the Personnel Department of the Salt Works from Kreka, 1967-2000

Today, the supply of the produced salt from the Salt Factory Tuzla on domestic and foreign market is reduced due to higher and higher competition between the Romanian, Polish, Austrian Russian, Mediterranean and other salts, whose prices are lower than of the Tuzla salt.

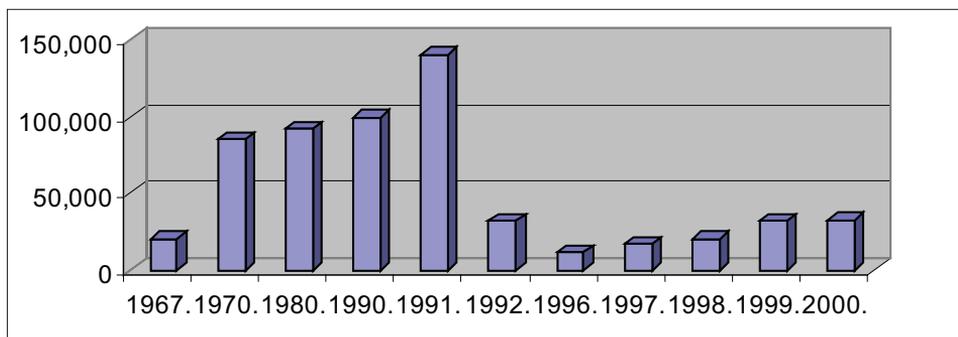


Figure 1. Production of rock salt in Salt Mine “Tušanj”, 1967-2000

Actual conditions for production and sales are very unfavourable for the Salt Factory. Production costs of the salt water itself are very high, and the unfavourable qualification structure of the employees cannot introduce the latest technology into business operations, which is required by modern salt industry.

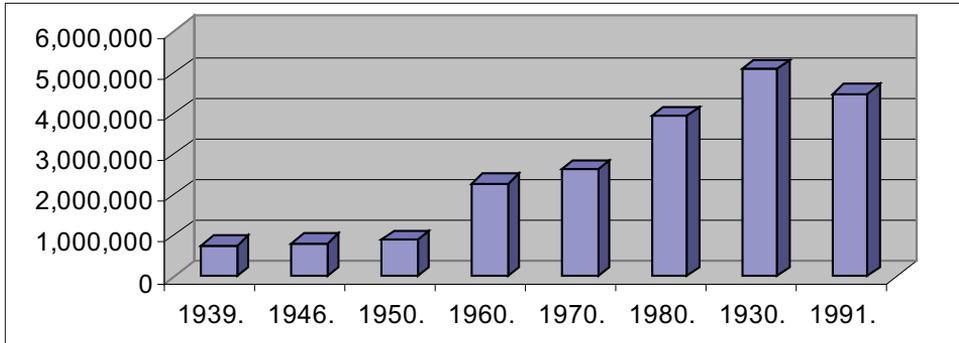
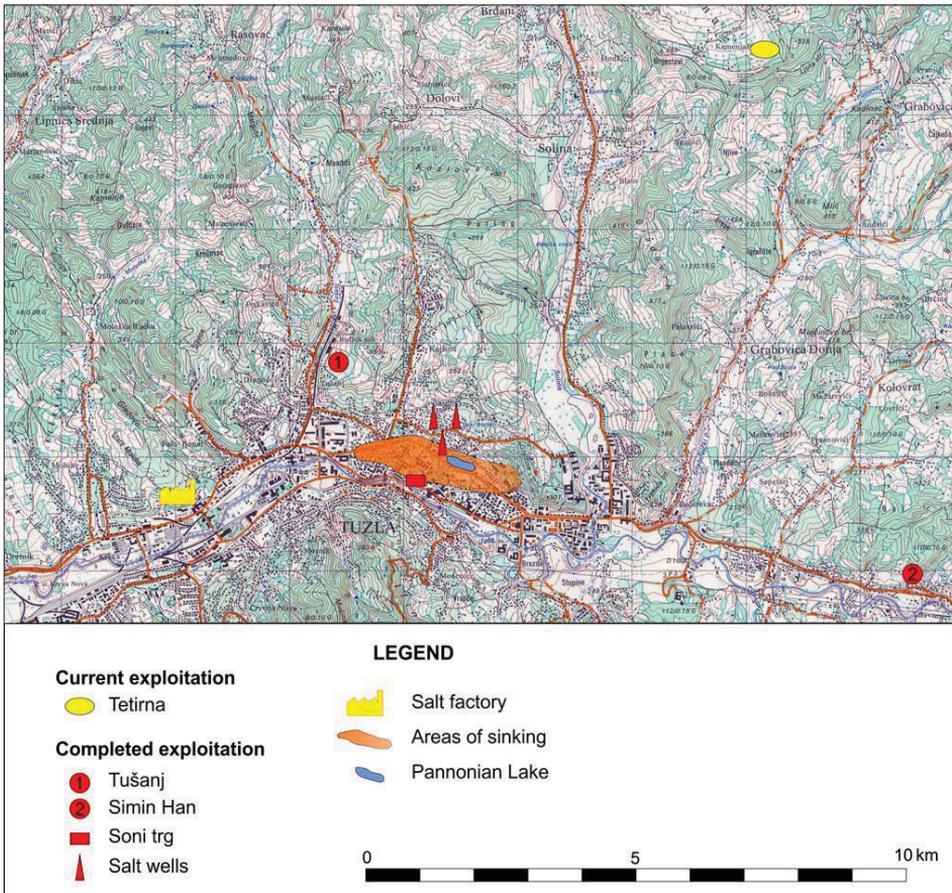


Figure 2. Production of salt water in Salt Mine “Tušanj” (in m<sup>3</sup>), 1939-1991

Source: Statistical yearbook SODASO Tuzla 2001 and documentation of Salt Mine ‘Tušanj’

### Spatial distribution of the Salt factory in Tuzla

After World War II, industry in the Tuzla valley developed on the locations, which had already been marked by the pre-war industrialisation (Slavec, 1991). Industrial firms expanded spatially by occupying larger and larger areas. On the old locations, new industrial firms also started to open (e.g. at Šićki Brod ) The industry of Tuzla valley is rather unevenly distributed in space. On the one hand, there is a strong concentration of the industrial jobs in Tuzla, and, on the other hand, there are almost quite unindustrialized areas. The Salt factory Tuzla is located in the settlement of Kreka, in vicinity of the Power Plant “Tuzla”, from where it is supplied with electric energy. It is also located near the sources of salt water Hukalo and Trnovac and in vicinity of the River Jala and the Salt Mine “Tetima” (Map 1). The new Salt Factory in Tuzla had nine facilities for production of salt and covered the area of 10 hectares. In the past twenty years none of the new settlements in Tuzla has obtained an industrial firm. The local development policy obviously gave the priority to construction of tertiary activities in the municipality of Tuzla, which was caused by extremely uneven social-economic development.



Map 1. Geographic distribution of salt deposits and the Salt Factory in the Tuzla valley, 2008  
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### Qualification structure of work force

Education is the so-called “human capital” and the most significant characteristic of the contemporary work force. General and expert knowledge represent the basic qualitative features, without which a modern industrial production cannot be imagined. It itself requires a higher general education of workers which enables more successful professional mobility and flexibility (Lorber, 2003). That need is a result of industrial development, technological progress, introduction of new technologies into production and more explosive spread of knowledge. Professional education, which along with the training in a work place forms a qualification structure, is important for productivity of the work force. With overall economic development in the Tuzla valley, education of workers in industrial firms has improved as

well. Younger new workers were more educated than those already working. The qualification structure improves owing to employment of new workers. We have followed the qualification structure of industrial work force in industrial firms and facilities of the Tuzla valley at different levels (Pak, 1980). By analysing the qualification structure of the employed people in the Salt factory Tuzla in 2008, the highest numbers of employed workers were skilled workers, 172 or 31.9% of all employees, respectively. These are followed by secondary school background: 150 or 27.8%, respectively, then the high qualified workers 93 or 17.3%, university qualification with 45 employees or 8.3%, lower educational background with 39 workers or 7.2%, semi-skilled workers 21 or 3.9%, and two-year post-secondary school qualification with 17 workers or 3.2%, respectively (Table 3).

Table 3. Qualification structure and number of employed workers at the Salt Tuzla, 2008

School background (total)	University qualification	Two-year post-secondary school qualification	Sec. school background	High qualified workers	Skilled	Semi-skilled	Unskilled
537	45	17	150	93	172	21	39
100%	8,3%	3,2%	27,8%	17,3%	31,9%	3,9%	7,2%

Source: The archives of the Salt Factory Tuzla, 2008

Despite great efforts of educational policy, which tended toward the forming of skilled work force with a network of primary and secondary schools, the Salt Factory in the Tuzla valley still has an unfavourable qualification structure. This is caused, first of all, by relatively young industrialization which relied on cheap and unskilled work force. On the other hand, it is a consequence of specific branch structure with predominance of industry with a great share of the unskilled work force (mines and chemical industry). Finally, we mustn't forget the social status of workers in the Tuzla valley. A large number of employed workers come from suburban areas and, in addition to work in the factory, work additionally on their land. Due to everyday commuting to work and working on the land, the workers were overloaded and have not expressed a particular willingness for additional education. There are also important differences in qualification structure of employed people in other industrial branches of the Tuzla valley.

### Conclusion

In the first part of the paper, general and historical conditions of influence of the salt production on development of industry in the Tuzla valley were elaborated. Rich deposits of salt, which conditioned a strong development of industry and the settlements, were also presented. It was during the Austro-Hungarian monarchy, at the end of 19<sup>th</sup> century, when industrialisation in the area of the Tuzla valley

started. Economic and cultural progress started rapidly owing to the capitalist state, which had a strong economic, military and technical organisation. Most of the facilities had predominantly a manufacturing and artisan importance. Basic data and periods of historic development of the Salt Factory in the Tuzla valley were mentioned herewith. Industrialisation in the Tuzla valley also influenced the distribution of population and population development. Industrialisation relied on agricultural population, as well as on utilisation of cheap, unskilled work force. This is why a question of development of other activities, not only the industry, was raised. At last, under influence of industrialisation in the Tuzla valley, spreading of central settlements, erasing the boundaries between urban and rural settlements, intensive development of traffic and electrical network, as well as improvement of living conditions occurred.

After 1991, economic importance of industry in the Tuzla valley also started weakening within the overall industry of Bosnia and Herzegovina. In the area of sales of its products in ex Yugoslavia, the Salt Factory and the chemical- industrial complex of the Tuzla valley cooperated with almost 5.000 clients (the most significant production and transport organisations from all larger towns). With dissolution of the state, the loss of the market and a break of business connections with clients followed. From 1992 to 1995, due to war in Bosnia and Herzegovina, a complete stoppage of production in the Soda Factory occurred, as well as in the Coke-chemical combine, which sold 75% of its products in the pre-war period out of the domestic market, mostly in Slovenia and Serbia.

It may be concluded that in the Tuzla valley we have negative forms of industry crisis. A significant factor, which influenced the appearance of crisis in facilities of the Salt factory, was aging of industrial firms. Even 55% of all industrial facilities were founded before 1950. Today, the offer of the produced salt from the Salt Factory Tuzla on domestic and foreign market is reduced due to increased competition between the Romanian, Polish, Austrian, Russian, Mediterranean and other salts whose prices are lower than of the Tuzla salt. Actual conditions of the production and sales are very unfavourable for the Salt Factory Tuzla. Production costs of the salt water itself are very high, and an unfavourable qualification structure of the employed workers is not able to apply the latest technology in business operations, which is required by modern salt production. The situation gets even worse from year to year and threatens to acquire elements of general endangerment of living, particularly in the central settlements of the Tuzla valley.

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