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ASPECTS OF TECHNICAL PROGRESSES IN ROMANIAN PETROLEUM INDUSTRY IN THE INTER-WAR PERIOD: DRILLING

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ABSTRACT. Petroleum has had an important role in the Romanian history and economy. Simultaneously with the quantity evolution of Romanian petroleum industry there had been registered also favorable quality results in different segments of these important economic branches. For example, in the drilling field the productivity recorded notable raises, the price of the drilled meter diminished between 1926 and 1936 with approximately 87% and the price of the extracted carload diminished in the same period with approximately 91%. The most important progresses in drilling were registered in the period of the economic crisis in 1929-1933. There were introduced the system of drilling by turns, the method of the unique column of tubage, the drilling was on direct lines, without deviations, the drilling speed of the well was increased, the use of the electric energy began, the amount of cement used for the realization of a well was decreased with 85-92% etc. Between the innovators who had an important role in the realization of this renewal we should mention a remarked person like the engineer Andrei Drăgunălescu. The Romanian drilling was at the highest points of the world technology, sometimes realizing innovations which were borrowed to the american technology.

АСПЕКТИ НА ТЕХНИЧЕСКИЯ ПРОГРЕС В РУМЪНСКАТА ПЕТРОЛНА ИНДУСТРИЯ В ПЕРИОДА МЕЖДУ ВОЙНИТЕ: СОНДИРАНЕ

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РЕЗЮМЕ. Нефтът е играл важна роля в румънската история и икономика. Едновременно с количествената еволюция на румънската нефтена индустрия се отбелязват и благоприятни качествени резултати в различни сегменти на този важен промишлен клон. Например, при сондирането се отбеляза значителен обем и цената на метър сондаж между 1926 и 1936 г. се намали приблизително с 87%, а цената на изваден товарен обем – около 91%. Най-значителният напредък в сондирането се регистрира в периода на икономическата криза 1929-1933 г. В сондирането се въвеждат редица нововъведения. Между иноваторите, които имат важна роля при реализация на тези обновявания трябва да се спомене забележителен човек като инж. Андрей Драгуналеску. Румънското сондиране беше сред водещите в световната технология, създавайки понякога иновации, които са били възприети от американската технология.

Petroleum has represented one of the most important natural resources of Romania.[1] Being certificate from the Antiquity, it accompanied the economical and social life of the Romanian community during Medieval Age and Modern Age. Since the half of the 19th century, the petroleum exploration has worn the industrial cloth. The year 1857 marks a triple world première for Romanian petroleum industry: the first petroleum production, the first refinery and Bucharest the first town ever to be illuminated with petroleum, all registered on international level.[2] The refinery of 1957 has set up by the brothers M. and T. Mehedinteanu from Ploiesti, with Austrian equipment. The petroleum Industry has developed incessantly. In 1857 Romania's petroleum production has been of 225 t. towards the end of the nineteenth century it has grown spectacularly, reaching 258 000 t. up to the outbreak of the First World War the maximum production has been reached to 1 885 619 t, in 1913. After the war, in 1925, the level of production during the pre-war period has been exceeded (2 316 504 t). The production has continued to increase constantly, reaching 8 784 000 t in 1936, quantity which represented maximum of the inter-war period.

It is very important the fact that petroleum production developed not just from the point of view of the quantity but also from the point of view of quality. In the next pages, we are going to treat in a conceive manner the evolution of an important part of the Romanian petroleum industrial activity during the inter-war period: the oil well drilling.

Our most important sources of documentation was speciality press of the time, especially the Petroleum Monitor, information taken from the petroleum societies, and found out in the National Archives, and in the Romanian special literature.

[1] See Gh. Ivanus, I Stefanescu, St. N. Stirimin, St. N. Stirimiu, St. Tr. Mocuta, M.P. Coloja, *The history of Romanian Oil*, Agir Press, Bucharest, 2004; Gheorghe Buzatu, A History of Romanian Oil, Bucharest 1998; Constantin M. Boncu, *Contributions to the History of Romanian Oil*, Academic Press, Bucharest , 1971.

[2] Gheorghe Buzatu, *A History of Romanian Oil*, I, Mica Valahie Publishing House, Bucharest, 2004, 36-37; Gh. Ivanus, I Stefanescu, St. N. Stirimin, St. Tr. Mocuta, M.P. Coloja, *quoted work*, 66-77; Marian Rizea, Eugenia Rizea, *Petrol. dezvoltare si (in)securitate,* Editura Asociatiei "Societetea Inginerilor de Petrol si Gaze", Bucuresti, 2007, 43-45.

Concerning the oil well drilling of the inter-war period we can assert an interesting evolution. Immediately, after the end of the First World War, the Petroleum Monitor considered that the problem of digging of new wells was an important problem of the renewal of the petroleum industry. [3] The activity evolution can be expressed by the following table[4].

Year	Number of drilled meters
1922	38.527
1925	204.402
1928	240.000
1931	139.190
1932	208.369
1933	253.209
1934	376.950
1935	312.500
1936	329.000
1937	394.000
1938	288.000
1939	256.000

We can remark that the maximum number of drilled metres was registered in 1937: 394000. Comparing to 1921, when the number of drilled meters was 55857, the rise was more than 700 %.

Concerning the efficiency of the drilling activity we can have an image looking at then next table[5] which gives a report upon the evolution of a report tone on drilled meter.

Year	The report tone on drilled meters
1922	15.3
1925	11.3
1928	17.7
1931	47.8
1932	35.3
1933	29.3
1934	21.2
1935	26.9
1936	26.5
1937	18.1
1938	23.00
1939	24.00

The highest efficiency of the report tone drilled meter, was registered in 1931, during the economical crisis when 47,8 tones on trilled meter were obtained. This fact has two explanations: during the crisis the number of the drilled meters diminished and the biggest decrease took place in 1931 on the one side and on the other side in the same period there were some rich oil land in a process of exploitation. We can consider, as a whole, that the efficiency of the drilling activity was a good one. It was even superior of the international one.

As an example, we are going to give a table[6] in which we are going to present the dynamics of this report between 1932-1936, comparing Romania with U.R.S.S. in order to case a dynamic following of the table, the presentation is realized by number rounding.

Year	Romania Efficienty t/drilled meters	URSS Efficienty t/drilled meters
1932	35	29
1933	29	26
1934	21	19
1935	27	17
1936	27	13

It can be seen that in Romania the number of tones on drilled meter was highest between 1932-1936 than in U.R.S.S, even with 2 to 14 tones.

If we are trying to compare the rise petroleum production and that of the drilled meter the report is favourable to the drilling activity. This thing is being illustrated in the next table [7], taking for example 1931.

Year	Petroleum production total number	Total number of drilled linear meters
1931	100	100
1932	110	150
1933	111	182
1934	127	271
1935	126	225
1936	131	236
1937	107	183
1938	99	207
1939	94	184

The analysis of this table is showing the fact that in the 4th decade of the past century the drilled rise percentage was constantly superior to that of the petroleum production rise. In 1932 a number of 33 enterprises realised a drilling activity. "Astra Romana" Society, "Steaua Romana", "Concordia", "Unirea", "Romano-Americana" and "Creditul Minier", all of them drilled more than 10000 meters.

Concerning the drilling technique there happened a lot of important evolutions. In 1924 "Steaua Romaneasca" Society, practices through galleries. The process was practically the same as that of coal mines. A well is digged through the oil field and then through galleries there happened a process of capturing the oil. The process was an efficient one. Currently speaking, through drilling it was managed to put out about 20% of the petroleum deposit. Through the galleries method it happened the drilling of about 60% of the petroleum deposit. This process was used on the fields of Buzau Department, at Saratu *** . The depth of the digged well was of 141 meters. The society had as main objective for the next year to introduce this process in the Prahova Department, in Campina. The petroleum gazette was estimating that such a process was proper for other oil field of the country, such for example Bustenari.

Abroad, this method was used also in Alsace[8]. Even if this method didn't have a great spreading and didn't become an usual method, it had a very important role in the field of the petroleum industry efficiency.

[3] Movement of Oil. General Situation, Moniteur du petrole roumain, (M.P.R.) 9, 1 May 1920, 253.
[4] Gheorghe Calcan, *Romanian Petroleum Industry in the inter-war period,* Tehnica, Publishing House Bucharest, 1997, 138.
[5] *Ibidem.*
[6] See M.P.R, 17, 1937, 1318.
[7] *The activity on sites of anonym societies in 1936*, M.P.R, 13, 1 july 1940, 709-721.
[8] *Gas Exploration through hollows*, M.P.R, 10, 1929, 856.

After all statistics, the period of 1927-1933 was important because there were registered many qualitative transformations in the field of drilling. The great economical crisis of 1929-1933 influenced this processes. In 1929, The Petroleum Industry Association of Romania addressed to the Industry Minister a memorial which asked for the approval of the drilling system named Rotary used in U.S.A. this system used a simplified system, being accompanied by similar operations concerning cementing. This system brought important savings of materials and contributed to a efficiency rise through the price reduction of drilling[9] . There is a fragment, of this memorial:

Minister,

American petroleum industry, after great progresses, which realised during the last years in the field of drilling art, reached to diminish to much the drilling price and indirectly the petroleum production cost.

This thing was realised by drilling more and more with the Rotary system, by using a very tubage program simple accompanied by casing cementing but also it developed because of mine authorities participation. The Romanian Petroleum industry is in the situation that if it doesn't get the same technical progresses as U.S.A, and if it doesn't reach an oil production price as that of U.S.S, it won't be able to maintain its place on the international market. […]

What we are asking by this memorial is to allowed to work in the same way as in U.S.A.…". After three years approximately 99% of the total drilled meters, were obtained through this method[10].

In 1931, the engineer A. Dragulanescu, the director of "Steaua Romana" Society presented during the "Engineers and Technicians Associations of the Mine Industry Congress" a method of using unique tubage column in the well field[11] . Dragulanescu's innovations: drilling on right hole, without deviations reductions of the column number etc. concurred to the same economical saving of 50% drilled linear meters[12].

We have obtained important successes in the derrick drilling speed. Around 1932/1933 the oil societies were reporting an average of 30-80 straight meters digged per day. Derricks of 1800 meters depth were dug within 2 months. When we managed to dig derricks in a record time (21 days, for example) even the American magazines mentioned that. The record in the drilling field has been attained by the Unirea Society which dug 395 meters in 22 hours with an average speed of 17.90 m/hour. Usually, the derricks deep of 800-1000 meters were dug in 2 months. Each year hundreds of derricks were dug (in 1926, 671 were dug). The deepest derrick was dug in 1932 by the Romanian Star Society, with a depth of 2434 meters. In 1936 the deepest productive derrick in USA had 2936 meters. In 1932, the number of the employees in the oil sites consisted of 250 engineers, 626 clerks, 581 workover team leaders, 4342 roughnecks, 3669 mechanics and qualified workers, 4636 day-laborers and watchmen, with a total of 13904 people[13].

Among the progresses of the Romanian oil industry in the inter-war period we must highlight the extension f the electric power. At the International Oil Congress from London in 1933, 2 representants of the Romanian oil industry presented the method of the electric sampling which was used to determine the nature of the strata which had to be dug. In 1932 electric power was used for 22.5% of the total drilling process to be executed[14].

We couldn't neglect the application of those innovations which led to the diminution of the cement quantities. In 1936, using the tubing system initiated by the engineer A. Dragulanescu, we managed to use only 30-60 kg of cement when tubing a derrick, compared to 380 kg in 1926. This cheap tubing method began to be used in USA as well[15].

In 1926-1936, the efficiency of the oil extracting is proved by the diminution by 87% of the costs for each drilled meter and by 91% of the oil barrel extracted[16]. The next table[17] illustrates that phenomenon:

Year	The cost on drilled linear meters in lei	The cost on oil barrel extracted in lei
1925	17.800	13.100
1927	15.400	12.300
1928	13.400	5.800
1929	10.400	5.850
1930	7.700	4.250
1931	7.000	2.000
1932	4.900	1.320
1933	4.600	1.300
1934	3.800	1.270

[9] *Simplifying Drilling Programs*; M.P.R, 10, 1929, 856.

[10] Here there is a table in which we can analyse the percentage of used methods in Romanian industry in 1931, number of wells and drelled meters in various systems in 1931.

[11] E. Fischer ,*Applying electrical character in Romania between 1931-1932*, M.P.R, 15, 1 august 1933, 861-864.

[12] *Reduction of Cost Drilling*, M.P.R, 1, 1 January 1930, 55-56. See Gh. Ivanus, I.Stefanescu, St. N., Stirimin, St. Tr. Mocuta, M.P. Coloja, *quoted work*, 251.

[13] *Record de viteza in Romania cu forajul rotativ*, M.P.R. 13, 1 july 1933, 762; *Solutiuni in chestia transporturilor* , M.P.R, 7, 1 april 1926, 601-902; *Technical Processies realized in well drilling at high depth, Societatea Steaua Romana*, MPR, 13, july 1933, 762, E.Fischer, *Technical Industrial Cronique of World Petroleum, in 1936*, MPR, 1, 1937, 13-22; *Rezultatele actiunii de foraj in Romania. Productia perimetrelor statului cuvenite pe anul 1932*, MPR, 6, 15 march 1933, 267-285; *Extractia titeiului si actiunile de foraj pe santiere in cursul anului 1932*, MPR, 7, 1 april 1933, 327-343.

[14] E. Fischer, *Aplicarea carotajului electric roman in anii 1931-1932*, MPR, 15, 1st august 1932, 861-864; *Energia electrica pentru forajul rotativ in Romania*, MPR, 14, 15 july 1933, 772-773.

[15] A. Dragulanescu, *Romanian Petroleum Industry in front of the crisis*, MPR, 8, 1937, 587-589, *Modificari in cimentarea coloanelor de tubaj cerute de Asociatia Industriasilor de petrol*, MPR. 15, 1937, 1227.

[16] Gh. Calcan, *quoted work*, 141.

[17] *Romanian Petroleum Industry in front of the crisis*, MPR, 8, 1937, 587-589. An apropriate report can be also observed in the next work: Gh. Ivanus, I. Stefanescu, St. N. Stirimin, St. Tr Mocuta, M.P. Coloja, *quoted work*, 251.

1935	3.100	1.060
1936	2.300	1.080

A special regulation without any precise terms regarding the drilling process: a derrick should be placed at least 30 meters from the border of the estate of a society located in between derricks and which had offices whose minimum distance was of 60 meters in the regions without eruptions and of 1000 meters in the places with eruptions[18].

The progress made by the Romanian drilling field made that this branch of activity of the Romanian oil industry be situated at the highest technical level. The Romanian drilling has been compared to the one in USA, which was used as inspiration sometimes and from which it took interesting solutions that imposed themselves internationally, inspiring the American technique. The Romanian specialists appreciated that the explanations to this situation should include the numerous trainings that the Romanian technicians underwent out of the country and in Venezuela.

"The Romanian sites became the meeting place of many specialists from various countries who wished to become familiar with this job"[19]. Concerning the Romanian petroleum industry, we should also mention the First International Congress of Drilling which took place in Bucharest in 1925[20]. In 1940, George Macovei, a very important geologist. Sustained a discourse at The Romanian Academy dedicated to many technicians, specialists and workers who contributed to the development of the Romanian industry: "The most important role of the Romanian technician was established during the economical crisis period of 1930."

On one hand there was a catastrophical crisis of international petroleum prices and on the other hand, there was very difficult to drill at a high depth and even there was a danger to loose some deposit. Without a fast solution and with a critical moment of the petroleum industry there was found only one solution: to reduce the cost price. And again the Romanian technician found out the proper way to escape the crisis applying in the technical field of drilling the unique column system. In this way a low cost was achieved and also a reduce waste of material and time. From this point of view the Romanian industry was an example for this other countries because they adopted the Romanian technique, all explorations becoming profitable"[21].

Romanian drilling is considered to have had a progressive evolution of all proceedings: the petroleum processing, the petroleum use[22], and the innovation.

By its production and its geographical position Romania had a special place in the petroleum map of the world but especially of Europe. In the same time petroleum had been an important element of the modern society during the interwar period.

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[18] *An incipient of mine police*, MPR, 6, 15 March 1926, 569-571.
[19] Gh. Ivanus, I. Stefanescu, St. N. Stirimin, St. Tr Mocuta, M.P. Coloja, *quoted work*, 255.
[20] E. Ficher, *World Industrial Progresses*...
[21] G. Macovei, *La contribution roumanie a la connaissance du petrole*, MPR., 15, 1st august 1940, 841-845.
[22] See Gheorghe Calcan, *Aspects of Romanian Petroleum Industry in the Inter–War Period.* – Annual of University of Mining and Geology "St. Ivan Rilski", Sofia, part IV, Humanitarian and Economics Sciences, 2005, 37-41.