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FEASIBILITY STUDY OF A TANK CLEANING STATION IN TOGLIATTI

Author applies for degree of Master of Science in Engineering (M.Sc.)

Tallinn 2015

I declare I have written the master's thesis independently.
All works and major viewpoints of the other authors, data from other sources of literature and elsewhere used for writing this paper have been referenced.
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TUT Faculty of Mechanical Engineering

MASTER'S THESIS TASK

2014 /2015 academic year, spring semester

Student: Dmitri Osmjorkin 132224MARM

Field of study: Industrial Engineering and Management

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Master's thesis topic (estonian and english languages):

Feasibility study of a tank cleaning station in Togliatti

Togliatti tsisternide puhastuskompleksi teostatavus-tasuvus analüüs

Nr	Task description	Completion date
1	Marketing study	1.05.2015
2	Technical study	12.05.2015
3	Financial study	16.05.2015

Engineering and economic problems to be solved:

Conduct the marketing analysis, outline the marketing strategy and pricing policy. Analyze the possible technological solutions for implementation of the projected production, propose the optimal technological scheme. Conduct the financial evaluation of the product by calculating the main economic parameters. Propose recommendation for the project successful implementation

Defence application submitted to deanery not later than …...… Deadline …….....

Student Dmitri Osmjorkin /signature/ ……..……. date ….....……

Supervisor Maksim Saat /signature/ …….…….…… date ….....……

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USED ABBREVIATIONS

ADR – Accord européen relatif au transport international des marchandises Dangereuses par Route/ European Agreement concerning the International Carriage of Dangerous Goods by Road

RTC – Rail Tank Car

IBC – Intermediate Bulk Container

ISO – International Organization for Standardization

SWOT – Strenght, Weaknessess, Opportunities, Threats

ITCO – International Tank Container Organization

EFTCO – European Federation for Tank Cleaning Organizations

ECD – European Cleaning Document

ECTA – European Chemical Transport Assossiation

Cefic - Conseil Européen des Fédérations de l'Industrie Chimique / European Chemical Industry Council

SQAS - Safety & Quality Assessment System

VAT – Value Added Tax

PLC - Programmable Logic Controller

MMI – Multi Media Interface

P&ID – Piping and Instrumentation Diagram

INTRODUCTION

According to Combined Standards Glossary feasibility study means “An early engineering and financial analysis of a proposed project to determine its viability” (Davidson 2009, 144). Feasibility study is made to help decision-makers understand whether the project is logical and profitable with the help of a series of technical-economic studies (Mular et al 2002, 67).

Feasibility study is the study of economic profitability, analysis and calculation of economic indicators of the investment project. The main task in the preparation of the feasibility study is to evaluate the investment costs of the project and its results, the analysis of the payback period of the project. Feasibility study is necessary to the entrepreneur to understand what the possible output of the project is and for the investor feasibility study is necessary for understanding the payback period of the invested money.

This work is intended to analyse whether the project of a new tank cleaning station in Togliatti is feasible from technological and financial points of view.

What does the work “tank” mean? In oil and gas industry it means the pressure vessel to transport liquids or gases. For this purposes are used several types of equipment. For bulk transportation there are rail tank cars, tank trucks and tank containers. And for transportation of smaller quantities on industrial scale are used Intermediate Bulk Containers (IBC) and drums (Erera 2005, 551).

Rail tank car (RTC) is used for a railway transportation of liquids and gases. Typical RTC is shown by the figure 1.

Figure 1. Typical rail tank car (“Globaltrans” homepage, 2015)

Tank trucks are used for a road transportation of liquids and gases. Typical tank truck is shown by the figure 2.

Figure 2. Typical tank truck („Oilmen's Truck Tanks" homepage, 2015)

For intermodal transport tank containers (also called ISO tanks) are widely used. This is a special type of container designed to carry bulk liquids and gases. It can be put on a railway car or on a truck chassis, thus making it a universal transportation unit for liquids. Typical tank container is shown by the figure 3.

Figure 3. Typical tank container („Asia Tank Container Association" homepage, 2015)

If there is a need to store or transport liquid on a smaller scale with volumes in around 200-1000 litres IBCs and drums are used. Typical IBC and drums are shown by the figure 4 and 5 respectively.

Figure 4. Typical IBC (“Auer Packaging“ homepage, 2015)

Figure 5. Typical drum (“Advance Drum Service Inc” homepage, 2015)

Transportation of liquids is very important in various industries, mainly in oil and gas, chemical and food industry.

And tank cleaning is an essential part of a supply chain for bulk liquid transportation.

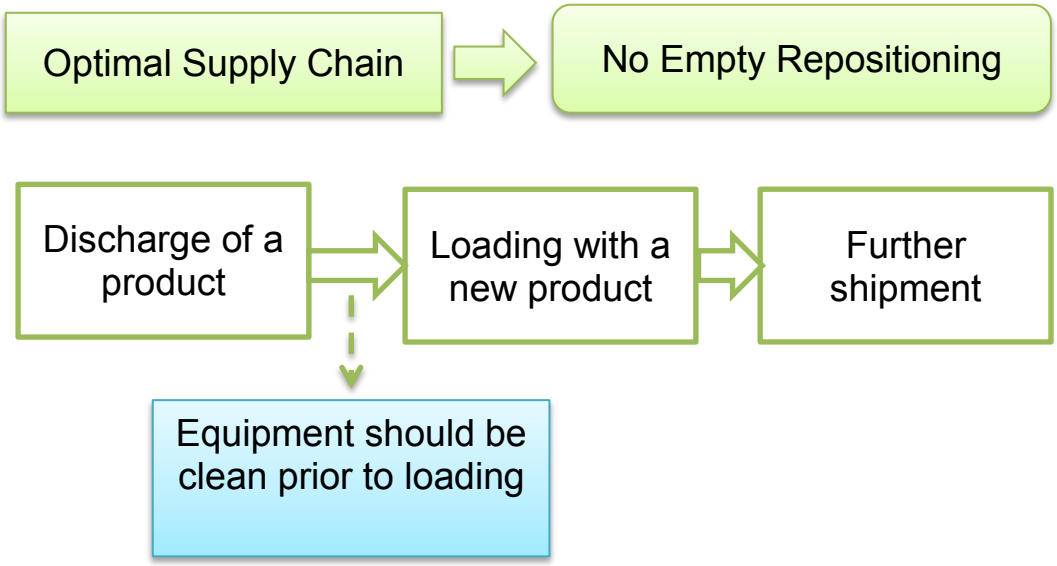


Figure 6. Simplified logistics scheme of cargo transportation

To optimize the logistics chain in international transportation companies should avoid the transportation and repositioning of empty tanks. This can be achieved by making backloads – meaning loading of a new product after the discharge. Prior to loading with a next product tank should be cleaned and that is where tank cleaning station plays its role.

Tank cleaning stations have always been an important part of a supply chain in chemical industry. With a growing market of tank container transportation there arises the need of development of infrastructure. Many large world chemical companies conduct business with Russia and large logistics company have the need to optimize the supply chain by cleaning equipment and loading it with new cargo. This is impossible without professional cleaning stations which can deal with a variety of chemical products.

In Russia at the moment there are no cleaning stations that work in accordance to European standards. International logistics companies and chemical plants are willing to work only with companies that can guarantee the quality of a cleaning process but having no possibilities are forced to use unqualified services and increase the risks of a damage of the equipment or the risks of equipment rejection by chemical plants because of left residues.

The market is unformed and has a great potential for development and that brings attention of a new investors that want to develop Russian market of tank cleaning stations. Thereby, it was conceived to construct a cleaning station, which operates in accordance to all European standards, in one of the most developed chemical regions of Russia – Samara region in the city of Togliatti known for the large chemical producers such as Kuibyshevazot and Togliattikauchuk.

The main parts of this paper include:

- Introduction to the business, which gives an overview of bulk liquids transportation and the need for tank cleaning stations
- Market study, providing marketing analysis of the business and evaluating the potential customers, demand and reasonable marketing strategies. Market analysis has been made using the Russian customs database which can be accessed via different paid sources as well as official statistical office of Russian Federation
- Technical study, describing the projected production processes, equipment and building facilities

- Economic evaluation of the project, which provides the calculations of the project possible financial results and economic feasibility

Moreover, this paper analyses the socio-economic impact of the project, describes the possible threats and gives the major recommendations for potential investors and entrepreneurs.

1. MARKET STUDY

This chapter covers the issues regarding the marketing of a service that will be offered by the project. This section describes the most important factors and other markets that can affect the market of the projected service. Market overview and analysis have been provided and based on that marketing mix, conclusion and recommendations have been outlined.

1.1. Product description

The project implies a construction of a cleaning station offering to its clients services on cleaning transport equipment which was previously carrying liquid chemicals. Services that will be provided include: tank container cleaning, tank truck cleaning and IBC cleaning. After the cleaning process client will be issued international cleaning certificate approved by all European chemical plants, transportation companies and regulation bodies. Tank cleaning station will offer different cleaning techniques depending on the last carried cargo and according to all local and European standards. Waste utilization will be made in accordance to Environmental Laws and Regulations and especially hazardous cargo residues will be utilized by a certified company.

1.2. Markets affecting the market of tank cleaning stations

Tank cleaning station is an important part of a supply chain and is affected by the same factors as the whole supply chain. Supply chain of chemical liquids mainly consists of chemical plants and chemical industry as a whole and transportation companies that transport products from A to B. Cleaning stations are integral part of cooperation between chemical industry and transportation, thus it is needed to consider both markets when analyzing feasibility of a new tank cleaning station.

Moreover, as business had become much globalized feasibility study should not only consider the local chemical market, but also have a broader overview of a world market as those two are closely interconnected.

1.2.1. World chemical industry overview

The main chemical industry countries are USA, China and Europe (especially Germany and UK). In this countries are located the biggest chemical companies like BASF

(Germany), Dow Chemical (USA), Ineos (UK), Shandong Haihua Group (China). It should be mentioned that Western European chemical industry is characterized with a lack of complete structure and the presence of some disadvantages, which includes the lack of production capacities, low integration of actives, high costs for raw material.

The market share of USA and other developed countries in production of chemical products has decreased for the past 10 years. This is caused by the fact that chemical industry of developing countries is progressing with every year. At the moment developed countries have concentrated on the production of high-tech specialties which is achieved by innovation and industry restructuring.

Herewith the production of bulk commodities, which still plays the big role for further production of end products and specialties, has mainly moved to the low wage countries with the cheap raw materials and cheap workforce.

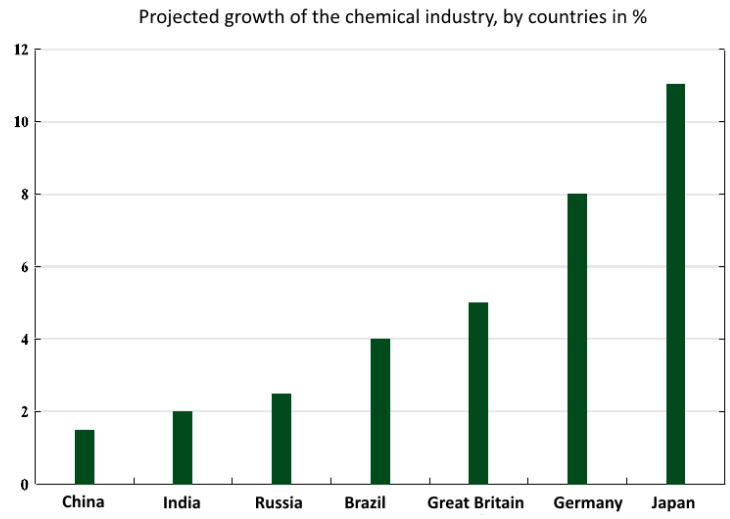


Figure 1.1. Growth of the chemical industry in various countries 2010-2020

The projected growth rate of chemical industry[1] in 2010-2020 for is shown in the figure 1.1.

The biggest chemical corporations are American companies, such as Dow Chemical, LyondellBasell and DuPont which are the leaders of the chemical market. Main clients of these companies in Russia are small-medium chemical enterprises which consume specialties for their main production. Transportation of bulk liquid chemicals from

[1] Data has been taken and considered from OECD Environmental Outlook for the Chemical Industry and statista.com

European and American plants is done using tank containers as it is the most suitable way of intermodal transport. The reason for buying from abroad is the fact that there is a lack of high-quality specialties' production in Russia.

Main Russian chemical companies such as Sibur-Neftekhim, Nizhnekamsk-Neftekhim, Orgkhim, Eurochem, Ural-kali and others are using raw materials available on the Russian market. Suppliers of these companies are mainly traders who specialize on certain products. Suppliers compete with each other and it is very important for them to have the lowest product price. This can be achieved by reducing logistics costs and leads to a heavy competition between the logistics companies.

1.2.2. Russian chemical industry analysis

In year 2014 foreign trade turnover of chemical and petrochemical products of Russia was 53.37 billion dollars[2]. Chemical and petrochemical production trade turnover in year 2014 consisted of 47.7% of export and 52.3% of import. Russian export chemicals comparing with the previous year decreased in value by 5.1% while import increased by 4.9%. The total foreign trade turnover of chemical and petrochemical products in Russia was negative (-2.44 billion dollars). Foreign trade with countries who are part of Customs union was growing more rapidly than trade with other countries. Trade with countries who are part of Customs Union makes 10.4% of all foreign trade and other countries make 89.6%. Profit of foreign trade with countries of Customs Union was positive and made 1.59 billion dollars in 2014, though profit from trade with other countries was negative

1.2.2.1. Export

In the year 2014 export of chemicals in Russia amounted to 25.46 billion USD

Leading positions in Russian chemical and petrochemical export structure traditionally have fertilizers. Its share in total export value of 2014 was 36.2%. Furthermore, large and stable supply abroad were observed for the following products (in % of the value of exports): synthetic rubbers – 9.3%, plastics and synthetic resins – 6.3, ammonia – 5.8, rubber ties and tubes – 4.6, acyclic alcohols and their derivatives – 3.3, mining raw material – 3.0, carbon black – 2.4, heterocyclic compounds containing only hetero-atoms

[2] Here and further data is taken and analyzed from official statistical office of Russian Federation

of nitrogen -2.0. Thus, represented structure of Russian export of chemical products indicates the predominance of raw materials and semi-finished products.

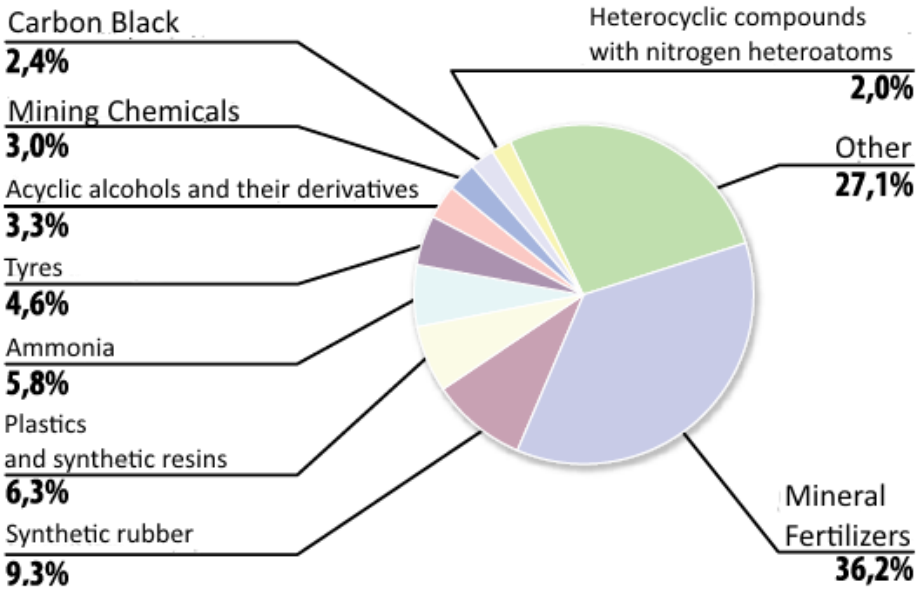


Figure 1.2. Export of chemicals in the year 2014

There was a sly reduction in export value of chemical and petrochemical products in 2014 compared to 2013 due to both reduced export prices and reduced exports of some goods. Reducing of export while reduced prices where noticed for such products as sulphur, potassium fertilizers and compound with functional nitrile group. Also the tonnage of acyclic alcohols and their derivatives export has decreased, however, the rising prices for these products has provided the rise of the value of their export.

At the same time export of products such as nitrogen fertilizers, phosphate fertilizers, ammonia anhydrous, synthetic rubbers declined in value terms, despite an increase in physical volumes of supplies of these products. Despite reducing prices high export value was observed for such products as apatite concentrate, heterocyclic compounds with only heterogenic nitrogen atoms, ethylene polymers, polyamides, carbon black, ethers, esters, alcohol peroxides and pneumatic tires (Figure 1.2).

There is a great geographic variety of Russian chemicals and petrochemicals export. In the year 2014 78% of the exported products were sold in the markets of 18 countries. The largest buyer of Russian chemical and petrochemical products became Ukraine. In 2014 the total export of Russian chemicals to this country amounted to 2805.4 mln USD or 11% of the total value of chemicals export. Traditional leader among importers of Russian

chemical and petrochemical products China moved to the second place. In 2014 the total export of Russian chemicals to this country amounted to 2121.2 mln USD (8.3% of the total value). Countries of Customs Union – Belorussia and Kazakhstan are on the third and the fifth place of importers accordingly. In 2014 export of Russian chemicals to Belarus amounted to 1923.3 mln USD (7.6% of total export value) and Kazakhstan – 1634.8 mln USD (6.4%). Fourth place from Russian chemical imported went to Brazil – 1639.4 mln USD, 6.4% of total export value. Sixth place in 2014 held Finland (1581,1 mln USD, 6.2%). Among the other foreign consumers of Russian chemicals should be noted Turkey, the United States and Poland. The amount of exports to each of these countries in 2014 exceeded 1 billion USD and their share in the export amounted to 4-5%.

1.2.2.2. Import

In the year 2014 Russian import of chemical and petrochemical products has amounted to 27.9 billion USD. Chemicals import structure forms the wide range of products, which mainly include chemicals with a high added value. Such goods are (in % of the value of imports): plastics – 23.0, tires and rubber tubes – 9.8, rubber and rubber products – 8.8, paints and varnishes – 3.8, surface-active substances – 2.3, plant protection chemicals – 1.9.

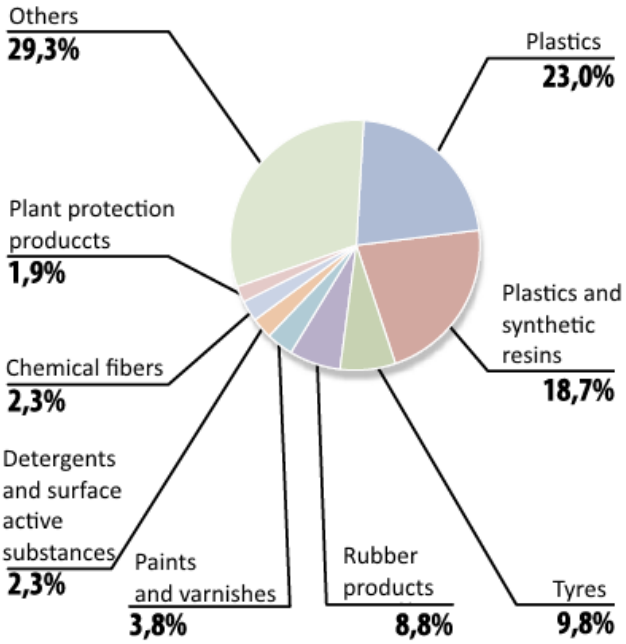


Figure 1.3. Import of chemicals in the year 2014

In addition, an important place in import holds plastics and synthetic resins, which share amounted to 18.7% and also chemical fibers – 2.3% of the total value of import. In the figure 1.3 are shown statistical data of the main positions of Russian chemical and petrochemical import.

Data analysis shows that increase of total import value amount is caused by the growth of import as well as increase in prices for import products. Increase in purchases of import production amid rising prices was observed for the products such as plant protection chemicals, paint and varnishes, surface-active substances, catalysts, laboratory reagents as well as rubber and rubber products. Growth of purchases in volume and value terms, despite the decline in prices was observed for acrylic polymers, synthetic rubbers, tires.

Reduction in import volume and value was observed for compounds containing other nitrogen-containing groups (mainly, isocyanates), polymers of ethylene, propylene polymers and other olefin polymers, vinyl chloride and other halogenated olefins. The price of compounds containing other nitrogen-containing group has grown substantially, however, the price for polyethylene and polypropylene - increased slightly. Reduction in volume of import while increasing the value due to the growth in prices was observed for plastic and styrene polymers. A significant increase in import volumes while reducing in value observed for other inorganic colorants (mainly titanium dioxide), a slight increase was observed for the procurement of chemical fibers and yarns.

In 2014, the largest leading provider of chemical and petrochemical products to the Russian market remained China. Annual imports of chemicals from this country reached 4 917.7 million. USD., Or 17.6% of the Russian import of chemical and petrochemical products. Until 2009, Germany was the largest supplier of chemical and petrochemical products to the Russian market. However, since 2010 it yielded its positions to China. In 2014, imports of chemicals from Germany amounted to 4 218.0 million USD, or 15.1% of the total value of import. The share of other countries in Russian imports is much lower. Import of chemical and petrochemical products from Belarus in 2014 amounted to 1 617, mln USD (5.8% of the value of import), United States - 1 394.1 mln (5% of the value of imports), the Republic of Korea – 1292.8 mln USD (4.6% of the value of imports, France - 1224 mln USD (4.4% of the value of import). An important supplier of chemicals to Russia among the EU member states, in addition to Germany and France, are Poland, Italy and Belgium. Among the CIS countries outside the Customs Union, the largest amount of

chemical products was imported to Russia from Ukraine (781.5 mln USD or 2.8% of the value of import).

1.2.2.3. Geography of the Russian chemical industry

On Russian Federation territory there are several chemistry bases: Central base, Volga-Ural base, Siberian base and North-European (Морозова 2013, 76).

Central chemistry base produces almost half of chemical industry products and covers Central, Central-Chernozem, Volga-Vyatka and North-European economical regions. It is orientated on scientific knowledge and consumer and it differs by a scarcity of resources and unique structure. Almost all types of chemical industry are well developed on Central chemical base: phosphate mining (Rudnickiy, Egoryevsk, Bryansk), production of phosphorus fertilizer, (Voskresensk), nitrogen fertilizer (Veliki Novgorod, Rossosh, Lipetsk), petroleum refining (Moscow, Yaroslavl, Ryazan, Kstovo, Kirishi), plastics production (Orehovo-Zuevo), chemical fiber production (Ryazan, Tver, Klin, Kursk), production of synthetic rubber (Yaroslavl, Voronezh), processing of polymers (Moscow, Saint-Petersburg, Voronezh, Yaroslavl), fine chemistry (Moscow and Saint-Petersburg) and household chemicals (Moscow, Odintsovo, Novomoskovsk, Yaroslavl).

Volga-Ural base is very good provided with raw materials (oil, gas, potash and salt, sulfur) and orientated not only on sources, but also on energetic system of Povolzhye, wastes and needs of metallurgic production of Ural. Volga-Ural chemical base produces two third of all chemical industry products in Russia. Next productions are developed in this base: production of acids, salts and alkalis (Krasnouralsk, Pervouralsk, Sterlitamak), potash fertilizers (Solikamsk and Berezniki), nitrogen fertilizers (Tolyatti, Nizhny Tagil, Salavat) and phosphate fertilizers (Balakovo and Krasnouralsk), petrochemistry (Samara, Volgograd, Ufa, Perm), gas chemistry (Almetjevsk, Saratov, Orenburg), plastics production (Samara, Volgograd, Ufa), chemical fiber production (Saratov, Balakovo, Volzhskyi), production of synthetic rubber (Tolyatti, Kazan, Nizhnekamsk, Volzhskiy), processing of polymers (Ekaterinburg, Nizhnekamsk, Volzhskiy), photochemistry (Kazan).

Siberian chemistry base is the most perspective base. It has huge stockpiles of chemical raw materials (oil, gas, coal, salt). Siberian chemistry base produces one sixth of chemical

industry products. It specializes on production of salts, acids and alkalis (Achinsk, Usolje-Sibirskoe), nitrogen fertilizers (Kemerovo and Angarsk), production of polymers (Omsk, Barnaul, Kemerovo, Krasnoyarsk, Angarsk), processing of polymers (Omsk, Tomsk, Barnaul, Krasnoyarsk), petro chemistry (Omsk, Tobolsk, Tomsk, Achinsk, Angarsk).

Northern-European base is the less developed (only 2% of all products) due to raw orientation of region. Only mining-chemical industry is developed here: extraction of apatite (Apatity), petro chemistry (Uhta) and production of nitrogen fertilizers (Cherepovets).

It is also worth mentioning that mean problems in development of Russian chemical industry are: domination of development of basic chemicals, weak development of new and research demanding types of chemical industry (especially chemistry of polymers, fine chemistry and household chemistry), low quality of products, non-competitiveness on world's market and environmental hazards.

1.2.2.4. Chemical industry of Samara region overview

In this chapter is described why Samara region can be considered as one of the best geographic locations for construction a tank cleaning station. Below are brought the main highlights of the chemical industry development in the recent years. Information has been gathered and analysed from the following resources: chemical industry news portal (http://rcc.ru/) and official website of Samara region (http://www.samregion.ru)

The volume of oil production in the Samara region in recent years increased. For example, in 2014 the volume of oil production was 15.6 million tons, which is 102% of the volume of oil production in 2013.

Investments in the period from 2013 to 2014 amounted to 48 billion rubles, and in the period from 2014 to 2018 is still 152 billion rubles. The total investment in the oil industry of the Samara region in 2013 and 2018 is more than 200 billion rubles. Investments are directed to the drilling of new wells, the use of innovative technologies in oil production, as well as increased use of associated petroleum gas by its processing.

The increase of oil production in the region in recent years has given steady growth to new jobs and wages of workers in oil industry.

Oil refining industry of Samara region includes three major refineries JSC "Novokuibyshev Refinery", JSC "Kuibyshev Refinery" and JSC "Syzran Refinery", Russia's largest producer of lubricants LLC «Novokuibyshevsk Oils and Additives Plant" and two factories processing associated petroleum gas CJSC "Otradnensky GPP" and ZAO "Neftegorsky GPP", a part of JSC "Rosneft ".

In 2014 the total volume of oil refined by Samara refineries amounted to 22.1 million tons, which is 100.4% of the volume processed in 2014.

From 1 January 2015 the refineries of the Samara region completely switched to production of gasoline and diesel fuel of Euro-4 standard and are heading to produce Euro-5 standard fuel by the year 2016.

Total investment in the refining industry Samara region from 2013 to 2018 will be 367 billion rubles.

In the year 2014 at "Novokuibyshevsk Oils and Additives Plant" was put into operation new unit of the vacuum pipe heater. The realisation of this project allows producing high quality raw materials for the production of lubricating oils that meet European quality standards.

In 2014 JSC "Kuibyshev Refinery" launched a new innovative isomerisation unit. Also, is continued a construction of large-scale catalytic cracking complex.

In 2015 JSC "Novokuibyshev refinery" will run a new catalytic reforming unit and a low-temperature isomerisation unit. Implementation of these projects will allow the production of low-sulfur high-octane gasoline component in order to produce the motor fuels that meet European Euro-5 standard of quality. Also at JSC "Novokuibyshev refinery" will continue construction of large-scale hydrocracking complex.

OJSC "Syzran Refinery" continues to build large-scale catalytic cracking complex and a new unit of diesel hydrotreater.

In the chemical industry of Samara region in 2014 the total amount of production valued to 147.6 billion rubles, which is about 13% more compared to 2013. The index of industrial production reached 102.5%.

The creation of new and modernization of existing production facilities in large chemical plants of the Samara region, such as JSC "Kuibyshev", JSC "Togliatti", LLC "Togliattikauchuk", JSC "Novokuibyshevskaya Petrochemical Company" and JSC "Tarkett" is provided by the large-scale investments. The volume of investments in the period from 2013 to 2014 amounted to 17 billion rubles, and in the period from 2014 to 2018 will amount to another 264 billion rubles.

Thus, the total investment in the chemical industry of Samara region from 2013 to 2018 will amount to 281 billion rubles.

With the help of large-scale investments the chemical industry of Samara region has created a number of high-tech innovative productions.

So, in 2013 JSC "Novokuibyshevsk Petrochemical Company" put into operation a new unit for the production of methyltretamine ether and upgraded the gas-processing unit TSGFU-3.

In addition, in 2013 JSC "KuibyshevAzot" commissioned a new unit for ammonium sulfate compaction and JSC "Tarkett" put into operation a new calendering unit.

In the year 2014, the Company "Tarkett" has put into operation a new innovative high-tech world-class production of heterogeneous linoleum with a capacity of 18 million sq. m. per year. The investment in this project amounted to 630 million rubles. CJSC "Novokuibyshevskaya Petrochemical Company" (holding "SANORS") upgraded gas fractionation unit TSGFU-2, and in July 2014 has upgraded more powerful unite TSGFU-3. Thus, the power of the whole gas processing complex of "SANORS" holding amounted to 1.3 million tons per year. The total investment in the project amounted to over 580 million rubles.

In 2014 JSC "KuibyshevAzot" put into operation new innovation unit for the cord fabric impregnation. Implementation of this project will provide access to a new market, as well as to increase the competence in the field of deep processing of caprolactam. Production capacity is up to 30 million linear meters per year. The project resulted in an additional 60 new jobs. The investment in this project amounted to 823 million rubles.

JSC "KuibyshevAzot" continues the realisation of large investment projects with foreign partners:

- Construction of a new innovative energy-efficient production of cyclohexanone together with the Dutch company «Royal DSM NV»;

- The creation of new innovative high-tech ammonia plant together with the German company «Linde Group»;

- Construction of the air separation unit with the American company «Praxair» with the use of innovative technologies.

«Togliattikauchuk" in 2014 completed the reconstruction of butyl rubber production to increase the capacity to 53 thousand tons per year. The investment in this project amounted to 1.3 billion rubles.

At Novokuibyshev branch of "Biaksplen" in 2014 launched a new innovative production line with a total capacity of 35 thousand tons per year, which increased the production capacity of the polymer film to 55.5 thousand tons per year.

At the moment JSC "Togliatti" provides large-scale reconstruction of production of ammonia and urea. After upgrading, the production capacity of ammonia unit will grow to 11.8 thousand tons per day and urea unit to 5.2 thousand tons per day.

In the end, it should be pointed out that it is continuing the work on creation of an industrial park on the territory of JSC "Tolyattisintez." Between the Government of the Samara region and the company "Sibur" was signed an investment memorandum on the creation of a favourable investment climate and mutual beneficial cooperation.

1.2.3. Russian market of bulk liquids transportation

Logistics market of bulk liquid chemical products is growing rapidly and is on the same level of growth as world tank container logistics market, which is growing by 10% a year.

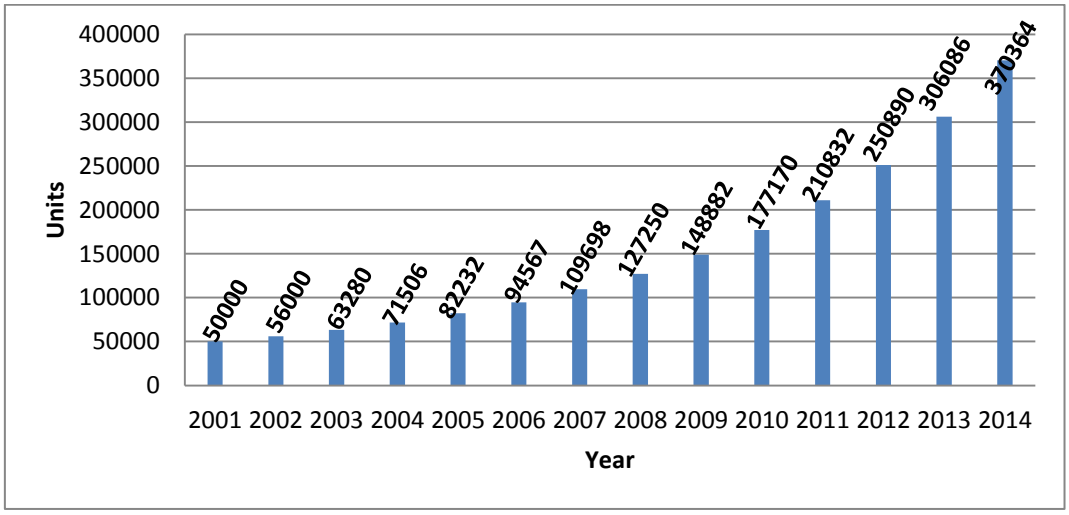


Figure 1.4. World tank container fleet (According to International Tank Container Organization (ITCO) survey

6-8 year ago the liquid transportation market in Russia was not progressing as much as it does nowadays. For the past 5 years there was a great surge in activity in this area of logistics services.

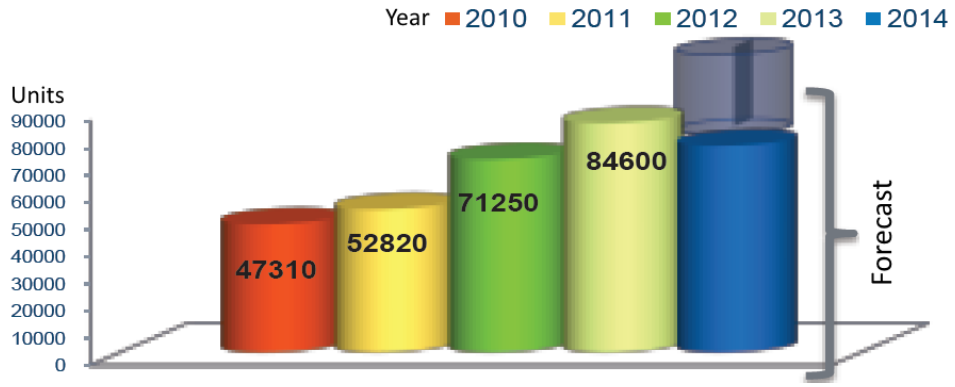


Figure 1.5. Volume of tank containers being transported inside Russia (Rough estimation according to the data gathered from Russian tank container operators)

There are about 10 tank container operators in Russia that own totally about 10 000 tank container units. This counts only about 2% of the total amount of tank containers in the world.

Import to Russia in tank containers grows from year to year along with a growth of a global tank container market and is presented by the figure 1.6. However, recently the import has been steady and industry experts believe that the growth will not be as big as before. Also weakened Ruble has been a negative factor of an import growth but it has not affected tank container market as there is no local substitution to the imported products carried in tank containers. Tank containers are used mainly for transportation of expensive specialities that are not produced in Russia.

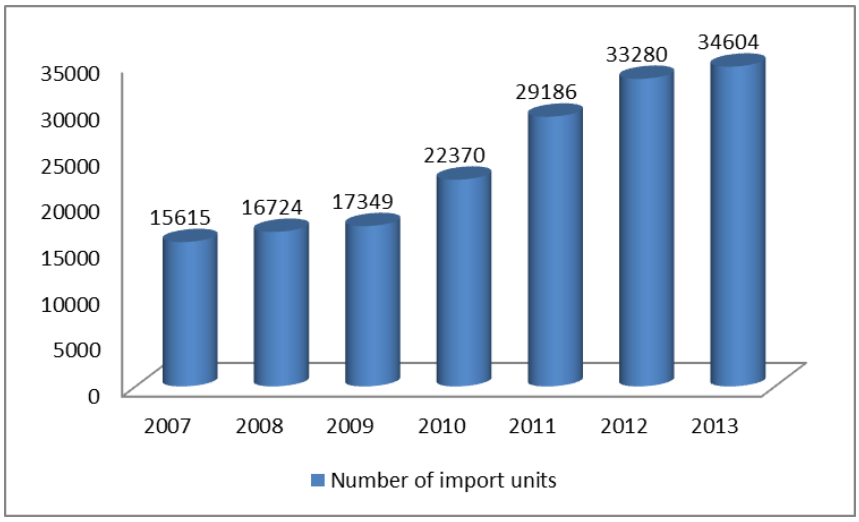


Figure 1.6. Number of tank containers with import[3]

As seen from the figure 3 about 35000 of tank containers are being imported in Russia and every unit needs to be clean.

In addition to the above it must be mentioned that the total volume of chemicals being imported to Russia by tank trucks amounted to 400 thousand tonns in the year 2014, which means about 20 000 trucks per year.

To understand the market fully Russian export of liquids should be analysed. As it is seen from the fig.4 export in tank containers is not developed as much as import. One of the reasons for that is the lack of infrastructure in Russia including the deficit of professional tank cleaning stations that can clean certain products and provide the international certificate.

The total volume of chemicals being exported from Russia by tank trucks amounted to 200 thousand tonns in the year 2014, which means about 10 000 trucks per year.

[3] Here and further data is taken and analyzed from Russian customs database

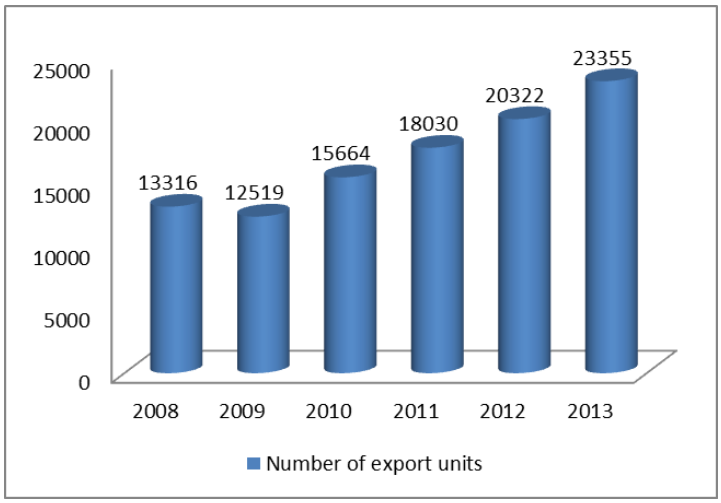


Figure 1.7. Number of tank containers with export

As seen from the analysis every second tank container or tank truck being imported to Russia is being backloaded with a new product. This means about 30 000 cleanings only from the point of the optimal supply chain. There is also a large movement of liquid chemical products inside Russia and every change of carried product brings the need of a tank cleaning.

1.3. European market of tank cleaning stations

According to European Federation of Tank Cleaning Organizations (EFTCO) at the moment in Europe functions about 750 tank cleaning stations (EFTCO homepage). Major part is located in Germany – 130, Netherlands – 50, France – 60, Poland – 26.

Total market of European cleaning stations is evaluated to do around 7 million cleanings per year. 70% of this amount is made from chemicals and 30% from foodstuff. Considering the average price for one cleaning of 100 EUR financial evaluation of the market is 700 million euro.

Tank cleaning in Europe is supervised by several organizations which collaboration resulted in the development of The European Cleaning Document (ECD). ECD is a document that proves all the procedures that were made during cleaning process. Along with a cleaning certificate it ensures the haulier that equipment was cleaned correctly in accordance to elaborated standards.

Organizations that are involved in tank cleaning station supervision include EFTCO, European Chemical Transport Association (ECTA) and European Chemical Industry

Council (Cefic). EFTCO is an organization which connects smaller local and international tank container cleaning station communities and networks. For example, EFTCO members include Italian Association of Tank Cleaning, Spanish Association, Belgium, Great Britain, Eastern-European and others. European Chemical Transport Association unites chemical hauliers and European Chemical Industry Council unites all the European chemical industry with 22 national federations, 8 associate federations and more than 650 individual members all over Europe. Cefic represents the interest of the major part of European chemical plants, therefore in cooperation with ECTA Safety and Quality Assessment System (SQAS) was developed. SQAS is a system for evaluating the quality, security, safety and environmental performance of logistics service providers „in a uniform manner by single standardized assessments carried out by independent assessors using a standard questionnaire“(SQAS homepage, 2015). In a further work with EFTCO was launched SQAS for tank cleaning station which is successfully used nowadays. If a tank cleaning station wants to work with main chemical plants and hauliers it should meet the requirements of Cefic i.e be SQAS certified.

Practically all cleaning stations in Europe are the members of EFTCO and are SQAS assessed.

The important part of a tank cleaning and SQAS is also to meet the standards of waste utilization in accordance to Directive 2008/98/EC on waste and other environmental regulation such as Directive 2000/60/EC on water. This is thoroughly checked by Cefic, ECTA and EFTCO.

1.4. Russian market of tank cleaning stations

At the moment there are no professional tank cleaning stations in Russia. There is no station which uses detergents in a cleaning process. Most of the complexes in Russia are using water pressure for cleaning and some are using steam.

Cleaning of tanks with steam is a process of removal of residues by introducing high pressure vapour into the tank (temperature is around 180degrees). As a result the product leftovers are cleaned from the walls of the tanks and gathered together with wastewater.

At professional cleaning stations wastewater goes to the industrial sewerage and then further to purification plant. In Russia most of the wastes after cleaning go either to the

traditional sewerage or directly to the nearby water bodies. It leads to the water contamination and environmental hazards. Some of the more decent cleaning companies gather all the wastes into the drums or IBCs (Intermediate Bulk Container) and then dispose it at purification plants or industrial incinerators.

Tank cleaning in Russia is performed at the below mentioned cleaning stations. Many of them are specializing in washing industrial vehicles (trucks):

- JSC Kazanorgsintez, Kazan
- LLC Neftetranslogistik, Sterlitamak
- LLC Lenhimsintez, Saint-Petersburg
- IP Sorokin, Dzerzhinsk
- LLC Atas, Mytischi
- VK , Kstovo
- LLC Avangard, Perm
- PPS Kombinatskaya, Omsk
- LLC Ekza, Samara

There are no legislations that regulate the cleaning of equipment carrying chemical products as well as no associations representing the conjoint ideas and standards on cleaning. However, all Russian chemical plants have their own standards and requirements for transportation equipment, which also includes the requirements for cleanliness. Normally, for a chemical plant it is enough to provide a document proving that the process of steaming has been performed.

In case of a hazardous cargo transported by rail there are sanitary regulations СП 2.5.1250-03 «Санитарные правила по организации грузовых перевозок на железнодорожном транспорте – Sanitary regulations on the organization of cargo transportation by rail». And in case of transportation of hazardous cargo by road only ADR regulation is valid (European Agreement concerning the International Carriage of Dangerous Goods by

Road). Waste utilisation is regulated by the Federal Law №7 on Environmental Protection and Federal Law №309 on Production and Consumption Wastes.

1.5. Marketing mix

There are a lot of different components to any marketing strategy and plan. While these different components represent a variety of activities meant to bring buyers and sellers together for a specific transaction, they fall into four specific categories. These categories are often referred to as the "four Ps" of marketing: Product, Price, Promotion, and Place (Liang 2013, 6)

Service customers may include

- Residents of "Togliattisintez" industrial park, their clients and service providers
- Nearby chemical plants with own equipment – "Togliattikauchuk", "Samaranefteorgsintez", "Kuibyshevazot" and others
- Logistics companies serving chemical plants

The offered service of tank cleaning is demanded by logistics companies and chemical plants, therefore it is obvious that marketing plan should imply business-to-business (B2B) marketing.

1.5.1. Product

Provided services:

- Tank container cleaning;
- Tank truck cleaning;
- IBC cleaning.

Cleaning of transport equipment can be made from different types of liquid products – foodstuff and chemicals including hazardous. Tank cleaning station will also provide heating and storage options.

Name of products that are being carried in transport equipment and that need to be cleaned and disposed:

- Formalin;
- Carbamide;
- PVA dispersion;
- Acrylic emulsion;
- Resins;
- Aniline;
- Dispersant (supronaft) pp;
- Antiknock additive ADA;
- Sunflower oil;
- Naphthalene;
- Industrial oil;
- Ethylene glycol;
- Mineral oil;
- Propylene glycol;
- Formaldehyde resin;
- Methacrylic acid;
- Ethanolamine;
- Diethanolamine;
- Triethanolamine;
- Tall oil;
- Dibutyl Phthalate;
- Dioctyl;
- Ethylhexyl acrylate;
- Sunflower oil fatty acid;
- Tall oil fatty acids;
- Phenol;
- Glycerol

1.5.2. Price

The wholesale price of goods is determined on the basis of the current situation on the domestic and foreign markets, as well as the level of profitability sufficient to maintain a stable condition and solvency of the organization. Pricing strategy mostly defines as competitive pricing – setting the price on the level of competitors.

Table 1.1. Name of the service and price (in RUB)

№	Name	Unit	Price without VAT	VAT, 18%	Price with VAT
1	Tank container cleaning	Pc.	7 118,64	1 281,36	8 400
2	Tank truck cleaning	Pc.	6 525,42	1 174,58	7 700
3	IBC cleaning	Pc.	169,49	30,51	200

1.5.3. Place

Service will be offered in Russia, Samara region, city of Togliatti. Samara region is reach of chemical enterprises that will need the service of tank cleaning. Moreover, tank cleaning station will be located in industrial park “Togliattisintez” which will give additional advantage in respect of potential clients. Togliatti is located on the way from Omsk and Ufa to Europe – main petrochemical regions of Russia, which makes it a very attractive place for logistics companies to clean equipment.

1.5.4. Promotion

As the customers of the described service of tank cleaning are limited to chemical industry companies and professionals dealing with liquid products the fundamental of promotional mix should include personal selling and direct marketing. Direct marketing means communicating directly with other business representatives by the means of emails or phone-calls. This method allows representing the service directly and describing the possibilities and advantages of using the service. One of the most important factors in promotion is communication strategy which in the current service must rely on positioning

statement. Positioning in this respect means the strategy of differentiation – showing and explaining the customer what and how you do differently and why it is better than others. (Kurian 2013, 216).

1.6. Conclusions and recommendations

As the result of a marketing study it can be concluded that the business of tank cleaning station implies business-to-business marketing. The target market of the offered service – cleaning of transport equipment from chemicals – is chemical industry and transportation companies that serve chemical plants. Marketing strategy is based on a direct marketing and a strategy of differentiation.

The market of tank cleaning in Russia is unformed; infrastructure for liquid transportation is very weak. In the same time chemical industry and transportation market is growing and it brings the need of infrastructure improvement i.e. the need of new tank cleaning stations.

Recommendations for the project would include the following:

1. Establish a strong contact with the residents of Togliatti industrial park to provide the business with the regular customers
2. As the cornerstone of a marketing strategy work out a detailed justification of how and why the new tank cleaning station is better than others
3. Aim to become the member of EFTCO as fast as possible to attract more European clients that work in Russia

2. TECHNICAL STUDY

In this chapter is described the process of cleaning, provided a detailed manufacturing process, plant size and needed machinery and equipment, plant location and layout, building facilities and the raw material and supplies for the operation of a new tank cleaning station in Togliatti

2.1. Tank cleaning introduction

Tank cleaning is a difficult specialized task that can be performed only by qualified personnel. If the transport equipment was previously carrying hazardous cargo its cleaning has to be performed only by approved cleaning station in order to secure the right waste utilization in accordance with Directive 2008/98/EC on waste.

Prior to loading with a new product tank should always undergo the procedure of cleaning unless it is loaded with the same product. It is desirable to clean the equipment without long delays because some residues can harden with time or can get in contact with air or moisture and undergo some chemical changes which can damage the tank shell with corrosion.

The post important thing in tank cleaning process is a disposal of chemical residues which is usually the most complicated and costly part of the whole operation. Tank cleaning station should be ensured that that the residues of hazardous cargo in the tank after discharge are not exceeding the amount prescribed by local environmental regulations. In Russia, for example, it is СП 2.5.1250-03 «Санитарные правила по организации грузовых перевозок на железнодорожном транспорте» ("Sanitary rules for the organization of freight traffic on the railways") which prescribes the maximum amount of 10kg per tank.

Prior to accepting equipment for cleaning tank cleaning station should get all the needed information concerning the last carried cargo and determine the recommended cleaning method and disposal possibilities. Disposal options depending on the cargo hazard class may be chosen from the following: incineration, settlement, filtering, dumping and should be picked out in accordance with the demands of the local authorities (Maagdenberg 2011, 152).

Modern cleaning technology reduces the dangers for the personnel by limiting the exposure of personnel by the use of automated cleaning heads with spinning nozzles inserted into the tank. Some products require a special cleaning medium such as detergent (caustic or acidic), emulsifier or a solvent. If the residues have been hardened it is possible to remove it by a steaming process or by a high pressure water. For removal of dried resins steaming with xylene or toluene is used (Maagdenberg 2011, 169).

Ultrasonic equipment can be used to speed up the process of cleaning. Cleaning station should also consider the effect of a cleaning method on the stainless steel of the tank internal surface. Some products upon heating or in contact with water can release free chlorides. It results in corrosion of a tank shell.

After the cleaning process cleaning station provides a certificate which shows the procedure that the equipment has undergone so that it could be checked the compliance with the chemical plant loading next product. Sometimes cleanliness chemical testing is demanded but normally it is not required as well as a visual inspection of a tank. For specific products even a throughout chemical inspection do not guarantee the cleanliness of a tank for carrying the next loaded product. In this case in addition to the standard cleaning sterilisation and deodorisation are required.

2.1.1. Theory of cleaning

Cleaning work is about moving chemical materials from where they are not wanted to where they are so (Durkee 2006, 32).

There is a number of cleaning techniques available for different types of contamination and cleaning objectives.

Mainly there are three types of cleaning: chemical, mechanical and hydrodynamic. Different techniques are shown in the table below:

Table 2.1. Types of cleaning

Hydrodynamic	**Chemical**	**Mechanical**
High pressure (cold water) – 250 to 1200 atm	Steaming	Scraping
Medium pressure (hot or cold water, with or without detergents) – 50 to 250 atm	Chemical solutions	Drilling
Low pressure (hot or cold water, with or without detergents) – 2 to 50 atm	Solvents	Brushes
		Pigging

For cleaning of tanks from liquids the main modes of cleaning include chemical and hydrodynamic types. The most suitable cleaning technique follows from the cleaning objective and depends on three main factors: hydrodynamic impact, temperature and detergents, which are added to the water. Below is shown the importance of each factor in the cleaning process (Harrington 2001, 178):

- High pressure water cleaning (over 250 atm). Factors – hydrodynamic impact 100%
- Medium pressure water cleaning (50 to 250 atm). Factors – hydrodynamic impact 60%, chemicals 20%, temperature 20%
- Low pressure water cleaning (up to 50atm). Factors - hydrodynamic impact 34%, detergents 33% , temperature 33%

It is seen that hydrodynamic impact is a very important factor in all water cleaning types. Impact depends on the pressure of the pump as it means the better combination of mass

multiplied by velocity. In many cases impact alone is enough; however some residues of greasy or oily nature normally may require detergent and high temperature for cleaning.

Approximately 95% of deposits can be removed using medium pressure hot or cold water, with or without a chemical additive, however, there are also a small number of products and chemicals which can only be removed by special solvents – it is explained by the fact that these product may explode or form solid matters in contact with water. In the table below are presented some chemical products and the pressure needed to remove this kind of deposits.

Table 2.2. Chemical products and pressure needed for cleaning (Harrington 2001, 185)

Type of deposit	Pressure, atm
Acrylonitrile	400
Alkyd resins	500
Carbon (coking)	750
Calcium carbonate	200
Epoxy resins	650
Emulsion polymers	600
Isocyanates	800
Synthetic latex	500
Light oils	100
Methyl Methacrylate	400
Crude oils	200
Phenolic resins	500
Polycarbonate	400
Poly Vinyl Chloride (PVC)	300

Poly Vinyl Acetate	400
Paint (emulsion)	400
Paint (epoxy)	600
Paint dried	800
Vinyl emulsion polymers	500

As it was said earlier an important factor influencing the length and quality of cleaning is the temperature and pressure of water. Tank cleaning process is partly a chemical process and temperature rise in most cases accelerates this process. The viscosity of the oils and fats also decreases with increasing temperature, which facilitates the separation of residues of cargo from the tank surface. As can concluded that cleaning efficiency increases with increasing temperature.

Increasing the pressure of washing water also increases the efficiency of cleaning. As shown by experimental studies, the combination of a slight rise in temperature of washing water and water pressure gives a much greater effect than a significant increase in only one parameter of the wash water (pressure or temperature only) (Jezequel et al 2009) (Kelly 1981).

The concentration of chemicals in the washing solution also plays an important role in ensuring the quality of tank cleaning. Many think that the high concentration of chemicals in the washing solution increases its efficiency. However, it is not so, because at higher concentrations of detergent comes the so-called inversion effect, which may lead to an increase in the layer of mud on the tank surface. Conversely, weak solutions (especially solutions of acids or bases) are most efficient at removing residual cargo in the cleaning process.

Tank cleaning depots all over the world are using pressure cleaning techniques in combination with chemicals to clean rail tanks, tank trucks and tank containers.

There are various types of pressure cleaners available on the market and the choice will always be a compromise between advantages and disadvantages (Skaarup 1985, 214).

There are different manufacturers of pressure cleaning machines which advise the products with different characteristics. Specific details are available from the product catalogues or some time it is available only directly from manufacturers upon request.

For installation of a cleaning machine is also needed installation of pumps and water connections. If detergent is required in the cleaning process air compressors should be installed as part of injection system.

There are cleaning machines that may work under pressure of 1 to over 250 atm and it is possible to change the pressure in this interval depending on a cleaning objectives.

High pressure water cleaning systems advantages include economic use of water and high level of contamination removal and from disadvantages can be indicated the high cost of equipment and difficulties in maintenance of machines (pumps, cleaning heads etc)

Low pressure water cleaning system equipment is cheaper but the water consumption is high. However, recently have been developed systems with low pressure and low water consumption. The main disadvantage of this kind of system is a small range of products it can clean.

When using medium and low pressure cleaning systems detergent application plays more important role in the cleaning process. Detergent is applied using the special injector systems. Injector is connected to the water supply of the cleaning system and have and intake for water, detergent and air (Skaarup 1985, 220).

It is possible to combine injector systems with cleaning systems of different pressures.

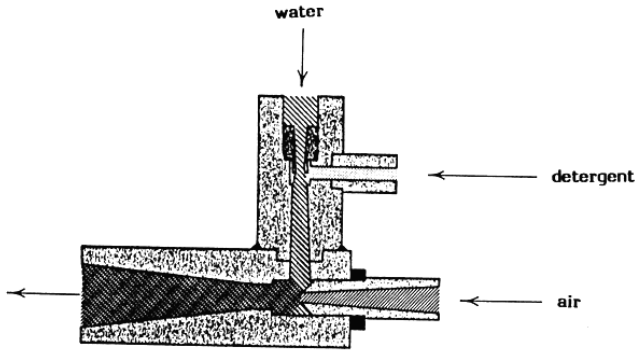


Figure 2.1. An injector showing intake of water, detergent and air. The intake of detergent and air can be closed (Skaarup 1985, 217).

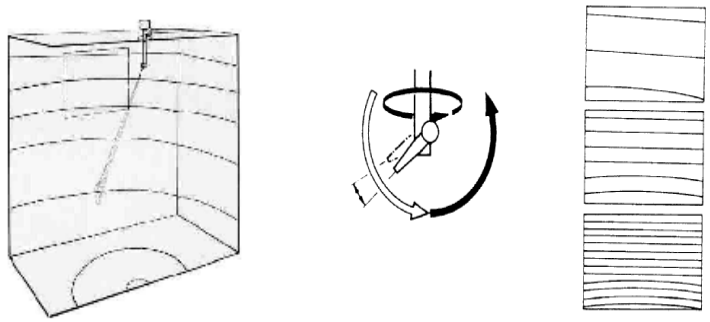
2.1.2. Tank cleaning equipment

The main part of tank cleaning is tank cleaning machines which can be divided into two different types: stationary and portable.

Portable cleaning device is placed in the tank and then removed after the completition of a cleaning process. Stationary cleaning device is placed permamently in the tank and is not removed during process, storage or transportation (Tank washing technology, PNR, 2015).

Example of a stationary cleaning machine is shown by the figure 2.2. Ordinary cleaning divices are usually single- or dual-nozzle, however, there are also more modern variants with four nozzles.

Figure 2.2. Dual-nozzle “Toftejorg i65” (on the left) and single-nozzle Toftejorg FT270FT (on the right) cleaning machine (“Alfa Laval” homepage, 2015)



(a) **(b)** **(c)**

Figure 2.3. Working principle of stationary cleaning machine (taken from Gamajet product broschure):

(a) Scheme of a spiral cleaning

(b) Movement of a cleaning machine nozzle

(c) Tank cleaning and pitch angle relation (nozzle angle)

The drive control of a nozzle of a stationary washing machine can be carried out by introducing washing liquid via the control unit or by the use of separate pneumatic or hydraulic drive. Under the effect of hydraulic fluid flow control mechanism provides the nozzle movement in the horizontal (nozzle makes one rotation in about 1 minute) and vertical plane (generally from 0° to 180°) in accordance with a predetermined program, which provides a surface treatment of a tank in a downward spiral. Below are the characteristics of stationary cleaning machines:

Table 2.3. Characteristics of stationary cleaning machines (average based on equipment brochures of several suppliers)

Washing fluid pressure, bar	Nozzle diameter									
	8 mm		10 mm		12 mm		14 mm		16 mm	
	Consumption rate, m^3/hour	Jet length, meters	Consumption rate, m^3/hour	Jet length, meters	Consumption rate, m^3/hour	Jet length, meters	Consumption rate, m^3/hour	Jet length, meters	Consumption rate, m^3/hour	Jet length, meters
6,0	4,8	9	7,4	10	11,5	12	17,3	14	21,3	17
8,0	5,5	12	8,3	14	13,1	16	19,2	18	25,8	22
10,0	6	13	9,2	15	14,3	17	31,3	19	29,4	25

Usually manufacturers of stationary cleaning machines provide the products with pre-installed programmes of pitch angle changing and rotation ratio. This enables to perform different types of cleaning as well as pre-cleaning procedure (program 4) if needed.

- Program №1 – 0,5 ^{o}/rev
- Program №2 – 1,5 ^{o}/rev
- Program №3 – 3,0 ^{o}/rev
- Program №4 – 27 ^{o}/rev

To determine the time of a cleaning cycle of a stationary cleaning machine it is needed to multiply the angle of a cleaning sector by revolution time and this result divide by the pitch angle

For example, for pre-cleaning procedure:

- Pitch angle – 27^{o}
- Full revolution time - 50 seconds
- Cleaning sector – full- 180^{o}.

Cleaning cycle = (180x50) : (27x60) = 5,5 minutes.

Then, depending on the nozzle diameter and the pressure of washing liquid it is possible to determine the amount of water needed for a cleaning cycle

- Nozzle diameter – 10mm,
- Water pressure – 8 bar,
- Water consumption – 8,3 m^{3}/hour

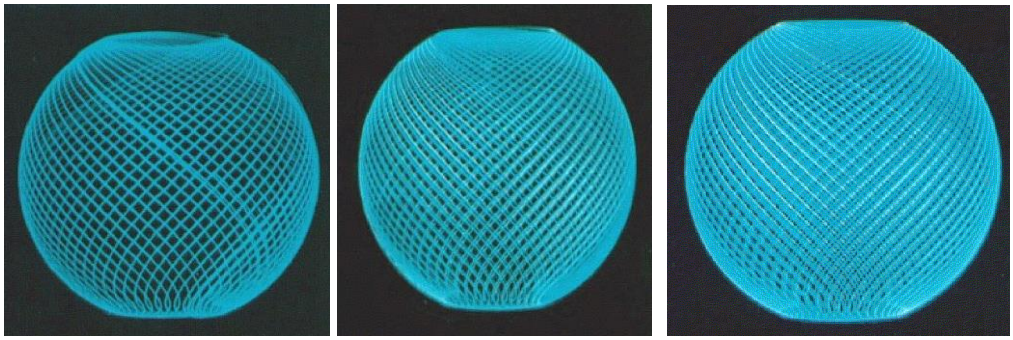
(8,3 : 60) x 5,5 = 0, 76 m^{3}.

Unlike stationary cleaning machines, portable machines do not permit to clean a predetermined portion of the surface of a tank. During the cleaning process nozzle describes the sphere, so the cycle time is determined by cleaning purposes. For pre-wash a

short cycle is used, amounting to ⅓ or ⅔ of the full cycle, for the final cleaning only full cycle is used.

(a) (b)

Figure 2.4. Dual-nozzle Cloud Inc “The Sellers 360” (a), triple-nozzle cleaning machine «Gamajet» (b) (official product catalogue of “Cloud Inc” and “Gamajet”, 2015)



1/3 of a cycle (20 rotations) 2/3 of a cycle (40 rotations) Full cycle (60 rotations)

Figure 2.5. Cycles of a cleaning machine (“Cloud Inc” homepage)

For each revolution of the machine around a vertical axis, the nozzles perform 2.5 revolutions around the horizontal axis. A full cycle of the machine is considered to be 60 revolutions around its vertical axis.

Below are the characteristics of portable cleaning machines.

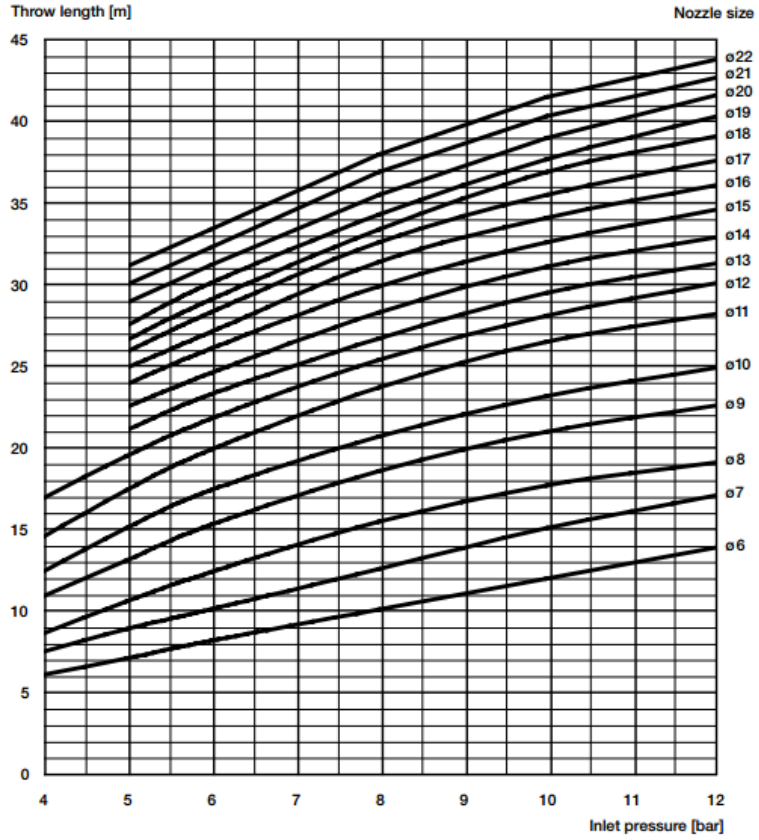


Figure 2.6. Jet length depending on the nozzle diameter and washing fluid pressure (Example of Alfa Laval Gunclean Toftejorg i40S) ("Alfa Laval" product brochure, 2015)

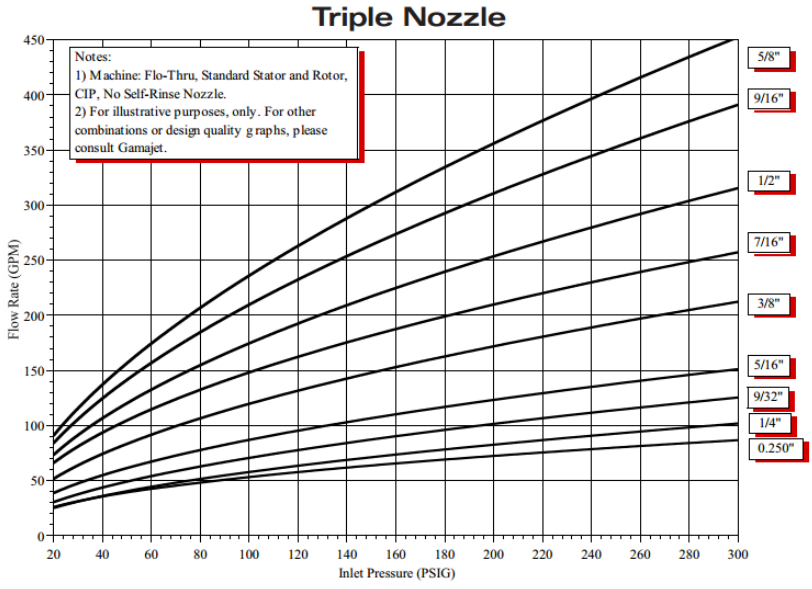


Figure 2.7. Triple-nozzle cleaning machine characteristics (Example of Gamajet VI) ("Gamajet" product brochure, 2015)

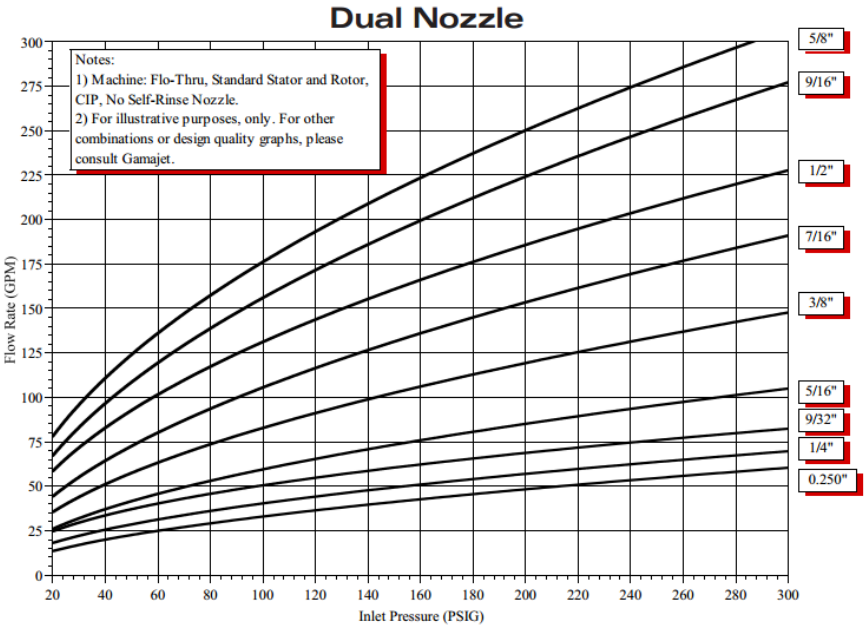


Figure 2.8. Dual-nozzle cleaning machine characteristics (Example of Gamajet VI) ("Gamajet" product brochure, 2015)

Comparative characteristics of portable cleaning machines can be found from Appendix A of this work.

2.2. Equipment and machinery for the project

Right equipment choice is a very difficult task which should be carried out by experienced and recognized professionals.

The market leader and the most-known provider of ready solutions for tank cleaning is the company “Gröninger Cleaning Systems BV“. It is pointed out by many industry professionals that Gröninger is renowned for its quality cleaning systems (Reitemeier 2014, 25)

During negotiations and relying on the input data that it is required to build a tank cleaning station which can handle up to 95% of the cargoes was selected a technological module, which includes all the necessary equipment to start a production right after installation.

Module

- High pressure pump 100 bar

A high-pressure pump type M6000 / 100TC.

Plunger pump consists of a ceramic plunger and copper valve housing. The pump includes an electric motor with a V-twin engine in a protective frame made of stainless steel, pressure regulator, safety valve, pulsation dampener and a pressure gauge.

Table 2.4. High pressure pump characteristics

Type	M6000/100TC
Power	100 L/min - 100 bar
Motor	22 kW
Electric power	3 x 400 V - 50 Hz.
Max temperature of water	80°C
Code	M021123

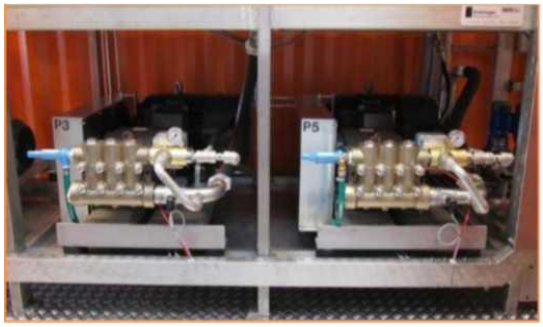


Figure 2.9. Pumping unit

- Booster pump

One booster pump system for high pressure water supply consists of:

- A 6.000 - 3 bar booster pump integrated in the water supply line.
- Pressure gauge
- Two butterfly valve of stainless steel DN50 to switch between hot and cold water

Integration into the system software.

Code: M025101 & M015030.

- Detergent injection system

Figure 2.10. Injection system

Metering pump for measuring the alkali in the suction hose of a high pressure plunger pump.

High-pressure pump is controlled by PLC controller, which sets the rate of pulsation with respect to the number of rotor nozzles that work. Measuring power: 0,2 - 1,2 % Code: M031013

Integration into the system software.

- Rotary cleaning head for tank containers

One rotary cleaning head made from stainless steel. Rotary cleaning head is driven by water and has the speed of rotation 15-20 rot/min. Two high performance spraying nozzles are included.

Table 2.5. Cleaning head characteristics

Max pressure	200 Bar
Max power	200 L/min
Max temperature	90°C
Material	Stainless steel

Rotary cleaning head is supplied, including

- ✓ One pneumatic hoist to put the cleaning head into the manlid of the tank.

Table 2.6. Pneumatic hoist characteristics

Max weight	250 Kg
Material	Stainless steel
Air consumption	2 m3/min. - 7 bar
Max lenght	5 m
Speed	18 m/min
Code	560-471

- ✓ One casing of the rotary cleaning head made of stainless steel. The lower part of the casing is made of aluminum to reduce the risk of sparks during the lowering to the manlid.
- ✓ A 7.5 meter high pressure hose with stainless steel M22 connections and spring.
- ✓ One high pressure electro-pneumatic 1/2 "RB - PN 110 ball valve made from stainless steel.

- Steam injection

One steam injection unit injecting the steam through the branch pipe into the tank

Steam injection unit consist of:

- One additional stainless steel pipe for steam
- A 7.5 meter high pressure hose with stainless steel M22 connections and spring.
- One high pressure electro-pneumatic ball valve made from stainless steel.

- Blower tube

Figure 2.11. Blower tube

One blowing tube of stainless steel with connection to 200 mm hot air hose. Supply of blower tube includes:

- One 4 meter neoprene hose for hot air
- One spring regulator, including 500 kg trolley with locks (for the weights of 15-20 kg), for use in combination with a 200 mm blowing tube.

Payload: 15-20 kg;

Cable: Stainless Steel;

The maximum length of 2 meters;

Code: M093030

- Cleaning head for IBC cleaning

Figure 2.12. IBC cleaning head

One complete unit for IBC cleaning includes:

- One electrically operated rotary cleaning head from stainless steel for cleaning of IBC internal surfaces

Table 2.7. IBC cleaning head characteristics

Power	20 L/min
Max pressure	120 bar
High pressure connections	1/2"
Length	650 mm

- One spring regulator to use with rotary cleaning heads. Payload of 15-20 kg, max length 4.5 meters.

- A stainless steel cover of the rotary cleaning head to prevent splashing of water from IBC container.
- A 7.5 meter high-pressure hose.
- A manual ball valve made of stainless steel.
- Single stainless steel handle for wall mounting. The handle is equipped with a monorail for the direction of the rotary cleaning head and blowing tube.

- IBC blowing tube

Figure 2.13. IBC blowing tube

One blowing tube of stainless steel with connections to 80 mm hose with hot air.

Each blowing tube is supplemented by:

- A manual butterfly valve of stainless steel DN80 for regulating air flow;
- One spring regulator with locks for use with 80 mm blowing tube. Loading capacity: 8-10 kg;

  Cable: Stainless Steel

  Maximum length: 4.5 meters
- A 5 meter long neoprene hose of 80mm.

- Wastewater pump

One low pressure pump for pumping of sewage sludge and waste water from the container.

All parts which are in contact with liquid are made of stainless steel or polytetrafluoroethylene.

Table 2.8. Wastewater pump characteristics

The maximum load at 5 bar air pressure	227 L/min
The maximum head at 5 bar air pressure	14 meters
Air consumption at 5 bar air pressure	2 m3/min

Unit supply includes:

- Air system with gear
- Filter
- Automatic dehumidification
- Stainless steel non-return valve
- Suction pipe

A four-meter aluminum suction pipe for pumping sludge and / or water from the tank container. The pipe is attached to the wastewater pump with 6 meter flexible hose. There is also a hook to mount the hose on the wall

- Protection from falling.

One 9 meter rail with moving trolley for protective purposes. Moving trolley is equipped with numerous rollers to ensure free movement in any position of use.

One fall protection spring stabilizer is attached to the rail. Stabilizer interrupts potential fall. Unit includes a belt and a certificate.

- Control panel

Figure 2.14. Control panel

Control panel includes:

- PLC controller including the I / O switch and software
- Motor Group (contactor, breaker, thermal relay, timer, etc.)
- Main switch
- MMI control panel
- Emergency stop circuit

Using the MMI control panel, you can get a very detailed error report. It also offers the ability to integrate future expansion setting without adding additional buttons / indicator lights in the control panel.

One pneumatic control panel includes:

- Filter gear
- Air pressure gear
- Pressure switch
- Oil separator

- Remote control panel

One control panel is mounted on a rack to control the cleaning heads and wastewater pump. Following functions may be chosen:

- Stand-by system
- Selection of a rotary cleaning head
- Hot / Cold detergent
- Cleaning program from 1 to 10
- Alarms

- Installation

Company Gröninger fullfills the following design and installation works:

- Detailed planning of proposed scheme (P&ID, piping layout, detailed layout, electrical schemes etc).
- Preliminary installation of the following equipment onto heavy frame from stainless steel, so called „Clean Pack“:
  - ✓ High pressure pumps
  - ✓ Booster pumps
  - ✓ Set of valves
  - ✓ Alkali pump
  - ✓ Dosing pump
  - ✓ High pressure ball valves
  - ✓ Steam ball valves
- Installation of all stainless steel parts inside the CleanPack frame.
- Connection of electric and pneumatic cables of all equipment with the control panels. The cables are laid in the gutters of stainless steel.
- PLC programming including cleaning programs.
- Final testing of the installation.

- Commissioning

Final commissioning and training of staff on site can be carried out under the Gröninger project manager.

- Pricing and conditions

The final price of the installation with equpment is € 152.905,00.

Price is given on the Ex Works Schiedam terms. 50% should be made in the day of an order, 40% prior to the shipment and 10% after all the unit is installed and comissioned.

Guarantee is valid for 24months and does not include does not include parts that wear out over time, such as hoses, seals, gears, etc.

2.3. Location of the object

The projected processing tank containers production will be located in Samara region, city of Togliatti, on the territory of "Togliattisintez" industrial park having borders:

- on north – existing pipelines overpass;
- on west – street Novozovodkaya and transit roads;
- on south and east – local transit roads.

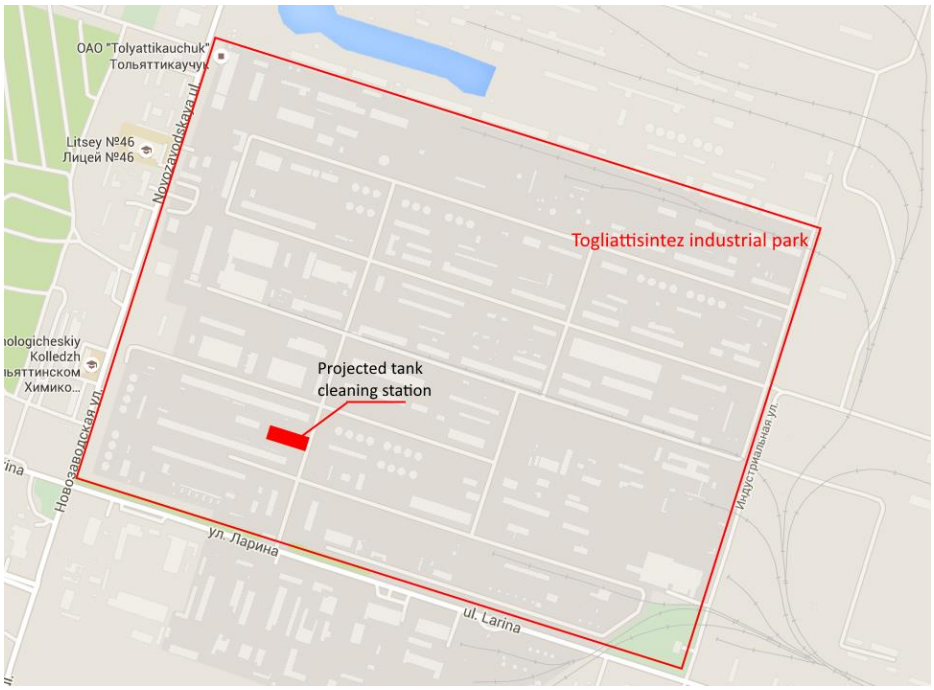


Figure 2.15. Location of the "Togliattisintez" industrial park and projected production

Here is a desription of the industrial area according to the industrial park webpage:

The total area of the Industrial park is 435.9 ha. In industrial park is located one of the biggest Russian chemical plants – „Togliattikauchuk" LLC. Nearby are also located heating and power plant and big chemical producers, such as „Kuibyshevazot" JSC. In the nearest surrounding is also located concrete plant which enables an incineration of chemical wastes.

Industrial park residents have a connection to the main communications such as water and electricity. Apart from that there is also an access to steam and nitrogen.

On the territory of the park has been developed railways and roads. Moreover one of the competitive advantages is good infrastructure. For example, „Syzran – Zhigulyovskoe More – Samara" railway line with access to „Transsib" transport corridor passes through Togliatti

Federal highway M5 (Moscow-Samara-Ufa-Chelyabinsk) passes 12 km away from the Industrial park.

2.4. Description of the projected production

According to the data acquired during the visits to European cleaning stations and based on the equipment needed for the project it was concluded that to ensure the functioning of tank containers processing production the project should include following buildings and facilities:

1. Main building of cleaning station;
2. Overpass of technological pipelines;
3. Points of tank containers' and tank trucks' heating;
4. Parking for the utility vehicles and tank trucks;
5. Warehouse for dirty tank containers;
6. Warehouse for clean tank containers;
7. Parking for crane;
8. Stock for solid waste containers.

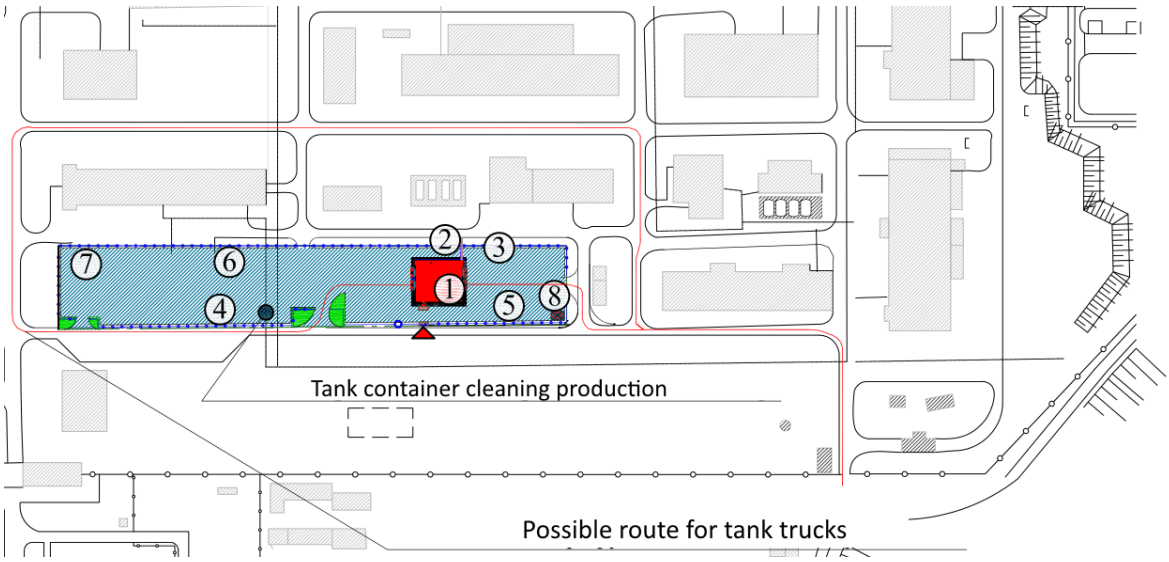


Figure 2.16. Layout of the production site and nearest borders

Layout of the projected tank cleaning station is proposed due to the configuration of an existing "Togliattisintez" Industrial Park in view of the entrance to it from the existing factory driveways and connection to engineering networks of water supply, sewerage and electricity.

2.5. Manufacturing process

Based on all the above was designed technological scheme of a cleaning process which is shown in the Appendix B of this work.

I. Supply of chemical detergents for cleaning in IBC containers and plastic drums by trucks into the building of a cleaning station and warehousing in the area of a chemical detergent stock

II. Discharge of a dirty tank containers from a railway platforms to the technological chassis by a truck crane. Transportation of dirty tank containers on a chassis by trucks to the territory of a cleaning station

III. Introduction of dirty tank containers on a technological chassis intro the territory of a cleaning station and warehousing in a special area. Introduction of dirty tank trucks and tank containers on chassis into the territory of a complex. Introduction of dirty IBC containers in the territory of a complex.

IV. Loading of a tank container from the warehouse onto technological chassis and transportation into the building of a cleaning station.

V. If tank containers and tank trucks were previously carrying highly flammable liquids, tanks are preliminary taken to the heating units where the process of nitrogen filling is performed.

VI. In winter time tank containers and tank trucks prior to cleaning are heated with steam with specially designed units in specific areas of production

VII. Introduction of a liquid detergent with the help of a pump through the pipelines into the 2 cleaning places.

VIII. Cleaning of tank internal surfaces using 2 rotary cleaning heads which are lowered with pneumatic hoists.

IX. Cleaning of tank external surfaces and truck heads with high pressure “Kärcher“ cleaning equipment

X. Drying of tank internal surfaces with hot compressed air

XI. Introductin of IBC containers into the cleaning station building, IBC cleaning with a rotary cleaning head, drying and transportation to the warehouse.

XII. Transportation of clean tank container on a technological chassis by trucks to the warehouse of clean tank containers

XIII. Loading of clean tank containers from the warehouse by truck crane onto chassis and transportation to the clients.

2.6. Description of production site

Developed and described model implies a construction of one main technological building and usage of available Industrial park concrete grounds. Main building design and construction calculation was outsourced from the local architect company.

Architect company has concluded that to ensure the arrangement of all the necessary equipment and compliance with the legal and technological requirements main building should be with dimensions 24x21 m and height of 6.6m.

According to the advices of the architect company was proposed the detailed site description.

- Main building

In the building of a cleaning station are located:

- Client manager room and switchboard room
- Room for equipment
- Room for tank container cleaning
- Site for collection of contaminated water, chemical storage and heating point
- Office and amenity rooms
- Ventilation chambers

- Storage area for chemical detergents

In this area warehousing of detergents is taking place. Detergents come in IBC containers and plastic drums and stored in 1 layer. IBC containers and drums with detergents are then served with pallet truck from the storage area to the area for equipment

- Area for equipment

Tap water that was processed on a softener unit enters the tanks for hot and cold water. From there it goes to the pump unit and two high pressure cleaning units "Kärcher". Detergent from IBC or drum is fed into the pump unit through the flexible hose and is mixed with water. Pump unit consist of two dosing pumps (one for alkaline detergents and other for acid), two pressure pumps, two high pressure pumps and control boxes.

Liquid detergent solution from a pump unit is then supplied trough the pipelines to the two rotary cleaning heads positioned in the cleaning area. Water from the first high pressure pump goes to the 3 pressure washer spray guns. Water from the second pressure pump goes to 1 washer gun and rotary cleaning head for IBC containers and drums, which are located in the cleaning area.

- Cleaning area

Cleaning of tank containers and tank trucks is made in two lines equipped with rotary cleaning heads. Tank containers are transported to the cleaning lines with utility vehicles or are carried directly by truck heads on a chassis.

Cleaning process is as follows:

If the last cargo inside the tank was a flammable liquid then prior to cleaning nitrogen is introduced into the tank container/tank truck via a flexible hose. Waste water pump can be used to pump out the residues from a tank to the settler. Rotary cleaning head is lowered by a pneumatic hoist into the tank container or tank truck manlid, after that liquid detergent, water and steam (according to the chosen cleaning program) is introduced into the cleaning head. Cleaning process is taking place – rotary nozzle spray out water and detergent under pressure. After the process ends pneumatic hoist takes the cleaning head up.

Control of a cleaning heads is made by a control panel. After the cleaning process tank containers and tank trucks are dried out by hot air blower-dryer, which is hanged on a manual hoist.

Cleaning of a truck heads is made manually using spray guns from the ground or from the upper platforms. Waste water after the cleaning goes through the gangway straight into the settler. In case of a baffled tank containers and tank trucks waste water is pumped into the settler by the pump.

In the cleaning area also takes place the cleaning of dirty IBC containers. Cleaning is performed only by water which is introduced via rotary cleaning head. If the last cargo in IBC was flammable then IBC is filled with nitrogen prior to cleaning. After the cleaning process IBC-container is dried with air-blower, which is attached to the same bracket as the cleaning head. Waste water from IBC-container is discharged through the gangway via channels into the settler.

- Wastewater collection site

Wastewater from the cleaning site through the channels flows into the settler with diameter of 1.5 m and depth of 2.5m. In the settler is located submersible drainage pump for pumping the water into the industrial sewerage.

The sediment formed at the bottom of the settler is pumped by a vacuum tank. To prevent caking of the sediment blade agitator is mounted at the bottom of a settler

- Warehouse for dirty tank containers

Dirty tank containers are coming into the territory of the projected production on technological trucks and chassis and are then stored on three concrete platforms with a total area of 558 m^2 in two layers. Number of stored tank containers is 50 units. Unloading of technological trucks and subsequent loading on chassis is made by a truck crane.

Tank containers which were previously carrying highly flammable liquid are stored completely empty and those carrying flammable and not flammable liquids with the remains which do not exceed 20L

- Tank container and tank truck heating points

Tank container and tank truck heating points means a concrete ground for 4 tank container or tank truck placement, where the process of heating is carried out during winter time. Heating points are equipped with steam distribution manifold with 4 branch pipe connections to the steam jacket of a tank container or a tank truck and 4 branch pipes for condensate removal.

In case tank container or tank truck was previously carrying highly flammable liquid they it is transported to the heating point where nitrogen filling is taking place to prevent an explosion.

- Warehouse for clean tank containers

Clean tank containers are taken out of the building on a utility vehicles/chassis and are unloaed by crane in a warehouse for clean tank containers, which consists of 2 concrete ground with a total area of 1010 m2. Storage of tank containers is made in one layer. The amount of stored tanks is 50 units. The same crane is used for loading the clean tank containers on a chassis of a client.

2.7. Requirements for production organization

Fulfillment of the works for organization of the described production should be carried out in accordance with the design estimates and requirements of technical standards existing in Russia.

In development of technological solutions for the project of tank cleaning station sh used the should be used the following basic methodological and regulatory documents:

1. The Union-wide rules for technological design of road transport enterprises. ОНТП-01-91;
2. Institutional building codes. Road transport enterprises ВСН 01-89;
3. Industrial buildings. The updated edition. СНиП 31-03-2001. СП 56.13330.2011;
4. Cross-industry regulations on labour safety in road transport. ПОТ Р М-027-2003;
5. Fire protection systems. Limiting the spread of fire in. СП 4.13130.2009;

6. Determination of categories of rooms, buildings and outdoor facilities for explosion and fire hazards. СП 12.13130.2009;

7. Federal Law. Technical regulations for fire safety requirements (№123-ФЗ. 2008 г);

8. ГОСТ 21.1101-2009. Main requirements for design and working documentation

2.8. Energy suppliers

Project implies the following energy suppliers:

Table 2.9. Energy suppliers

№	Energy type	Supplier
1	Heat	"Togliattisintez", Togliatti
2	Gas	"Togliattisintez", Togliatti
3	Water	"Togliattisintez" , Togliatti
4	Electricity	JSC “Samaraenergo”

2.9. Cleaning materials

For tank container and tank truck cleaning detergents are used. Their characteristics are shown in the table below.

Table 2.10. Cleaning materials

№	Name	Specification	Characteristics
1	«Sofeks-TMC-2001» type B	TU 2499-019-42942526-01	Liquid concentrate of surfactant mixture, demulsifiers, corrosion inhibitors. It has an alkaline character. Biodegradable.
2	«O-BISK»	TU 2383-023-72489136-2007	Liquid concentrate of surfactant mixture, demulsifiers, corrosion inhibitors. It has an acid character. Biodegradable.

Detergents come at production place in IBCs and plastic drums by trucks.

Supplier:

- **«Sofeks Silikon», Moscow**

2.10. Production capacity

Production capacity according to the project amounts to 20 units per day which is yearly 4800 units (20 working days per month, 12 months). Forecasted production is shown in the table 3.4.

Table 2.11. Production capacity

Name of the unit to be cleaned	**Daily performance, units.**	**Yearly performance, units.**
Tank container (with dimensions 6058x2591x2438 mm), Tank trucks (with dimensions 9000x2500x3600 mm)	20	4800
Intermediate Bulk Containers (with dimensions 1200x1000x1170 mm)	12	2880

2.11. Number of employees

Project implies creating 11 working places with the following positions:

- General Manager – managing and supervising the work of a cleaning station. Providing reports to the owners
- Operator - 2 employees are required to cover daily service of cleaning IBC containers in two shifts and extra employees to cover work load during sick leaves and vacations
- Mechanic-repairman - Perform equipment and building maintenance, drives loaders and tractors

- Shift leader - responsible for supervising the activities of operators and carrying out works on handling tank containers, additional working equipment and also fulfils functions of operator.
- Accountant - responsible for accounting related functions, moreover takes orders, extract passes and makes applications
- Chief accountant - prepare reports, communicates with banks, tax authorities etc
- Technical director - is second person who is responsible for condition of buildings, equipment and vehicles safety, for safe conduct of the technical process, in absence of general manager performs his duties

Table 2.12. Employees

Employee	Average salary	Number of employees	Shifts
Operator	22000	3	2
Mechanic - repairman	25000	2	2
Shift leader	25000	2	2
Accountant	20000	1	Office hours
General Manager	50000	1	Office hours
Technical Director	40000	1	Office hours
Chief Accountant	35000	1	Office hours
Total:		11	

Labour costs are calculated in Chapter 3 of this work.

2.12. Comparison of the old and the projected cleaning schemes

Very often, especially when logistics company finds a new destination for transportation, arises the question of the nearest tank container or tank truck cleaning station. Ordinary cleaning stations (car cleaning stations) close to the points of discharge are not suitable for cleaning of chemical substances. Long transportation of dirty empty vessels always negatively impacts the overall profitability of a transport as well as may simply damage the equipment.

Currently, as per experience of a logistics service providers for bulk liquids chemicals, tank container and road tanker cleaning is made using a hose with artesian water under pressure (2 – 2.5 atm) followed by steaming and blowing with compressed air.

Average time of cleaning ~ 2 hours.

Average energy consumption per one cleaning cycle:

- ✓ water –15 $m^{3;}$
- ✓ steam –3.1 Gcal;
- ✓ compressed air –325 $m^{3.}$

According to the projected tank cleaning scheme the average time for cleaning would be:

- ✓ pre-wash - 10 min.;
- ✓ cleaning - 8 min.;
- ✓ rinsing - 10 min.;
- ✓ steaming - 15 min.

Total time of cleaning = 43 min.

Working time economy would be 120 – 43 = 77 min.

Water consumption 5.6/60 x 28 min = 2,6 m3

Table 2.13. Different cleaning scheme comparison

№ п/п	**Parameters**	**Old scheme**	**New proposed scheme**	**Economy**
1	Average time of cleaning, min	120	43	77
2	Water consumption in m^3	15	2,6	12,3
3	Amount of residues m^3	15	2,6	12,3
4	Steam consumption, Gcal	3,1	1,8	1,3

At the present time on the Russian market has been introduced the equipment of a widely known German company Kärcher which enables to reduce the water consumption and improve the quality of tank container and tank truck cleaning. However, this equpment do not allow to avoid tank steaming process in which the chemical remains evaporate poisoning the atmosphere. There are also other important issues, such as environmental concerns and safety at work. In Russia there were several incidents with fatalities during the process of tank container, tank truck and railway cisterns cleaning after chemical products and even the food products. It all happened when the workers tried to get inside the tank to check the quality of cleaning or to clean the tanks with the rags and to remove the moisture. Most often the residues in this kind of unprofessional cleaning stations are directed into the city sewers or to the water bodies. In this cleaning station project the above mentioned problems are solved.

All the procedures in current project should be made according to all EU standards of safety at work. Prior to tank cleaning process inert gas is provided into the tank which eliminates any possibility of explosion of flammable liquid vapors. After that the unit is taken inside the building where the cleaning using the hot water and detergent is made. Detergent and cleaning process is specially selected for a specific product and cleaning is made using modern equipment of European quality.

Equipment which will be purchased for the project allows cleaning in automatic mode, by setting the program through the computer for tank cleaning from the specific product, followed by drying. Operator will only change the process whether to cleaning or to drying by lowering (with the help of the hoist) to the inside of the tank cleaning head or blowing pipe. Cleaning quality is monitored and registered by a specially designed camera. Photos of a clean tank will be attached to the cleaning certificate. Residues that do not exceed the permissible parameters will be discharged into industrial sewers. Especially harmful effluents will be collected in IBC-containers and disposed by enterprises engaged in disposing of such waste (Mytischi, St. Petersburg "Limpek").

2.13. Project scheduling

The company „Gröninger“, which will provide the equipment for production and the local architect company, which will handle the construction of the main building have indicated the possible time-frame of the major works to start a production. As per their indications

the time needed for construction of the main building is 4 months. Time needed for installation of the equipment is one month.

Considering all the above it can be provided the following simplified schedule:

- Start of the project - June 2015
- Registration of a company and registration of the production place in Togliatti industrial park – June 2015
- Start of the building construction – July 2015
- Construction finalization – October 2015
- Start of the equipment installation – October 2015
- Equipment installation commissioning – November-December 2015
- Official opening of a tank cleaning station for the customers – January 2016

2.14. Conclusions and recommendations

Technical study has indicated that 95% of the residues can be cleaned with a medium pressure hydrodynamic cleaning process with adding detergents for some specific products. For implementing this type of cleaning were involved specialists of the company "Gröninger Cleaning Systems BV" who proposed the set of equipment needed to start a production.

Based on the proposed module was developed an appopriate scheme and layout of production that takes into account features of Togliatti industrial park. According to the specialists of the local architect company tank cleaning production can be covered with a construction of one main technological building and usage of available concrete grounds.

Technical study has shown that proposed cleaning scheme is a lot more economical and environmental friendly than the old schemes used all over Russia and allows to reduce the cleaning time by 77 minutes, water consumption and amount of residues by 12 m^3.

Togliatti industrial park can supply the projected tank cleaning station with necessary energy supplies from nearby sources without additional investment costs.

Technical study has shown that projected yearly capacity of a cleaning station is 4800 tanks and 2880 containers. With the help of a technical study it was concluded that to ensure a stable performance of a tank cleaning station in its full capacity 11 people are needed.

Recommendations for the project would include the following:

1. Due to the lack of qualified labour familiar with tank cleaning and high quality cleaning equipment ensure the qualification of personnel by additional training programs

2. Protect the business from costly repairs of equipment by ensuring the longer guarantee period

3. FINANCIAL STUDY

In this chapter is provided the calculation of financial feasibility of the project, methodology is described and main financial indicators are shown and explained.

3.1. Theory

3.1.1. Internal rate of return

Internal Rate of Return (IRR) is time-discounted measure of investments similar to the NPV (net present value) criterion. The IRR of project is defined as the rate of interest that equals the NPV entire series of cash flows to zero (Liang 2013, 52). The IRR rule states that an investment can be accepted if it offers an IRR in excess of the opportunity cost of capital. For a project lasting n years, IRR is the discount rate r such that:

$$NPV = \sum_{n=0}^{N} \frac{C_n}{(1+r)^n} = 0 \qquad (1)$$

Cash flow return on investment is the after-tax rate of return (IRR) on a company's existing assets. In principle, cash flow return on investment is that rate that sets the present value of the after-tax operating cash flows equal to their investment cost. Like IRR, cash flow return on investment is that rate which sets a company's net present value equal to zero (Feibel 2003, 33)

3.1.2. Net Present Value

To take into account the time value of money, it is necessary to convertall cashflows to a single standard. This is the so-called present value (PV). The Net Present Value of a project producing cash flows C_1 to C_n over n years equals the Present Value minus the required initial investment I (or minus the present value of the successive outlays, if the project requires outlays in two or more periods) (Cholet 2008, 192):

$$NPV(i,N) = \sum_{n=0}^{N} \frac{R_t}{(1+i)^t} \qquad (2)$$

Net present value is probably the most well-known term and commonly used in financial valuation. The NPV method of project evaluation uses a discount rate (or cost of capital), which is basically the rate of return that could be obtained by the company or its investors

by investing elsewhere. NPV >0 suggests a firm should invest in a project; NPV <0 suggests rejection of a project; NPV = 0 requires further evaluation (Liang 2013, 98).

3.1.3. The rate of return of full investment costs

Establishment of return on investment (ROI) represents a structured approach to quantifying and delivering business value. In order for any business to take full advantage of a proposed, new, or enhanced capability or management solution, it is necessary to engage a wide cross section of the business to determine where and how business value can be best delivered, and be able to prove it. The most effective way to achieve this is through the development of a robust and realistic implementation strategy, a ROI-based decision case, and a benefits-delivery road map (Davis et al 2014, 203).

$$ROI = \text{Profit Margin} \times \text{Asset Turnover} \tag{3}$$

3.1.4. Discounted payback period

The payback period of a project is found by counting the number of years it takes before the cumulative discounted cash flow equals the initial investment. The discounted payback period is calculated in exactly the same way with the exception for the time value of money (Mian 2002, 27). The simple payback period does not account for the time-value of money or for the cash flow variations over the life period of the project. To overcome these limitations, the notion of discounted payback period or discounted cash flow payback period is used.

$$DPP = \mathrm{A} + \frac{\mathrm{B}}{C} \tag{4}$$

Where,

A = Last period with a negative discounted cumulative cash flow;

B = Absolute value of discounted cumulative cash flow at the end of the period A;

C = Discounted cash flow during the period after A

3.2. Economic Calculations

3.2.1. Investments and financing

For economic evaluation of the project first of all was considered the invesment costs of the project which have been combined in the following tables.

Table 3.1. Estimated capital expenditure for the project

№	**Item**	**Costs / thousands of RUB**
1	Building installation works	26 000
2	Equipment	9 500
3	Other expenses	2 600
Total:		**38 100**

Table 3.2. The volume of investments of the project:

№	**Item**	**Costs / thousands of RUB**
1	Capital investment	38 100
2	Increase in working capital	1 640
Total:		**39 740**

Table 3.3. Financing sources

№	Source of financing	Amount of financing, thousand / RUB
1	Loan of a project founder	39 740
Total:		**39 740**

3.2.2. Production and sales

Furthermore, program of production and sales of the project has been made and presented in the table 3.4.

Table 3.4. Program of production and sales

Name	Measure	2015	2016					2017	2018	2019	2020	Total
		Total	per annum				Total	Total	Total	Total	Total	
			I	II	III	IV						
1. Tank container cleaning												
Production volumes:												
Units	Unit	0	200	225	250	300	975	1 500	2 000	2 200	2 400	9 075
Price for the service, excl VAT	Thousand RUB/unit		7,12	7,12	7,12	7,12	7,12	7,12	7,12	7,12	7,12	7,12
Price for the service, incl VAT	Thousand RUB/unit		8,40	8,40	8,40	8,40	8,40	8,40	8,40	8,40	8,40	8,40
Sales, exl VAT	Thousand RUB	0	1 424	1 602	1 780	2 136	6 941	10 678	14 237	15 661	17 085	64 602
Sales, incl VAT	Thousand RUB	0	1 680	1 890	2 100	2 520	8 190	12 600	16 800	18 480	20 160	76 230
2. Tank truck cleaning												
Production volumes:												
Units	Unit	0	200	225	250	300	975	1 500	2 000	2 200	2 400	9 075
Price for the service, excl VAT	Thousand RUB/unit		6,53	6,53	6,53	6,53	6,53	6,53	6,53	6,53	6,53	6,53
Price for the service, incl VAT	Thousand RUB/unit		7,70	7,70	7,70	7,70	7,70	7,70	7,70	7,70	7,70	7,70
Sales, exl VAT	Thousand RUB	0	1 305	1 468	1 631	1 958	6 362	9 788	13 051	14 356	15 661	59 218
Sales, incl VAT	Thousand RUB	0	1 540	1 732	1 925	2 310	7 507	11 550	15 400	16 940	18 480	69 877
3. IBC cleaning												
Production volumes:												
Units	Unit	0	150	200	350	500	1 200	2 800	2 800	2 800	2 800	12 400
Price for the service, excl VAT	Thousand RUB/unit		0,17	0,17	0,17	0,17	0,17	0,17	0,17	0,17	0,17	0,17
Price for the service, incl VAT	Thousand RUB/unit		0,20	0,20	0,20	0,20	0,20	0,20	0,20	0,20	0,20	0,20
Sales, exl VAT	Thousand RUB	0	25	34	59	85	203	475	475	475	475	2 102
Sales, incl VAT	Thousand RUB	0	30	40	70	100	240	560	560	560	560	2 480
2. TOTAL SALES, INCL VAT	0	0	3 250	3 663	4 095	4 930	15 938	24 710	32 760	35 980	39 200	148 588

Here it is seen that the production volumes in calculation was increased step by step with every annum with the entrance into the full capacity by the year 2020.

The maximum amount of sales after entering the full production capacity (4800units of tanks and 2800 units of IBCs) is 39 200 thousand RUB per Year (including VAT).

3.2.3. Labor and production costs

The labor costs for production are shown in the table 3.5.

Table 3.5. Labor costs

Name	Unit	2015	2016	2017	2018	2019	2020	Total
		Total	Total	Total	Total	Total	Total	
Amount of people employed	people	3	7	11	11	11	11	11
including:								
Workers directly involved in production	people	0	3	6	6	6	6	6
Workers not involved in producion - Accountant	people	0	1	1	1	1	1	1
Managers and directors	people	3	3	4	4	4	4	4
1. Labor costs for employees directly involved in production	Thousand RUB	0	1 175	1 865	2 210	2 210	2 210	9 670
including:								
Salary	Thousand RUB	0	900	1 428	1 692	1 692	1 692	7 404
Social taxes	Thousand RUB	0	275	437	518	518	518	2 266
2. Labor costs for employees not involved in production	Thousand RUB	0	392	392	392	392	392	1 959
including:								
Salary	Thousand RUB	0	300	300	300	300	300	1 500
Social taxes	Thousand RUB	0	92	92	92	92	92	459
3. Labor costs for managers and directors	Thousand RUB	552	1 693	1 959	2 272	2 272	2 272	11 105
including:								
Salary	Thousand RUB	423	1 296	1 500	1 740	1 740	1 740	8 439
Social taxes	Thousand RUB	129	397	459	532	532	532	2 666
4. Total labor costs	Thousand RUB	636	3 260	4 216	4 874	4 874	4 874	22 734
including:								
Salary	Thousand RUB	423	2 496	3 228	3 732	3 732	3 732	17 343
Social taxes	Thousand RUB	213	764	988	1 142	1 142	1 142	5 391

The costs of production and marketing of the project as the sum of all presented above is shown in the table 3.6.

Table 3.6. Production costs

Name	Unit	2015	2016	2017	2018	2019	2020	Total
		Total	Total	Total	Total	Total	Total	
1.Total cost of production:	Thousand RUB	1 487	7 278	10 049	12 293	12 928	13 562	57 597
в том числе:								
Costs of raw materials	Thousand RUB	0	412	414	417	418	419	2 080
Costs for energy	Thousand RUB	0	2 319	3 657	4 789	5 241	5 694	21 701
Salary	Thousand RUB	423	2 496	3 228	3 732	3 732	3 732	17 343
Social taxes	Thousand RUB	213	764	988	1 142	1 142	1 142	5 391
Other - parts, components etc	Thousand RUB	851	1 288	1 762	2 214	2 394	2 575	11 083
2. VAT and excise duties	Thousand RUB	153	723	1 050	1 335	1 450	1 564	6 275

3.2.4. Depreciation

Depreciation for a full horizon of calculation is presented in the table 4.7. As seen enterprise has no assets in the beginning of calculation. Cost of european equipment is 152905EUR which was calculated with the rate 1EUR=55RUB as 8409,775 thousand RUB and local Russian equipment cost is 1090 thousand RUB which totally gives 9500 thousand RUB. Total costs of building with the deduction of construction works is 34 000 thousand RUB.

Table 3.7. Depreciation

Name	Depreciation in %	2015	2016	2017	2018	2019	2020
		Total	Total	Total	Total	Total	Total
1. Fixed assets and intangible assets of the project, total		0	34 000	34 000	34 000	34 000	34 000
including							
a) according to the project, total		0	34 000	34 000	34 000	34 000	34 000
including:							
buildings		0	24 500	24 500	24 500	24 500	24 500
equipment		0	9 500	9 500	9 500	9 500	9 500
b) cumulative depreciation of the project, total:		0	1 569	1 569	1 569	1 569	1 569
including:							
buildings	3,3%	0	809	809	809	809	809
equipment	8,0%	0	760	760	760	760	760
c) depreciated cost of fixed assets and intangible assets of the project (a- sum(b))		0	32 432	30 863	29 295	27 726	26 158

3.2.5. Financial results

Financial results (profit plan) of the investment project show the distribution of the receipts received from the sale of products and the amount of net profit for the quarter and year. It is presented in the table 3.8.

Table 3.8. Financial results

Name	Unit	2015	2016					2017	2018	2019	2020	Total
		Total	per annum				Total	Total	Total	Total	Total	
			I	II	III	IV						
1. Total sales according to the project	Thousand RUB	0	3 250	3 663	4 095	4 930	15 938	24 710	32 760	35 980	39 200	148 588
2. VAT and other duties paid	Thousand RUB	0	496	559	625	752	2 431	3 769	4 997	5 488	5 980	22 666
4. Total sales minus VAT and duties	Thousand RUB	0	2 754	3 104	3 470	4 178	13 506	20 941	27 763	30 492	33 220	125 922
5. Total costs of production	Thousand RUB	1 487	1 667	1 751	1 844	2 017	7 278	10 049	12 293	12 928	13 562	57 597
a) VAT and duties	Thousand RUB	153	496	559	625	752	2 431	3 769	2 720	1 450	1 564	12 087
6. Depreciation	Thousand RUB	0	393	393	393	393	1 569	1 569	1 569	1 569	1 569	7 845
7. Tax on land	Thousand RUB	0	169	169	169	169	675	675	675	675	675	3 375
8. Profit	Thousand RUB	-1 487	526	792	1 065	1 600	3 984	8 647	13 225	15 320	17 415	57 105
9. Profit taxes, total:	Thousand RUB	0	0	0	0	0	0	0	0	0	339	339
Including:												
Property tax	Thousand RUB	0	66	132	131	129	458	507	489	472	454	2 379
Property tax rebate	Thousand RUB	0	66	132	131	129	458	507	489	472	115	2 041
10. Interest payment for a loan	Thousand RUB	0	0	0	0	0	0	3 811	7 745	2 197	939	14 692
12. Taxable income	Thousand RUB	-1 487	526	792	1 065	1 600	3 984	4 836	5 480	13 123	16 475	42 412
13. Income tax, total	Thousand RUB	0	0	0	168	247	679	744	844	2 028	3 112	7 109
income tax, full	Thousand RUB	0	0	0	213	320	797	967	1 096	2 625	3 295	8 482
income tax rebate	Thousand RUB	0	0	0	45	73	118	223	252	596	183	1 373
14. Net profit	Thousand RUB	-1 487	526	792	897	1 353	3 305	4 092	4 636	11 094	13 364	35 303
Return on Sales (p8/p4), %		#DIV/0!	19	26	31	38	29	41	48	50	52	45
Profitability of production		-100	32	45	49	67	45	41	38	86	99	61

The maximum amount of the net profit is achieved in the year 2020 and amount to 13 364 thousand RUB /year. Return on sales in the year 2020 amount to 52%. Profitability of production on net profit is about 100% when the production launches at full capacity.

3.2.6. Cashflow

The plan of cash flow is presented in the Table 3.9.

Table 3.9. Cashflow

Name	Beginning of the project	2015	2016	2017	2018	2019	2020	Total
		Total	Total	Total	Total	Total	Total	
Production and sales								
1. Monetary receipts	0	0	15 938	24 710	32 760	35 980	39 200	148 588
a) income from the sale of products (without indirect taxes)	0	0	13 506	20 941	27 763	30 492	33 220	125 922
b) VAT, excise duties and other indirect taxes from the sale of products	0	0	2 431	3 769	4 997	5 488	5 980	22 666
2. Monetary payments	0	1 487	10 791	15 263	18 834	21 144	23 624	91 143
a) production costs (without indirect taxes)	0	1 487	7 278	10 049	12 293	12 928	13 562	57 597
b) VAT, excise duties and other indirect taxes	0	153	2 431	3 769	2 720	1 450	1 564	12 087
c) budgetary payments	0	-153	1 082	1 444	3 821	6 767	8 499	21 459
3. Production and sales cashflow balance	0	-1 487	5 147	9 447	13 926	14 836	15 576	57 444
5. Disbursements, total	0	38 100	0	0	0	0	0	38 100
6. Investment activities cashflow balance	0	-38 100	0	0	0	0	0	-38 100
7. Production and investment cashflow balance	0	-39 587	5 147	9 447	13 926	14 836	15 576	19 344
Financial activity								
8. Receipts of funds, total	0	39 740	0	0	0	0	0	39 740
a) loans	0	39 740	0	0	0	0	0	39 740
9. Disbursements, total	0	0	0	3 811	20 992	15 444	14 186	54 432
a) payments of interests	0	0	0	3 811	7 745	2 197	939	14 692
b) principal repayments	0	0	0	0	13 247	13 247	13 247	39 740
10. Finance activities cashflow balance	0	39 740	0	-3 811	-20 992	-15 765	-14 507	-14 692
11. Total cashflow balance	0	1 115	5 147	5 636	-7 067	-929	1 069	4 652

The company intends to receive investment tax incentives in the framework of the state support of investment activity on the territory of Samara region in the amount of 3 414 thousands RUB, including for income tax in the amount of 1 373 thousands RUB and property tax in the amount of 2041 thousands RUB. A necessary condition for the feasibility of the project is a positive indicator of cash flows for each time interval.

The project is characterized by a positive balance of net cash flow for the project planning for all periods throughout the planning.

3.2.7. Project integrated performance

Table 3.10. Project performance

Name	2015	2016	2017	2018	2019	2020	Total
Investments	38 100	0	0	0	0	0	39 740
Production and sales cashflow balance	-1 487	5 147	9 447	13 926	14 836	15 576	57 444
Net cashflow	-39 587	5 147	9 447	13 926	14 836	15 576	25 156
Discount factor = 7,05%							
Discounted net cashflow	-36 979	4 491	7 701	10 604	10 553	10 350	6 719
Absolute value of discounted cumulative cash flow	-36 979	-32 488	-24 787	-14 184	-3 631	6 719	
1. Net Present Valie (NPV) =	*6 719*						
2. Internal Rate of Return (IRR) =	*12.6%*						
3. Return on Investment (ROI)							
On NET value =	*25156/38100=*	*66%*					
Discounted value =	*6179/38100=*	*16%*					
4. Discounted Payback Period (DPP)							
0,540407799	*12 months*						
*0,54*12=*	*6,48 months*						
7 months in 2015 and (4+3631/6719)years =	*5 years and 1,48 months*						
Start of the project - june 2015							
Payback of the project - july 2020							

Analysis of integrated performance of the project, calculated on the time horizon of 6 years is presented in the table 3.10.

- Internal Rate of Return (IRR) – 12,6 %;
- Net present value (NPV) - 6719 thousand RUB;
- The rate of return of full investment costs – 16%;
- Discounted payback period (DPP) - 4 years 9 months.

- Start of the project - June 2015.
- Payback of the project will come in July 2020.
- The initial calculation parameters:
  - The discount rate – 7,05%;
  - Horizon of calculation - 6 years.

4. SOCIO-ECONOMIC BENEFITS OF THE PROJECT

The regional importance of the project depends on a number of fundamental factors:

- Organisation of production close to the chemical production in industrial zone solves the following problems: wastes from tank cleaning will be properly utilized
- Budgetary efficiency – project will bring additional income from taxes to the budget of Samara region
- The project has a social value, allowing to create a number of workplaces

4.1. Budgetary efficiency

The project pretends to get support from regional administration - the project is intended to be included in the regional investment program, under which it will be entitled to receive the investment tax incentives for taxes paid to the regional budget.

Taking into account the fact that the project involves getting governmental support it is necessary to evaluate the effectiveness of the budget and budgetary effects of the project. Evaluation should be carried out in accordance to Resolution of November 22, 1997 N 1470 "On approval of the provision of government guarantees on a competitive basis by the budget of the Russian Federation and the provisions on the evaluation of investment projects when placed on a competitive basis centralized investment resources of the budget of Russian Federation" (Постановление от 22 ноября 1997 г. N 1470 «Об утверждении порядка предоставления государственных гарантий на конкурсной основе за счет средств бюджета развития Российской Федерации и положения об оценке эффективности инвестиционных проектов при размещении на конкурсной основе централизованных инвестиционных ресурсов бюджета развития Российской Федерации»)

Budgetary effect of the investment project is defined as the balance of revenues and expenditures of the state budget in connection with the implementation of the project (Table 5.2). The calculations are carried out discounting the volume of receipts and disbursements in respect to the year of realization of the project.

Table 4. 1. Budgetary effect

Name	2015	2016	2017	2018	2019	2020	Total
1. Disbursements, total:	0	576	730	741	1 068	299	3 414
Including:							
a) state support of the project	0	576	730	741	1 068	299	**3 414**
2. Receipts, total:	115	3 043	3 582	6 189	9 462	10 424	32 815
including:							
a) taxes and payments to the budget:	-153	1 955	2 174	4 562	7 835	8 797	25 170
VAT	-153	0	0	2 277	4 039	4 416	10 579
Tax on land	0	675	675	675	675	675	3 375
Property Tax	0	458	507	489	472	454	2 379
Income Tax	0	822	992	1 121	2 650	3 252	8 837
b) salary tax (0,13x salary)(see table 6)	55	324	420	485	485	485	2 255
c) social taxes (see table 6)	213	764	988	1 142	1 142	1 142	5 391
3. Balance of receipts and disbursements	115	2 467	2 851	5 448	8 394	10 126	29 402
4. Discounted value of a balance (discount factor of 7,05%)	107	2 153	2 324	4 148	5 971	6 728	**21 433**
5. State NPV considering discount factor with risks (7,05+12=19,05)	97	1 741	1 690	2 712	3 510	3 557	**13 306**

Net Present Value as the effect of the implementation of the project (NPV) is the sum of yearly balances of receipts and disbursements to the budget given to the prices of the first year:

$$NPV = \sum_{t}^{T} P_t \frac{1}{(1+d)^{t-1}} \quad (5)$$

Where:

T - The total duration of the project life cycle, including the reconstruction of the object and the operation of the main process equipment;

P - The annual difference between the payments and revenues (Table 4.1, point 3);

t - The years of the project (t = 1, 2, 3 ...);

d – Discount factor.

The discount factor (d_i) without taking into account the risk of the project is defined as the ratio of the rate of refinancing (r), set by the Central Bank of the Russian Federation, and the current rate of inflation (i) announced by the Government of the Russian Federation:

$$1+d_i=\frac{1+\frac{r}{100}}{1+\frac{i}{100}} \quad (6)$$

Current rate of inflation by the last 12month at time of project calculation amounted to 16, 46% (data till April 2015 http://www.gks.ru/)

Current rate of refinancing from 14.09.2012 is 8,25% (data from Russian central bank http://www.cbr.ru/)

This data gives the value of discount factor of 7,05%

The amendment to the risk of the project is determined according to the following table:

Table 4.2. Project risk factors (Resolution of November 22, 1997 N 1470)

Level of the risk	Project essense	P, percent
Low	Reduction of production costs	6 – 10
Average	Increasing sales of existing products	8 – 12
High	Production and marketing of a new product	11 – 15
Very high	Investments in research and innovation	16 – 20

The discount factor that takes into account risks associated with the implementation of projects is determined by the equation:

$$d=d_i+\frac{P}{100} \quad (7)$$

Where $\frac{P}{100}$ is the risk factor. Calculations take into consideration the average risk of 12%

Thus, Budgetary effect (calculation presented in the table 5.2) is 13 306 thousand rubles.

The value of the budget efficiency is as follows: 8.61 Rubles per 1 ruble of state support for the project (29 402 thousand RUB / 3 414 thousand RUB).

5. REZUMPTIVE SWOT ANALYSIS

SWOT (strengths, weaknesses, opportunities, and threats) is an effective strategic planning tool applicable to a business or project objective. Strengths and weaknesses are identified with respect to the internal capabilities of an organization. They provide an introspective view. Strengths and weaknesses should not be considered opposites. This can be readily seen in Table 6.1. On the other hand, opportunities and threats look outside the organization. Quite simply, we are trying to identify opportunities for the organization and threats to the organization (Kubiak et al 2009, 353).

SWOT is one of the most common types of marketing analysis. It helps to analyze the market from several points of view. Below is a SWOT analysis of the current project – tank cleaning station in Togliatti

Table 5.1. SWOT analysis

Strenghts	Weaknesses
High quality cleaning equipment Economical use of resources European standards of cleaning Very good location	High cost of equipment Lack of qualified personnel
Opportunities	**Threats**
Unformed market, free market share Growth of chemical industry Growth of tank container market Governmental support	New competitors Major accidents, fires, natural disasters Rise of taxes Political risks (sanctions etc) Red tape

Described project of tank cleaning station in Togliatti has several major strengths which include:

1. High quality cleaning equipment – project involves buying and using European equipment designed especially for tank cleaning purposes. This type of equipment provides the possibility to clean 95% of all products that were previously carried in a tank or container. High quality equipment is also the reason of the strength №2
2. Economical use of resources – equipment used in this project is very efficient and uses small amount of water an detergent for the perfect cleaning result
3. European standards of cleaning – cleaning procedures are carried out according to all European standards and after the cleaning corresponding cleaning certificate is provided
4. Very good location – cleaning station is located relatively close to the all major chemical areas of Russia such as Samara, Ufa and Omsk. Moreover, being located in the industrial zone of Togliatti close to the chemical plants of the region provides great competitive advantage in the form of potential regular customers right from the start of production.

From the major weaknesses of the current project can be named:

1. High cost of equipment – this point means not only the significant amount of money that need to be invested in the project but also the fact that every repair or modification will also require a large sum
2. Lack of qualified personnel – as the business of tank cleaning is rather new to Russia there is very difficult to find a person familiar with the procedure of cleaning chemical products. New personnel should be trained by qualified European professionals.

There are also external factors that can affect the new business of a tank cleaning station in Togliatti.

Opportunities include:

1. Unformed market, free market share – as there are no direct competitors offering the same level of service it is a great opportunity to be the first to take own market share.

2. Growth of chemical industry – chemical industry is growing from year to year bringing challenges for organized an optimal supply chain which is impossible withour a high quality tank cleaning stations.
3. Growth of tank container market – tank containers play bigger and bigger role with every year. This market is growing bringing the need of impoving todays infrastructure for tank container in Russia.
4. Governmental support – as the project is an innovation in Samara region and bring a good socio-economic effect it can be included in the regional investment program, under which it will be entitled to receive the investment tax incentives for taxes paid to the regional budget.

There are also different threats that can influence the business:

1. New competitors – with time some big companies may step into this business dumping the prices
2. Major accidents, fires, natural disasters – as the cleaning station will be located close to the big chemical plants there is always a danger of an incident or explosion.
3. Rise of taxes – rise of the taxes can be influential for every type of business. Each changed tax means the need of recalculation of projected financial figures and forecasts
4. Political risks (sanctions etc) – Russia is an unsteady state and conducting business in Russia always means the risks of change in political situation. Politics of sanctions can cut down the flow of chemicals from/to Russia which will bring the need of redirection the local clients and businesses.
5. Red tape – difficulties connected with Russian bureaucracy in opening new business. A lot of paperwork should be done do get an approval from different legal authorities for the start of operations and different inquiries from bureaucratic bodies may follow after the station will be put in operation.

As a result of a SWOT analysis it can be stated that the project is very attractive because of the free market share and unformed market. Perfect location and European quality will draw attention of not only international companies that conduct business with Russia but also local companies that strive to match European standards.

Modern high quality equipment allows reducing the amount of water and energy needed for cleaning process; however, this effectiveness is the reason of the high costs of equipment. Equipment damages may lead to the stop of production and repairs can be very costly because qualified professionals should be brought from abroad. There is a lack of qualified labor familiar with modern cleaning equipment.

Solution for the problems above may be the longer guarantee period and additional training programs for personnel so that they could maintain equipment correctly without any problem.

As the world chemical industry is growing along with chemical logistics market tank the demand for tank cleaning services is expected to rise. However, unstable political situation in Russia may result in sanctions which may reduce the international transportation market. This can be solved by the service re-orientation to the local customers. On the other hand, Russian companies at the moment are not that interested in high quality European tank cleaning stations and the problem of international transportation decrease remains the main threat of the projected production.

The other main problem connected with conducting business in Russia is bureaucratic red tape, which can become a barrier in opening a new business. To decrease possible risks it is recommended to attract the local law companies for processing of all papers. Moreover, this company will help to expedite and facilitate all the bureaucratic processes in getting the governmental financial support.

CONCLUSION

The aim of this work was to analyse whether the project of a new tank cleaning station in Togliatti is feasible, rational and profitable. In order to answer these questions was concluded market study, technical study and financial study of the project.

Market study has provided information about the markets affecting the business and analysed corresponding markets. Were brought throughout analyses of Russian chemical industry, Russian market of bulk liquids transportation and Russian market of tank cleaning stations.

Result of this analyses showed that chemical industry in Russia and in the world is growing together with transportation market for liquid chemicals. This fact brings the need for infrastructure improvement which will lead to supply chain optimization, which in turn will reduce the price for transportation and the total price of chemical goods.

To optimize the logistics chain in international transportation companies head to avoid the repositioning cost of empty equipment. This is achieved by loading of a new cargo right after discharge. Next cargo can be loaded only into cleaned equipment. In order to satisfy the needs of a transport companies as well as chemical companies and plants there arises the need for a new high quality cleaning stations.

Market study showed that in Russia the market of tank cleaning is unformed and infrastructure for liquid transportation is not developed. It can be concluded that there is a big demand for the service of tank cleaning and building a new tank cleaning station in Russia allows getting a free market share.

Marketing study has indicated that Togliatti is very suitable location for a new tank cleaning station because of the developing chemical industry and increasing interest among international investors. Moreover, it was clarified that marketing strategy should be based on direct business-to-business marketing with strong differentiation why and how the current projected cleaning station is better than possible competitors.

To understand the technical feasibility of the project has been conducted a technical study which described the best suitable production layout, processes and equipment.

According to the study cleaning station proposed under this project will provide the following services: tank container cleaning, tank truck cleaning, IBC cleaning. Moreover, station will also provide heating and storage options.

There are different types of cleaning methods and machinery but according to the technical study 95% of the residues can be cleaned with a medium pressure hydrodynamic cleaning process with adding detergents for some specific products. The process implies the usage of water under pressure and alkaline or acid detergent.

The market leader and the most-known provider of ready solutions for tank cleaning is the company “Gröninger Cleaning Systems BV“.

According to the advices of the above mentioned company was selected the module that covers everything to start a production according to high quality european standards. Based on the proposed module was developed an appopriate scheme and layout of production. Developed model implies a construction of one main technological building and usage of available concrete grounds. Main building design and construction calculation was outsourced from the local architect company.

Technical study has shown that proposed cleaning scheme, which is new to Russia, is a lot more economical and environmental friendly than the old schemes used all over Russia. Old cleaning method means cleaning with water under pressure with hoses or sometimes with Kärcher equipment and steaming. There is no correct utilization of wastes and in most cases all residues are sent into the general sewerage or directly into the water bodies. In comparison to the standard variant of cleaning in Russia proposed cleaning scheme allows to reduce the cleaning time by 77 minutes, water consumption and amount of residues by 12 m^3. Furthermore, hazardous residues are collected into the settler and utilized by special waste utilization companies.

Location of the object in Togliatti industrial park allows receiving all needed energy supplies from nearby sources without additional investment costs. Cleaning materials or detergents for production can be provided by the local suppliers.

Technical study has shown that projected capacity of a cleaning station is 20 units of vehicles per day and 12 intermediate bulk containers per day. 20 working days per month gives the yearly full capacity of 4800 tanks and 2880 containers.

With the help of a technical study it was concluded that to ensure a stable performance of a tank cleaning station in its full capacity 11 people are needed. It was presented the list of staff and proposed corresponding reasonable average salary.

According to the data acquired with the help of a technical study it was possible to conduct a financial evaluation of the given project, which provided the information about the possible financial results and economic feasibility of the project. Annual cashflows have been complied and analysed. As a result of a financial study with a discount rate of 7.05% and a horizon for calculation of 6 years were obtained the following numbers:

- Internal Rate of Return (IRR), the rate of growth a project is expected to generate: 12,6 %
- Net present value (NPV), overall value of the project: 6719 thousand RUB
- Return of Investment Ratio, efficiency of an investment: 16%
- Discounted payback period (DPP), number of years to breakeven: 4 years 9 months

Herewith, it can be concluded that the project is profitable and beneficial in terms of investments.

Study has also showed that the project creates socio-economic benefits in the form of new working places and paid taxes and it was necessary to calculate whether the project can be included in the regional investment program. According to the calculations of a budgetary effect project can count on governmental support as the budgetary effect amount to 13 306 thousand rubles.

Summing up all the studies was conducted a SWOT analysis of the project which indicated the main information for decision-makers in regards of strengths, weaknesses, opportunities and threats of a tank cleaning station in Togliatti.

There is a demand for this kind of service on Russian market and it will continuously grow in the near future. However, establishing this kind of a production in Russia brings corresponding risks. The equipment is costly and in case of damage there is lack of professionals that can provide a repair services. There is also a lack of qualified labour and new personnel should be trained by competent European colleagues. The main risk

connected to this project is a political risk that comes from the fact that political situation in Russia is unstable and certain sanctions of Western countries or internal problems can decrease the flow of chemicals. It also can be concluded that the main barrier to successful quick start of operations is red tape in Russia.

All the above is intended to help a decision-maker to decide whether to start and develop the construction of a tank cleaning station in Togliatti. As a result of this paper can be concluded that the project of a tank cleaning station in Togliatti is economically and technically feasible, however, the final decision is up to the investor.

SUMMARY

Selle töö eesmärgiks oli analüüsida kas uue Togliatti tsisternide puhastuskompleksi projekt on teostatav ning majanduslikult tulus. Selleks, et nendele küsimustele vastata oli tehtud turu-, finants- ning tehniline uuring .

Turu-uuring andis informatsiooni turgudest mis äri mõjutavad ning analüüsis vastavad turud. Oli läbi viidud Vene keemiatööstuse, Vene vedelike vedu ja Vene tsisternide puhastusjaamade turude analüüsid.

Nende analüüside tulemused näitasid, et keemiatööstus Venemaal ja maailmas kasvab koos vedelate kemikaalide transpordiga. See asjaolu toob kaasa vajaduse ifrastruktuuri parandamisele, mis põhjustab tarneahela optimiseerimist, mis omakorda vähendab transpordi ja keemiakaubade summaarset hinda.

Logistikaahela optimiseerimise eesmärgil rahvusvahelised ettevõtted püüavad vältida tühjade sõidukite, tsisternide ning konteinerite ümberpositsioneerimist. Selle saavutamiseks uus produkt peab olema laaditud kohe pärast eelmise produkti välja laadimist. Uue produkti võib tsisternidesse laadida ainult siis, kui tsistern on puhas. Selleks, et rahuldada transpordi ning keemiatööstuse ettevõttete nõuded tekib vajadus uue kõrge kvaliteediga puhastusjaamade järele.

Turu-uuring näitas, et Venemaa tsisternide puhastusjaamade turg on mittemoodustanud ja vedelikke vedu infrastruktuur ei ole arenenud. Sellest järeldub, et vene turul on suur nõudlus tsisternide puhastusteenuste järele ning uus puhastuskompleks Venemaal lubab saada osa vaba turust.

Turundus uuring on näidanud, et Togliatti on väga sobiv koht uue tsisternide puhastamiskomleksi rajamiseks keemiatööstuse arendamise ja rahvusvaheliste investorite kasvava huvi tõttu. Lisaks oli selgeks tehtud see, et turundusstrateegia peaks lähtuma otsest business-to-business turundusest tugeva diferentseerumisega, miks ja kuidas praegune projekteeritav puhastuskompleks on parem kui võimalikud konkurendid.

Selleks, et näidata, kas ptojekt on tehniliselt teostatav oli läbiviidud tehniline uuring, milles oli kirjeldatud tootmise protsessid ja seadmed.

Puhastuskompleks käesoleva projekti raames pakub jargmised teenused: tank konteinerite puhastamine, autotsisternide puhastamine ning IBC puhastamine. Lisaks, kompleks peab pakkuma ka kütte- ja ladustamise võimalusi.

On olemas erinevat tüüpi puhastamise meetodid ja seadmed, kuid vastavalt tehnilisele uuringule 95% jääke saab puhastada keskmise surve hüdrodünaamilise puhastamise protsessiga lisades pesemisvahendeid. Protsess eeldab veesurve ja aluselise või happelise pesuvahendi kasutamist.

Tsisternide puhastamise valmislahendusi pakkuv ettevõte “Gröninger Cleaning Systems BV“ on kõige tuntum teenuse pakkuja ning turuliider.

Vastavalt ülalmainitud firma nõuandele valiti moodul, mis hõlmab kõike, et alustada tootmist vastavalt Euroopa standarditele. Lähtudes moodulist töötati välja tootmise skeemi ja planeeringu. Mudel eeldab ühe tehnoloogilise peahoone ehitamist ja betoneeritud pindala kasutamist. Peahoone projekteerimise ja ehitamise arvutamise delegeeriti kohalikule ettevõtele.

Tehniline uuring on näidanud, et väljapakutud puhastamise skeem, mis on uus Venemaal, on palju säästlikum ja keskkonnasõbralikum kui vanad skeemid mida kasutatakse üle kogu Venemaa. Vana puhastamise meetod tähendab puhastamist suruveega voolikutega või mõnikord Kärcher seadmetega ja aurutamisega. Ei ole kasutusel õige jäätmete utilisatsioon ja enamasti kõik jäägid on läkitanud üldise kanalisatsiooni või otse veekogudesse. Võrreldes standard Venemaa variandiga pakutud puhastamise süsteem võimaldab vähendada puhastamise aega 77 minuti, vee tarbimist ja jääke 12 m^3 võrra. Lisaks, ohtlikud jäätmed kogutakse setitisse ja on utiliseeritud professionaalse ettevõttega.

Objekti asukoht Togliatti tööstuspargis võimaldab saada kõik vajalikud energiavarud kohalike allikatest ilma täiendavate investeeringuteta.

Tehniline uuring on näidanud, et projekteeritud puhastuskompleksi töövõimsus on 20 ühikut sõidukit päevas ja 12 mahtlastikonteinereid päevas. 20 tööpäeva kuus annab aastas täisvõimsust 4800 tsisterni ja 2880 konteinerit.

Tänu tehnilisele uuringule jõuti järeldusele, et selleks, et tagada stabiilset tsisternide puhastuskompleksi tööd on vaja 11 inimest. See oli esitatud töötajate nimekirjas koos võimaliku pakutud palgaga.

Vastavalt tehnilise uuringu abiga saadud andmetele oli võimalik teostada projekti finants-eelhinnang, mis andis informatsiooni projekti võimalikust majandustulemustest ja majandusliku teostatavusest. Aastased rahavoogud olid summeeritud ja analüüsitud. Finants uuringu tulemusena diskontomääraga 7,05% ja arvutamise silmapiiril 6 aastat oli saadud järgmised numbrid:

- Projekti sisemine tulumäär (Internal Rate of Return, IRR): 12,6 %
- Netonüüdisväärtus (Net Present Value, NPV): 6719 tuhat RUB
- Investeeringutasuvus (Return of Investment, ROI): 16%
- Diskonteeritud tasuvusaeg (Discounted Payback Period, DPP): 4 aastat 9 kuud

Uuring näitas, et projekt loob sotsiaal-majanduslikku kasu uute töökohtadega ja makstud maksudega ning oli vaja arvutada, kas projekti saab lisada regionaalse investeeringutoetuse programmi.

Vastavalt arvutustele projekt võib loota riigi toetusele, sest riigieelarve kasum projektist ulatub 13 306 tuhat RUB.

Võttes kokku kõik tehtud uuringud oli läbi viidud projekti SWOT analüüs, mis näitas ära Togliatti tsisternide puhastuskompleksi tugevused, nõrkused, võimalused ja ohud.

Käesoleva töö tulemusena jõuti järeldusele, et Togliatti tsisternide puhastuskompleksi projekt on majanduslikult ja tehniliselt otstarbekas.

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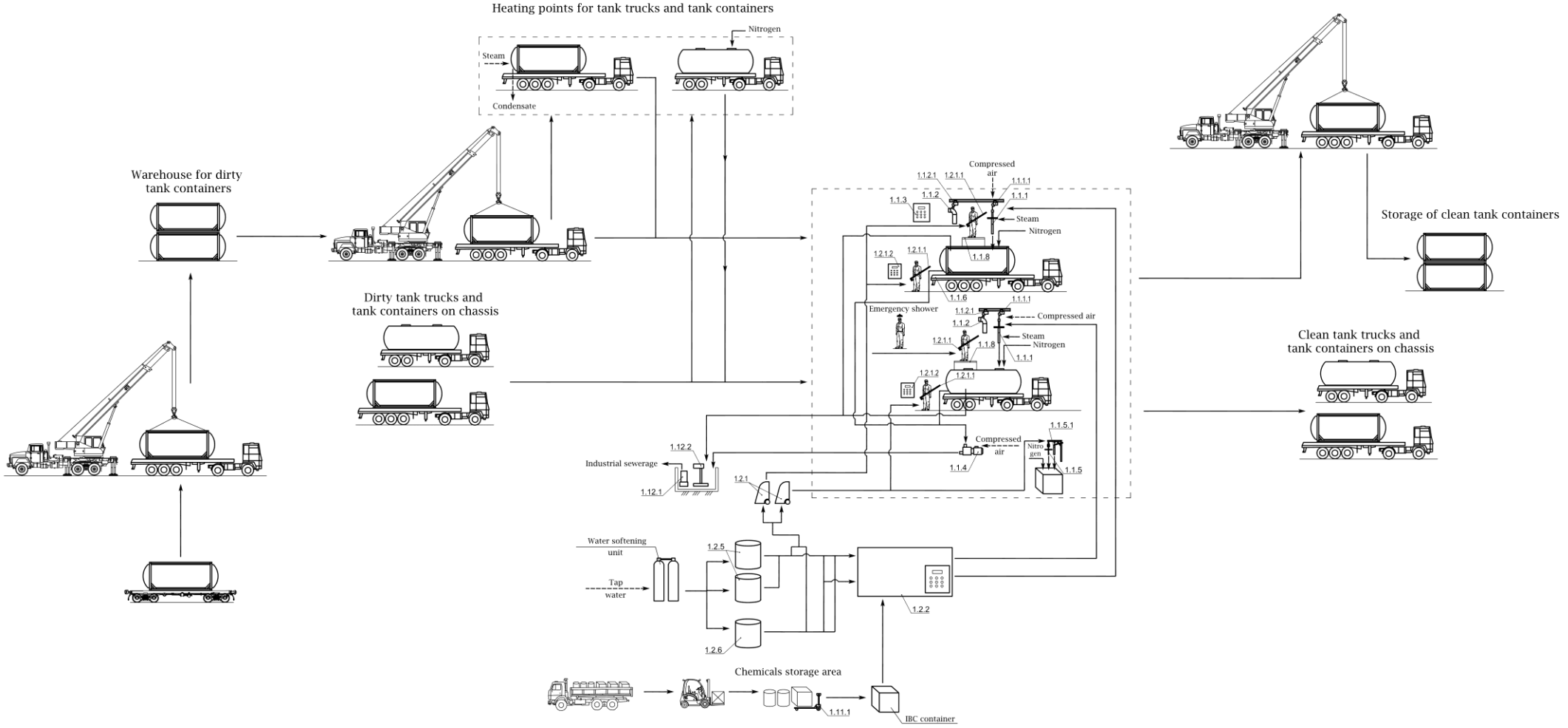
APPENDICES

Appendix A. Characteristics of portable cleaning machines

Washing fluid pressure, bar	Nozzle diameter						Cycle time		
	6 mm		8 mm		12,5 mm		Short cycle	Standard cycle	Full cycle
	Water consumption, m^3/hour	Jet length, m	Water consumption, m^3/hour	Jet length, m	Water consumption, m^3/hour	Jet length, m			
6	7,8	11,6	12.6	12,9	26,4	11,7	10	20	40
8	9,6	13,0	15,0	14,3	31,2	13,8	8	15	30
10	10,2	14,5	16,2	15,2	33,6	16,9	6	12	24

	Pressure in a cleaning line, kg/cm^2					
	3,5	5,3	7,0	8,8	10,5	12,3
Flow rate through the machine, L/min	273	336	391	436	482	523
Flow rate through the machine, L/min, m^3/hour	16,29	20,36	23,41	26,47	28,5	31,56
Cycle time, min	50	37,5	32	28	25	23
Nozzle rotations, rev/min	1,3	1,7	2,0	2,3	2,6	2,8
Water consumption per cycle, m^3	13,74	12,72	12,47	12,22	12,11	12,01

Appendix B. Technological scheme of a projected tank cleaning station



Appendix C. Technological scheme specification

Position	Name	Supplier
	1.1. Tank cleaning area	
1.1.1	Rotary cleaning head for tanks	Gröninger Cleaning Systems
1.1.1.1	Pneumatic hoist	Gröninger Cleaning Systems
1.1.2	Air blower-dryer	Gröninger Cleaning Systems
1.1.2.1	Manual hoist	Gröninger Cleaning Systems
1.1.3	Remote control	Gröninger Cleaning Systems
1.1.4	Wastewater pump	Gröninger Cleaning Systems
1.1.5	Rotary cleaning head for IBCs with bracket	Gröninger Cleaning Systems
1.1.5.1	IBC blowing tube	Gröninger Cleaning Systems
1.1.6	Utility vehicle, chassis	Schmitz Cargobull
1.1.7	Protection from falling.	Gröninger Cleaning Systems
1.1.8	Bridge	
	1.2. Area for equipment	
1.2.1	Pressure washer	Kärcher
1.2.1.1	Washer spray gun	
1.2.1.2	Control panel	
1.2.2	Pumping unit	Gröninger Cleaning Systems
1.2.3	Air compressor	Remeza
1.2.4	Air compressor	Remeza
1.2.5	Hot water tank	
1.2.6	Cold water tank	
	1.11. Storage area for chemical detergents	
1.11.1	Hydraulic trolley	«Lema» LLC
	1.12. Wastewater collection site	
1.12.1	Submersible drainage pump	JSC «Vilo Rus»
1.12.2	Agitator	JSC «BMT»

Appendix D. Project tax environment

№	The name of the tax	Percent/SUM
1	Insurance premiums	30,6 %
2	Value Added Tax, VAT	18%
3	Property Tax	2,2%
4	Tax on profit*	20%
5	The land Tax	675 000 RUB/year

*Project can count on a governmental support. According to the Federal law of Samara region „On the reduced tax on profit rate" № 187-ГД tax on profit can be reduced to 15.5%