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Potash fertilizer to agricultural based economies

VASILI KATOVICH[1], FADI THABTAH[2] and CAROLINE DAY[3]

ABSTRACT

Potash is an indispensable element in agricultural development and innovation. It is relatively cheaper to mine, produce and be imported compared to other fertilizing materials such as nitrogen. This makes potash a viable material for agricultural based economies such as New Zealand. Despite the well documented benefits of potash, there is limited scholarly interest in the potash global market, its potential and economic advantages. This paper fills this gap by providing an overview of the potash market using secondary data provided by the Food and Agricultural Organization of the United Nations. Further, this research presents a market analysis of the potash industry worldwide. Most importantly, the study argues that the prospects of potash production can be realized by countries such as New Zealand without significant changes or investments in the existing agro-economic infrastructure. We will also consider the size of the market and future perspectives for potash demand in New Zealand. Furthermore, a critical analysis of potash consumption and production by the country will be done. The influence of the demand on the price and interrelation with the global volume of production will be considered. This research uncovers the negative impact of oligarchies on the mining, production and importation of potash. It also highlights the significance of diversification in New Zealand's future agricultural development strategies. The burgeoning of Eastern European Potash markets offer New Zealand's farmers the opportunity to access cheaper, better and diversified products greatly improving their local and to be exported crops.

KEYWORDS: agriculture economy; belaruskali; canpotext; fertilizer; potash, potash market, uralkali

1. Introduction

Agriculture in New Zealand occupies the largest share of the country's economy. While this sector is composed of several smaller markets, the fertilizers market is one of the most important parts of New Zealand's agricultural industry. Potash is one of three main types of fertilizers that are used worldwide and is currently under-utilized in New Zealand's agricultural life despite its well-documented benefits, prospects and ease of access and importation. (Jiang, 2003).

Human population growth has increased the mining, production and use of Potash significantly enlarging its market by 3% worldwide in 2016. People require more food and use more fields for agricultural development, therefore they necessarily consume more fertilizers such as potash increasing crops' yields. there are few places in the world where mining potash is economically reasonable. Almost 90% of all known reserves are situated in three countries: Canada, Russia and Belarus (Jasinski, 2012).

During the past few decades, the price for potassium nutrients was extremely unstable. The potash market is very narrow and is not traded on stock exchanges. Many analysts have argued that oligopoly is a major problem in the Potash market. Few large companies have consented to keep prices high. Up to the end of 2006, the price of a ton of potash was less than $200. Then it drastically increased reaching a $1000 US in 2008 until the global financial crisis reduced the price. In 2013 the agreement between the two largest companies Uralkali and Belaruskali was cancelled. These two companies shared more than 35% of world market and due to their business conflicts, price of potash decreased dramatically. In 2015 Belaruskali signed a contract with the largest customer, China, selling Potash at $315 per ton.

New Zealand companies only import potash from Germany and Canada at higher prices. This prompts policy makers to reconsider the current New Zealand's strategies concerning potash importation. It is more reasonable to start looking for other suppliers in different parts of the world (Roberts, 2014). Another possible reason to start

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[1] International Business, Nelson Marlborough Institute of Technology.

[2] Corresponding author: Applied Business and Computing, Manukau Institute of Technology, Auckland, New Zealand. Fadi.fayez@manukau.ac.nz.

[3] Applied Business, Nelson Marlborough Institute of Technology.

buying from different places is the lack of production in Germany, since reserves of potash in this European country are almost exhausted.

The main aim of this article is to assess the potash market worldwide and then assess the demands on this fertilizer in New Zealand. Potassium does not need a complex processing to become ready, unlike other fertilizers such as nitrogen and phosphate. This made potash producers almost 100% importers, and Uralkali and Belaruskali from former USSR republics Belarus and Russia are not an exception from the rule (Volkova, 2015). Not many firms are operating on the potash market. However, a huge amount of commodities must be delivered from the opposite side of the planet when it comes to potassium for customers in New Zealand, which also makes influence on the final price. Suppliers must be reliable, experienced and at the same time able to react quickly if the situation on the market alters.

To achieve the aim of this research, potash markets from different countries must be compared. It is extremely important to clarify the ability of companies to follow the contract and deliver the exact amount of goods on time, as agriculture is a seasonal industry. Hence delays may have a negative influence. For that reason, production volumes and stability must be checked and be compared to other market players. Price is another important factor to take into consideration.

This research has several objectives. Firstly, we analyze the amount of annual potassium production between current suppliers to the New Zealand market and Uralkali with Belaruskali. Then, we compare reserves of fertilizer that both companies own. Beside potash price fluctuation, as potash is not trading on stock exchanges, it is possible to analyze its price by comparing contracts of primary consumers, such as China, India and Brazil. By combining all these objectives, it is possible to forecast future perspectives of the global potassium market. The following questions are clarified in this report: how reliable are importers from Belarus and Russia; and what benefits can New Zealand farmers expect when getting potash deliveries from that regions.

Scholarly research on potash mining, production and importation by industrialized countries such as New Zealand is limited. Most analysts discuss potash within the general fertalizers' framework and ignores the several benefits of considering it on its own. This has led to the underestimation of the mineral' potential in agricultural use and cost-effectiveness for agricultural development. New Zealand's agricultural sector can improve significantly if potash is optimally purchased from new markets and utilized efficiently.

2. Literature review

2.1. Potash

When it comes to the agriculture industry, potash is a solid single nutrient or straight fertilizer. It has been used from ancient times, however the industrial mining of it started in the middle of 19th century in Germany (Figure 1. The author of this research in a potash mine near Kassel in central Germany, 800m below the surface). Extraction of the potassium is a complicated process. Deposits of this salt are lying under the earth surface at depths between 350-1000 meters (International Plant Nutrition Institute, 2010).

The plant's growth requires sunlight, water and nutrients, and the three main nutrients are nitrogen (N), phosphorus (P) and potassium (K). An insufficient amount of any of these elements in the soil leads to the limitation of the plant growth and to the yield reduction. Fertilizers provide plants with the necessary amount of nutrients at the appropriate stage of the growth. The proper use of fertilizers can increase the yield in two, and sometimes even three times. Potassium activates more than 60 enzymes and ferments which are necessary for the synthesis of proteins and carbohydrates. Among the ingredients of the potassium-based fertilizers are substances that are perfectly soluble in water. When the soil is fertilized by such substances, the chemical reaction with the existing components starts immediately (Jin, *et al.*, 2012).

There are several main periods during the crop growth for the potash fertilizers:

- The pre-sowing or basic fertilizer is applied in autumn or spring, based on the temperature conditions of a particular climate zone. Fertilizer before sowing provides green culture with nutrients for the whole season.

Figure 1: Author of the report in the salt mine 800m below the Earth surface near Kassel, central Germany, 2013

- The sowing or starting fertilizer is applied during the planting. It helps the root of the young plants and ensures the stable growth on the early stages.
- The post-sowing fertilizer is an additional step to the above methods. The main objective of it is auxiliary nutrition at the peak of the crop growth and replenishment of the missing elements.

Different types of plants require different amount of potash. It depends on weather conditions, season, type of soil, crop yield and other factors. Potassium helps plants to keep the humidity of the soil, increases the nutritional value, and improves the test and color of the product. When a plant receives enough potash there are following benefits:

- oxidation process in cells is more intense
- cellular metabolism enhanced
- increased resistance to the lack of humidity
- photosynthesis accelerates
- plant quickly adapts to temperature changes
- increased resistance to disease

The main aim of using potash is to compensate for the lack of nutrients caused by human or by nature and to get higher yields. It is the same in both tropical and temperate climates. As the area of pastoral fields in the world is limited and the population of humanity is increasing, there is no other way to get more food than to use more fertilizers. An example of this is in developed countries, where potash used by the hectare is almost four times higher than in developing countries. In Russia potash use is 40 kg per hectare and in the USA it is 140 kg per hectare (Volkova, 2015).

The Food and Agriculture Organization of the United Nation (FAO) has predicted that the world potash market will be increasing 2.8–3.3% per year. Latin America and Asia are making the biggest impact on it, as shown in Figure 2.

The main factors, which influence the global fertilizer market is the growing of Indian and recovery of Brazilian economies, although at the same time the unstable and unpredictable situation in China makes this forecast less reliable. New Zealand does not play an important role in the global potash market, despite the main role of agriculture in their economy.

According to the industry experts, the global consumption of potash in 2014 was 62 million tons. In monetary terms the annual turnover was approximately 20 billion USD (Petrov, 2015). Figure 3 shows the production of potash in 2014 by countries. According to the market specifics it is common to consider the whole country as a single customer or a producer. There are three large producers of potash worldwide: Canpotex Ltd. (Canada), Belaruskali (Belarus) and Uralkali (Russia).

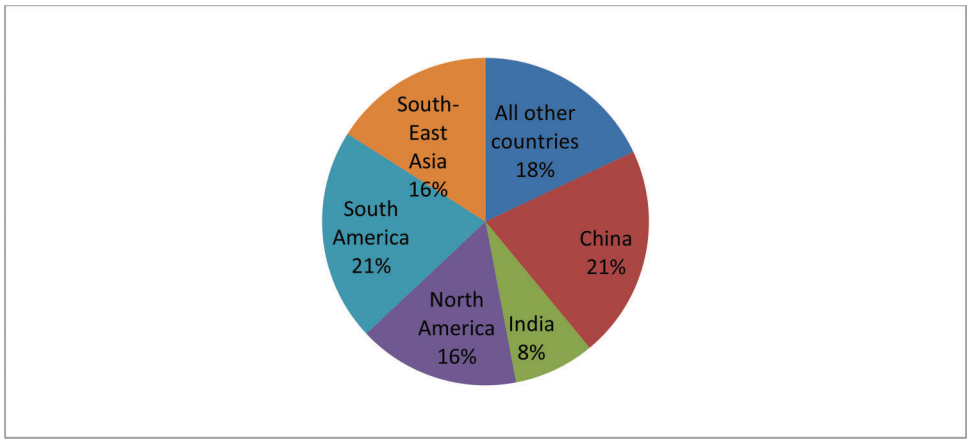

Figure 2: Potash use by region. Source: FAO

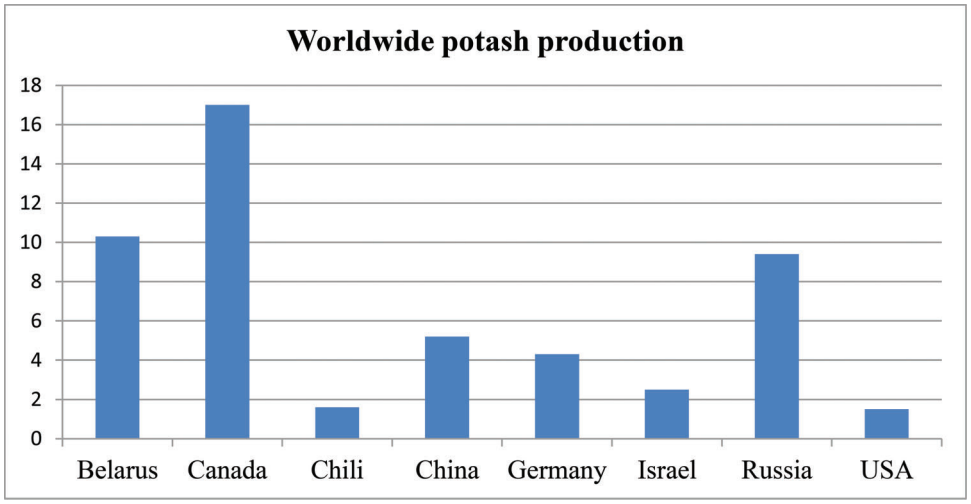

Figure 3: Worldwide potash production by country, 2014. Millions of tons

2.2. Potash Primary Producers

2.2.1. Canpotex

Canpotex was founded in Canada with the purpose of exporting fertilizers all over the world. Shareholders of this company are Mosaic Canada, Potash Corp. of Saskatchewan and Agrium Inc. Canpotex is the only firm from the top three producers that operates not only on the potash market, but also in sales of superphosphates and nitrogen fertilizers.

The Canadian potash producer has a close cooperation with the government. For example, in April 2005, it received a 10-year tax relief from the Provincial Government of Saskatchewan. In response to this positive move, Canpotex invested in increasing the capacity of potash mines in Saskatchewan. The Canadian potash importer is constantly developing and has numerous projects. Logistics is an important part of the industry as commodities count by tons and even small contracts include supplying thousands of tons. Recently, Canpotex has invested more than 140 million Canadian dollars in Portland Bulk Terminals. They also agreed with National Steel Car of Hamilton (Ontario, Canada) to manufacture 700 railcars for transportation of potash from Saskatchewan mines to coastal ports. These facts show that Canpotex is an important Canadian firm.

2.2.2. Uralkali

Uralkali has its main office in a mining potash area called Berezniki in the Perm region, Russian Federation. The company was founded in 1926, after potash was recognized in Solikamsk by Professor Preobrazhensky, from that time Uralkali is constantly developing and modernizing their production according to industry standards. The first huge modernization was in 1950s-1960s, when machines changed human work. From that time Uralkali increased their production capacity step by step. Nowadays Uralkali has a share of 20% of the global potash market and sells their product to more than 60 countries all over the world. Main markets are China, India, Brazil, South-Eastern Asia, the USA, and European countries. A further 16% of all mined potash goes to the internal Russian market. As the logistic component is significant, the company has storage for 640,000 tons of the product and 8,000 railcars for delivering potash to customers and to coastal ports. Even this is not enough during the peak season, so Uralkali hires railway transport from logistic companies and additional storage in Ventspils sea port.

The Russian potash producer is investing a lot into a scientific activity and R&D. With their support in 2009 the Kali Institute was founded in Perm Region. Since 2012, Uralkali is developing a project of increasing crop yield in agriculture. Such scientific programs give benefits to both, farmers and the company. Farmers get a higher crop yield, Uralkali sells more potash. The company has several projects for increasing the capacity which have already been launched. New mines Solikamsk-2, Solikamsk-3, Ust-Yayva and Polovodovo will start to work in the near future. According to the plan, Solikamsk-2 is able to increase capacity by 2.3 million tons and requires the total investment of 723 million USD. Solikamsk-3 is able to provide additional 0.6 million capacities and requires 135 million USD of investment. Ust-Yayva estimated capacity will be 2.5 million tons, and its total investment will be 1.12 billion USD. The biggest project is Polovodovo with a future capacity of 2.8 million tons and 1.9 billion USD investments. With all these projects, Uralkali can almost double its current capacity. Figure 4 shows estimated growth of Uralkali potash mining according to the company's future business plan.

2.2.3. Belaruskali

Another important player on the global potash market is Belaruskali from Saligorsk, Belarus. According to IFA Belaruskali produced 1/7th of all potash in the world in the year 2015. Almost all the mined product was imported, as the Belarusian market is quite small. As it is possible to recognize from the company web site, Belaruskali exported potash to more than 70 countries. The first potash mine was built in 1949 in Starobin. The mine gives a start to the city Saligorsk, which was built to supply Belaruskali worker's needs. In 1981 Belaruskali reached the point of 100 million ton of mined potash.

The Belarusian potash producer is constantly increasing its capacity. In 2014, the company started the Petrykau project. According to the plan, the mine in Petrykau will reach full capacity by the year 2020. For the aim of potash exporting, in September 2013, Belaruskali established the Belarusian Potash Company. A company with the same name operated in the market previously and was selling commodities from two large potash suppliers in the region, Belaruskali and Uralkali. However, the

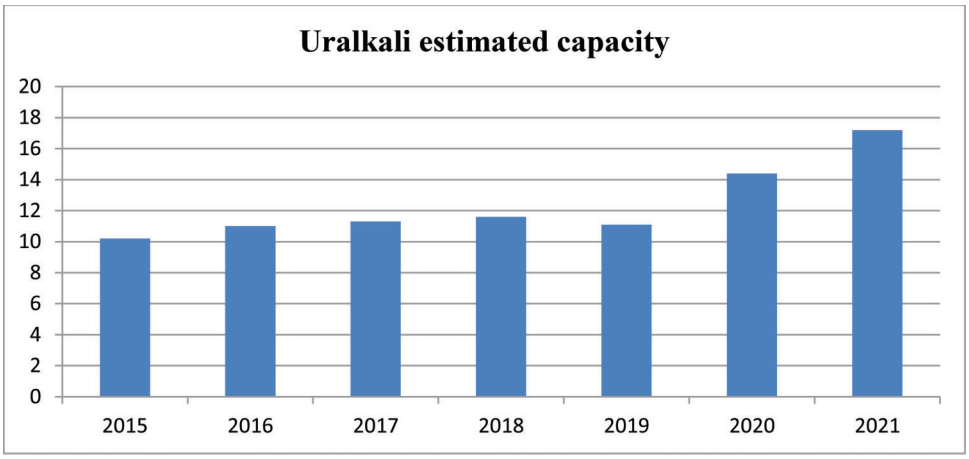

Figure 4: Current and estimated capacity of Uralkali, million ton

business relationship with Uralkali was broken in 2013 and after a few months a company based in Saligorsk started to sell potash separately. Now the Belarusian Potash Company has several offices worldwide including Delhi, Beijing, Singapore and Sao-Paolo.

Belaruskali is 100% owned by the government. Since Belarus is not a member of WTO and other financial and economic organizations, the information from the company does not follow international standards. At the same time, Belaruskali and Belarusian Potash are members of IFA and send reports to this organization. Moreover, FAO collects statistical information from governments, including data connected to the fertilizer industry, which is used in this current paper.

2.3. Potash in New Zealand

New Zealand is totally dependent on imported potash as there is no source of it inside the country. According to statistics from FAO, New Zealand imports around 100,000 tons of potash per year. Unlike the rest of the world, consumption of this fertilizer in New Zealand decreased during the last decade. However, since 2010, quantities imported potash stabilized to 100,000 tons per year, as shown in Figure 5.

Agriculture in New Zealand is the largest sector of the tradable economy, contributing about two-thirds of exported goods (Brazil, 2008). The land area, devoted to horticulture, has increased during recent years. Total horticulture exports reached 2.45 billion of dollars in 2012. Average production of grapes is more than 200,000 tons per year. Also important products of the horticulture industry are peaches, nectarines, plums, apples, kiwifruits, avocados, onions and squash. All these, and many others, require fertilizers for high crop yield and for the good taste and quality. As the horticulture is a growing industry in New Zealand, the likelihood that the quantity of potash used will decrease is negligible.

3. Critical analysis

The years 2014 and 2015 can be considered successful for the global potash market. Consumption of potash was increasing by almost 4%. Key markets were recovering faster than had been predicted and there were increasing demands, primarily from China, India, Malaysia and Indonesia. However, prices have fallen down. Because of the business conflict between Uralkali and Belaruskali in 2013 Belarusian Potash has suspended its operation. Customers were unable to purchase potash in the East-European market. In 2014 customers refilled their empty storages. Demand in China grew up to 24% and markets in South-Eastern Asia demanded over 10 million tons in 2014 compared to 8.1 million tons in 2013. Significant increases in demand were observed in Brazil, about 20%, and India signed contracts for 4.3 million tons in 2014 and 4.6 million tons in 2015.

The North American market had a stable high demand. It could slightly decrease in the near feature since less corn are planned to be produced. European, Middle-East and African markets showed the same level of consumption. The average load of production in the industry was 83-85%. Russian and Belarusian producers showed record levels of production. Figure 8 represents potash production by country from 2001 up to now. Data from 2001-2011 was taken from U.S. Geological Survey (Jasinski, 2012) and IFA, later data – from companies.

Figure 6 depicts that potash production in the world grew up from 2001 to 2014. However, the growth cannot be considered as stable. In the years 2006, 2008, 2009, 2012 the number of mined potash decreased due to different reasons. In 2006 and 2012, main potash customers had a lot of potash in storage and refused to buy more due to world instability. Most potash suppliers were simultaneously reacting to demand except Belaruskali. In 2013 the Belarusian company mined a smaller amount than expected. The problem was due to breaking relationship with Uralkali, after which Belaruskali almost stopped production for a few months as it lost sales markets.

New Zealand potash consumption has been stable for the last five years. The current global situation, when the production is increasing as a result of competition for market share between leaders, is positive for New Zealand importers as it gives hope for a stable low price. Production in different world regions has been changing in the same way for the last decade. It gives a confidence that all suppliers considered in this paper, Canadian and East-European, are equally reliable.

The price for potash has been stable for decades. However, in the last 10 years there was significant price fluctuation. There was a jump from 120 dollars per ton in early 2000 to almost 900 in 2008. Then, under the influence of the global financial crisis in 2008, it decreased to 300 USD in 2010. For the last two years the price for potash has fluctuated near 300 USD per ton. The most

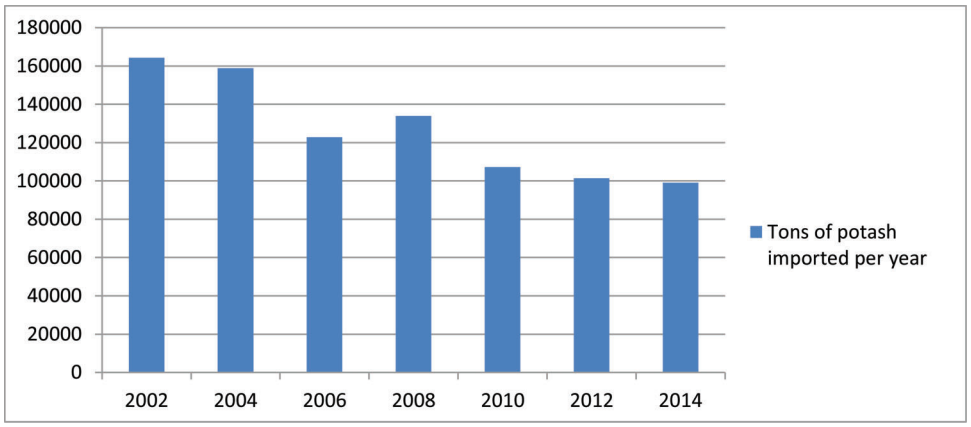

Figure 5: New Zealand potash import

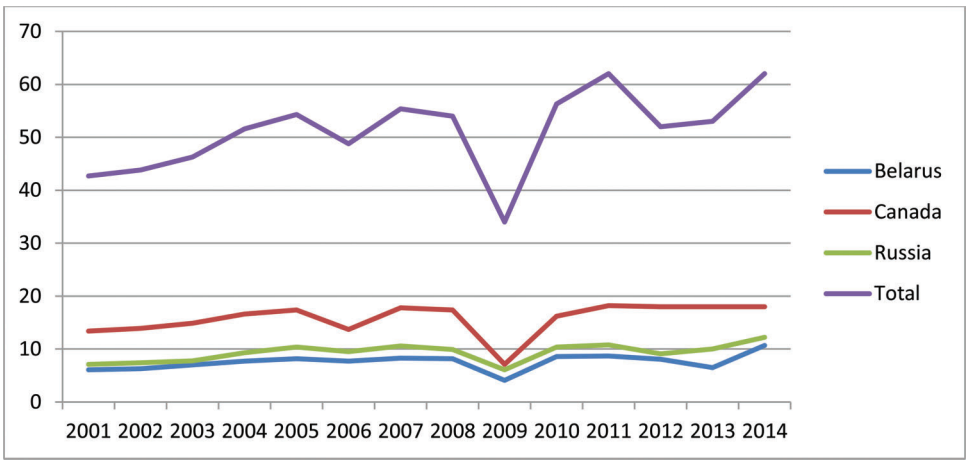

Figure 6: Potash production by country, millions of tons

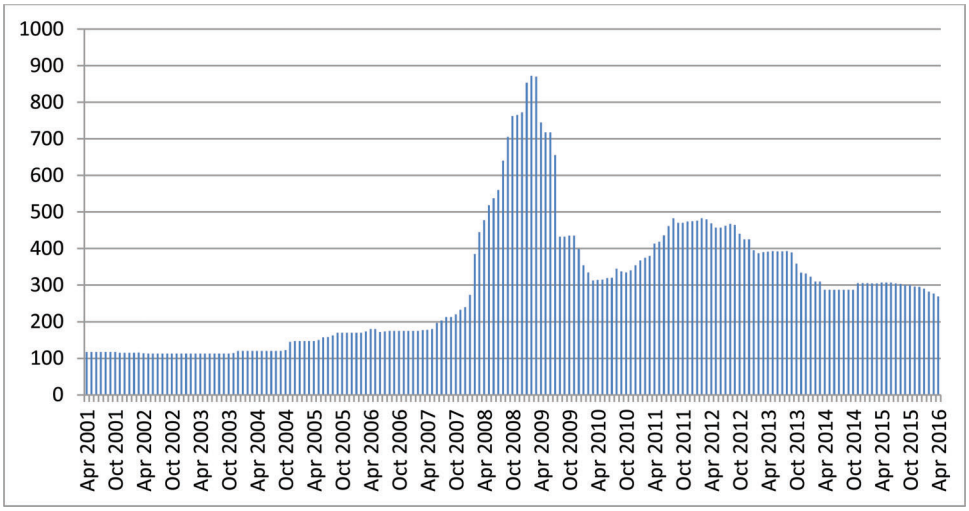

Figure 7: Price for potash, USD per ton. Source: World Bank

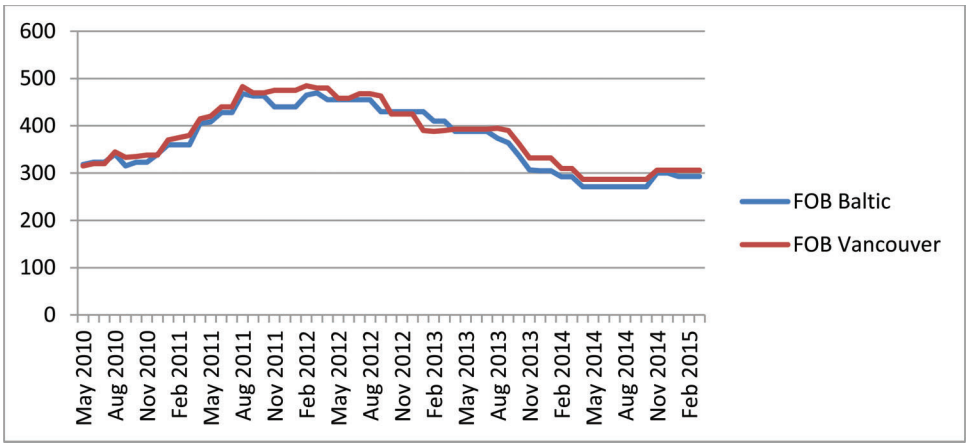

Figure 8: FOB Baltic and FOB Vancouver contracts prices for potash, USD per ton

important event for this year is that India halted potash imports because droughts hit the crop fields in the country. As a result, price is going down again.

As the most significant potash producers are situated in Canada and Eastern Europe, to compare their prices we can observe contracts on FOB Baltic and FOB Vancouver basis (Incoterms 2000). The data has been collected from IFA and company web sites. Canadian potash was more expensive during the last five years. However, there was a period of time in the end of 2012–beginning of 2013 when potash in the Baltic port cost more than in Vancouver.

For New Zealand importers, such as Balance Agri-Nutrients, Ravensdown Fertiliser and Summit Quinphos, the average difference in 10 USD per ton can save 1 million USD per year, as their need is 100,000 tons. The total price for any kind of goods for New Zealand customers is definitely depends on logistic costs. However, as potash normally delivered by ships, which are the cheapest possible transport, the difference in transportation price cannot be high. It means that price based on FOB Baltic could be considered as permanently lower for New Zealand companies.

4. Conclusions

The potash market is specific as the main resource deposits are concentrated in a few places in the world. There are limited numbers of players on the potash market worldwide including Canpotex (Potash Corporation, Mosaic and Agrium) in Canada, and the Belarusian Potash Company (Belaruskali and Uralkali) in Belarus. European commission classified the market as an oligopoly in 2010. According to the antimonopoly investigation in the USA in 2008-2012, these two associations coordinated prices with each other. That was the main reason of unexpected growth of the potash price in 2008.

In 2013 Belaruskali and Uralkali broke business relations and started to divide markets. This changed the situation dramatically. The consequence of this act is that world suppliers of potash began to increase their production capacities and the price decreased. New Zealand fertilizer importers can choose where to buy potash. Currently, all potash entering the country is only from Germany and Canada, so we believe, it is the right time to start to diversify suppliers. This is since the commodity is cheaper in Eastern Europe, however the price difference is not significant. It is surprising as costs of mining in Belarus and Russia is significantly less than in Canada. According to statistical data provided by Uralkali, the cost of one ton of product for Uralkali is 58 USD, for Belaruskali is 86 USD and for Canpotex is 135 USD. At the same time the price for a ton of potash is almost the same and customers can choose where to buy. The profit of Belarusian and Russian companies must be reasonably higher and allow them to invest more in their growth. However, it is definitely not so for Belaruskali, as company is owned by the government and the revenue is tumbling.

Comparing two potash producers from the former Soviet Union, Uralkali looks more preferable. The Russian company owns the biggest potash deposits in the world. Also it is very important that this company follows international standards as it has foreign investors. Even though by all parameters Belaruskali is not losing to its competitors, it is still a closed government-owned firm and not all information about it is reliable.

For the New Zealand market both potash producers can be considered as potential suppliers. Their productivity is stable and even if it changes, it is only a response to the global market situation. It means that they are reliable partners and can deliver the amount of goods required. The price in Eastern Europe is lower, even though logistic costs can influence it and minimize the difference with the price in Canada. One of the findings of this business case is that oligopoly exists not only among potash producers, but also inside the New Zealand fertilizer market and there are only three importers in the country. It has been empirically proved, that absence of competition has a negative impact the potash market. Hence, a few more fertilizer suppliers will be definitely beneficial for New Zealand farmers and in being competitive with already existing firms, new importers can deliver potash from Eastern Europe.

5. Limitations

This case study has some limitations. Firstly, potash is not a commodity that is normally traded on any stock exchange. This makes it difficult to find prices for it, as we must rely on information from limited companies market. The number of producers is also limited and does not allow for including a lot of them in the research. Only a few companies play a significant role in the market and must be considered. Another important limitation is that one of the biggest players on the market is government-owned. Information about Belaruskali can be accessed only from international sources. The New Zealand market is not big enough to play an important role in global potash consumptions and only three companies are operating. The situation in the New Zealand fertilizer market looks similar to the global potash market in 2008, when two associations divided it among themselves.

About the authors

Vasili Katovich has a post graduate degree in international business from Nelson Marlborough Institute of Technology (NMIT). Prior that he had an Engineering degree from Belarus and worked multiple years across Europe in material engineering trade.

Fadi Thabtah is a professor of Business and Information Technology who had worked at Nelson Marlborough Institute of Technology (NMIT). He is now working at Manukau Institute of Technology in Digital Technology. Fadi has a PhD in Computing and Mathematics from the University of Bradford, UK and an active researcher. His research interests are in the areas of machine learning and its applications to healthcare, web security and other applications. Fadi has extensive research publications and research supervisions.

Caroline Day is the Academic Manager at Nelson Marlborough Institute of Technology (NMIT). She has a Master of Arts in Conflict Resolution and is currently undertaking her PhD in the field of Social Sciences at Auckland University of Technology (AUT). Her research interests are in the areas of gender studies, anthropology and health.

REFERENCES

Beresford, R.M. and McKay, A.H. (2012). *Climate change impacts on plant diseases affecting New Zealand horticulture*. The New Zealand Institute for Plant & Food Research Limited.

Borisov, V.A. (2014). *Efficiency of potash fertilizers for vegetables and melons*. Russian Scientific Research Institute of Horticulture.

Cherednichenko, V. (2013). *The use of potash in the rice crops*. Kuban State Agrarian University.

Dennis Kostick (2006). *Potash. Minerals Handbook*. USGS.

EuroChem (2013). *Annual Financial Report*.

Hugh Campbell and John R. Fairweather. (1998). *The Development of Organic Horticultural Exports in New Zealand*. Lincoln University, Canterbury.

International Plant Nutrition Institute. (2010). *Potassium Fertilizer Production and Technology*. Norcross, Georgia, USA.

J.Y. Jin., H.T. Wang., R.Z. Cui and C.J. Li. (2012). *Yield responses and potassium use efficiency for winter wheat in north-central China*.

Jasinski, S.M. (2012). *USGS Mineral Commodity Summary*.

Jiang, C.C., L.S. Yuan and Y.H. Wang. (2003). *K-efficiency in different cotton genotypes at seeding stage*. Journal of Huazhong Agricultural University.

Kevin Stone (2008). *Potash*. Canadian minerals yearbook.

Panteleeva, O. (2014). *The economy of potash use*. Moscow Agriculture Academy.

Petrov, O. (March 2015). *Potassium market overview 2014*. Key Element.

Roberts, A. (2014). *Fertiliser industry - The industry today*. *Te Ara - the Encyclopedia of New Zealand*.

Sarah Brazil (2008). *New Zealand Official Yearbook*. Statistics New Zealand.

Sonya Gulati (March 2014). *Uncertainty hovers over the global potash industry*. TD Economics.

Stephan Bogner (2015). *The Race For Western Potash's White Knight Is On Win, Place or Show in the Global Potash Market?* Rockstone Research.

Vasudha Mishra., Gahlaut, P.S., Awasthi, U.S. and Rajesh Kumar Sadangi. (2014). *59th annual report*. Indian Potash Limited.

Volkova, A. (2015). *Fertilizer market. National University of Research, Higher School of Economy*. Moscow, Russia.

Yasko, S. (2015). *On the construction site of Petrikov MPP*. Kaliishchyk.

Yeliseev, A. and Avtushko-Sikorskiy, A. (2014). *The potash industry in Belarus: reasons and consequences of broken relationships with Uralkali*. Belarusian Institute for Strategic Studies.