# *Potassium fertiliser and development: review of major approaches to improve supply*

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# Outline

1) Global potassium production
2) Potassium and SDGs
3) Ways of improving the supply

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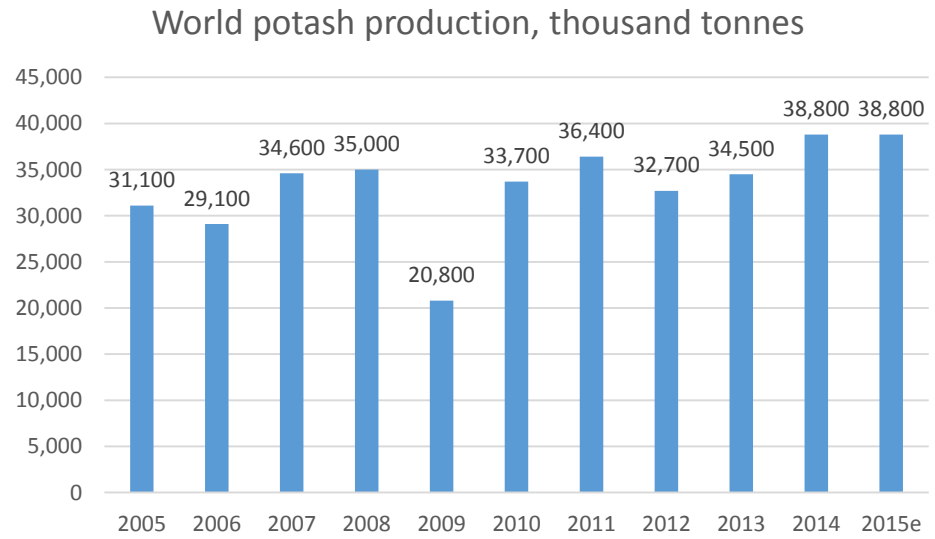
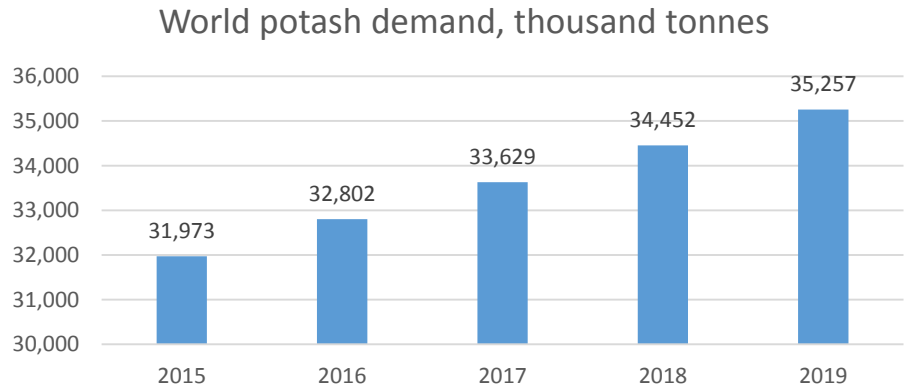
# World potassium supply and demand

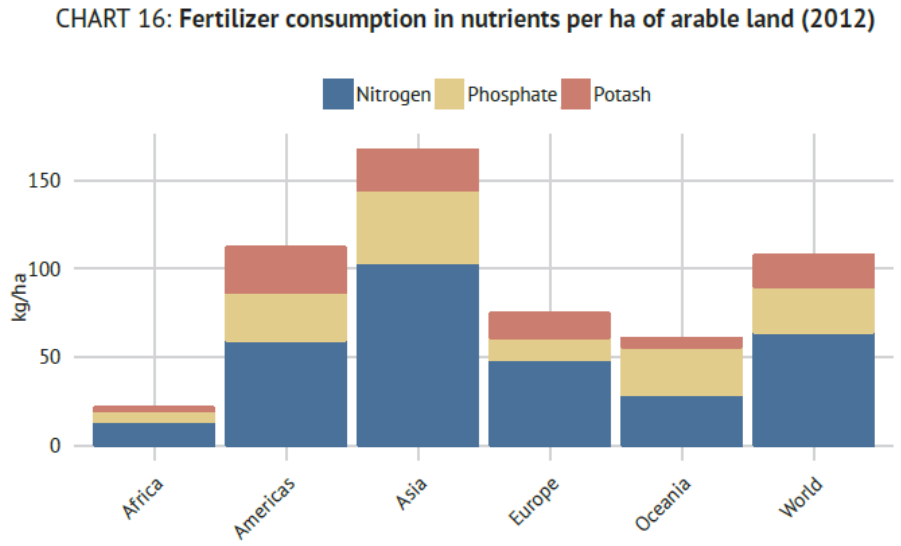
- Potassium (K) is one of three key nutrients necessary for plant growth (NPK)
- 93% of mined potassium goes for fertiliser production
- Global reserves of potassium are estimated at about 3.7 billion tonnes and the current production rates meet global demand patterns
- Global reserves of potassium are not immediately scarce, estimated reserves will last for the next 400 years at the current consumption rate

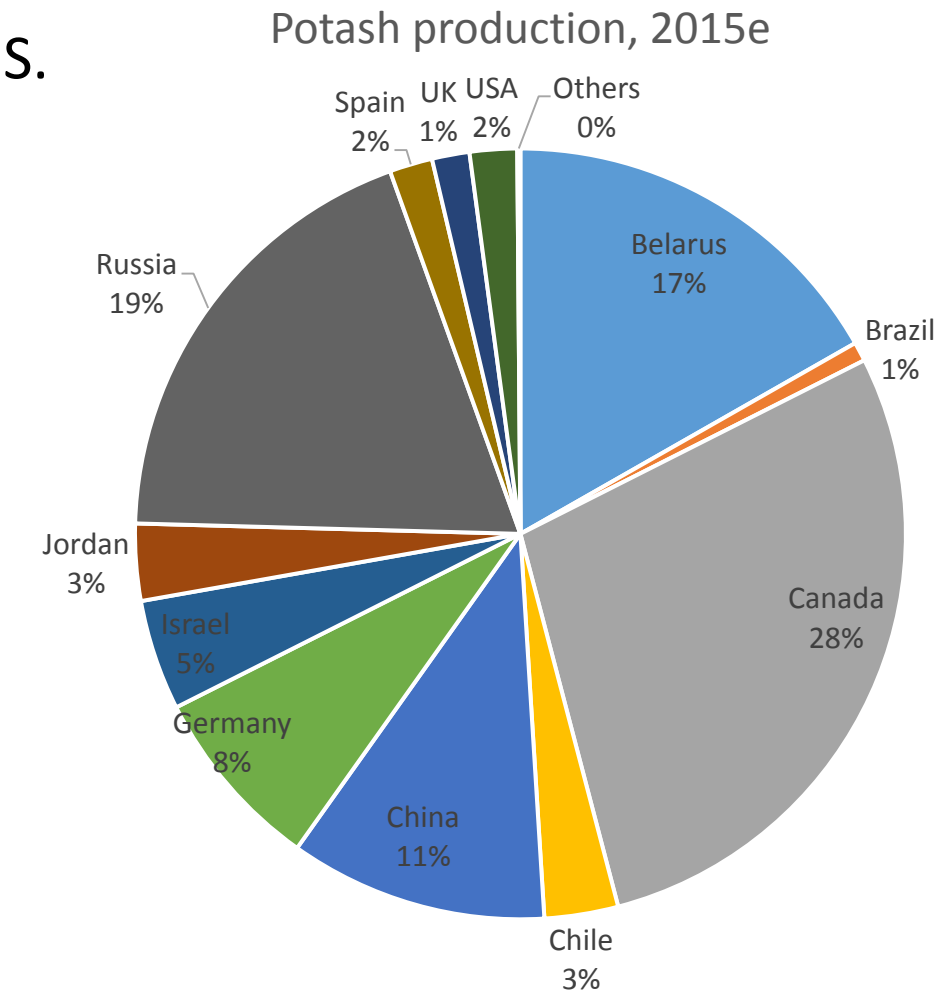


# Global potassium production and consumption

- Major countries-producers of potassium are Canada, Russia, Belarus and Israel, followed by smaller producers such as China, Germany, Jordan and the US.
- Geographical separation of potassium mines in the northern hemisphere and growing demand for potassium fertilisers from the southern hemisphere (Asia, Africa and Latin America)



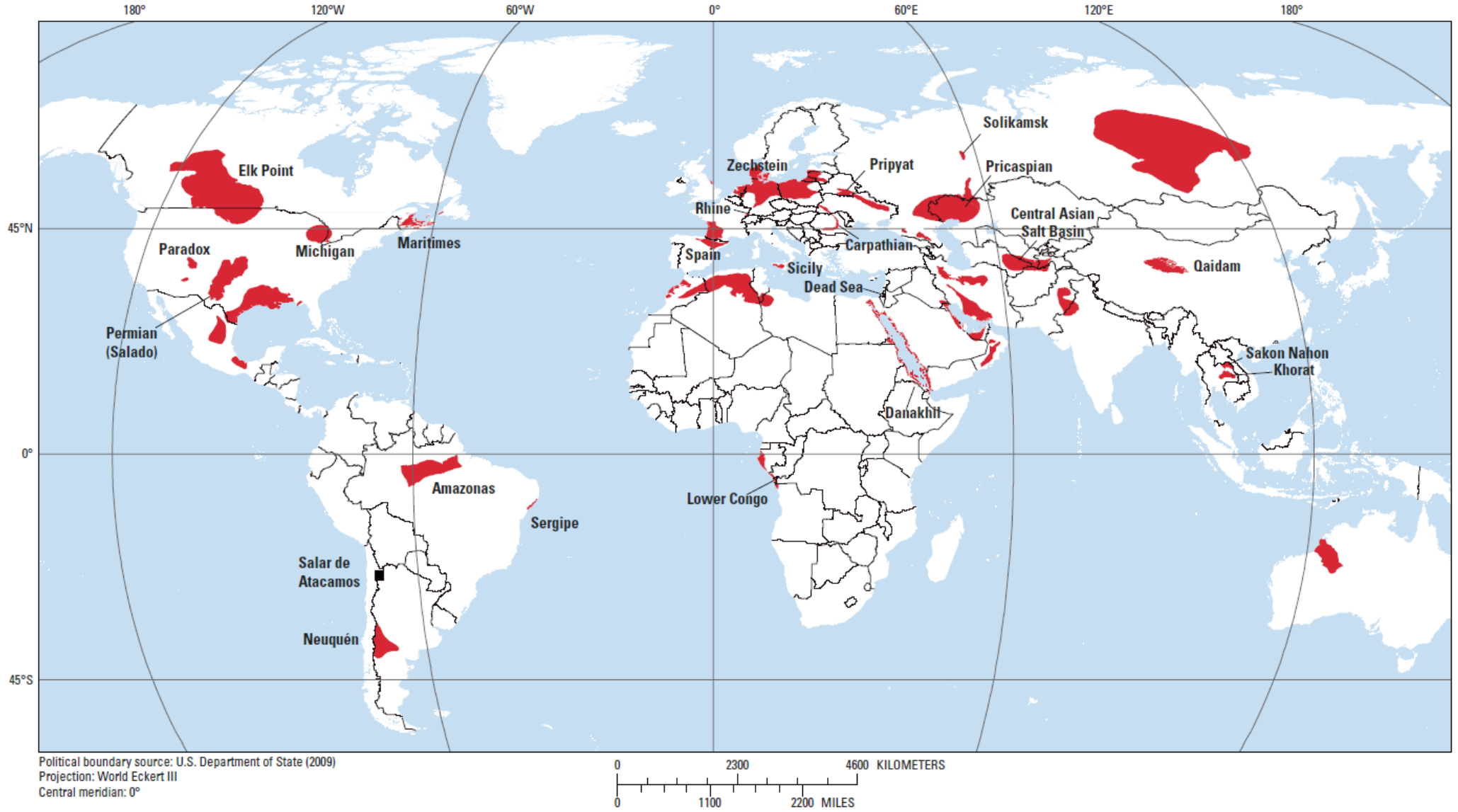


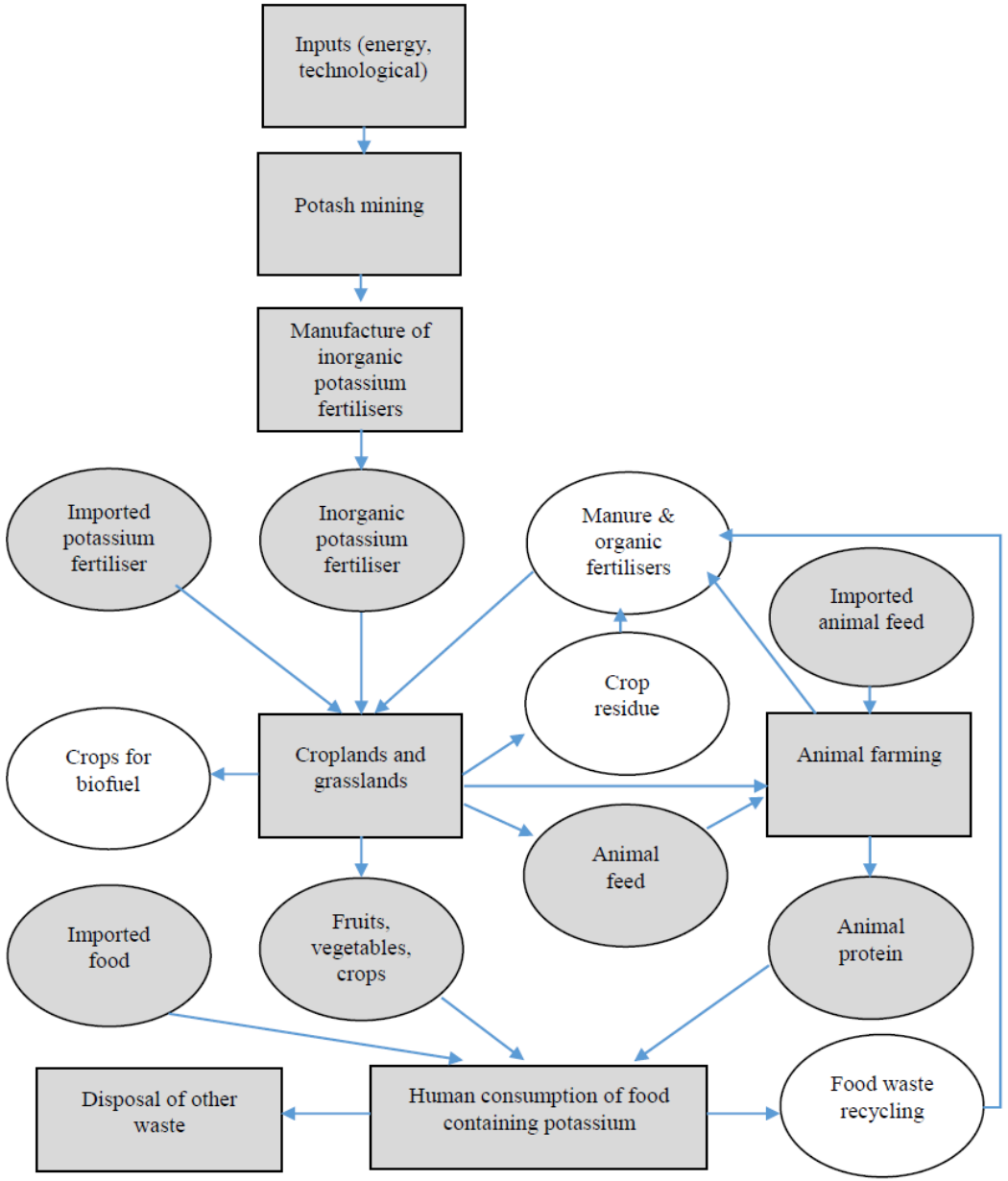

Figure 1. World map of significant potash-bearing marine evaporite basins, modified from Orris et al. (2014). Basins are in red, and the major potash-producing salar in Chile is depicted by a black square. For more detail, interactive geographic information system–based maps and data are available in Orris et al. (2014).

Cocker, M.D., Orris, G.J. and Wynn, J. (2016) *U.S. Geological Survey assessment of global potash production and resources—A significant advancement for global development and a sustainable future.* The Geological Society of America Special Paper 520, 2016.

# ‘Mine to mouth’

- Potassium is not widely recycled in agriculture
- Follows a one-way stream from mining o potassium to disposal with liquid waste
- Organic production also uses potassium fertilisers though suggestions are made to move away from commercial fertiliser (Nowak et al, 2015)
- Potassium can be applied to soil not only from mineral-based fertilisers, but also from manure, crop residue and compost
- Geological limits to inorganic fertiliser in global food production reviewed with focus on phosphorus (Villalba et al, 2008 – global metabolism

*Figure 1. Potassium life cycle*




Source: Adapted from the Potash Development Association, 2008, 2016.
Note: In shade are dominant stages in the potassium life cycle

# UK food consumption and potassium

- 40% of food consumed in the UK comes from abroad. Overall intake of potassium in the UK relies on imported food and animal feeds.
- The UK currently maintains low self-sufficiency rate in vegetables at 58% and fruit at 11%. UK saw a decline in the area for fruit and vegetable growing from 1985 to 2014 by 27%.
- UK imports up to 13% of food from regions deficient in potash production for fertilisers, such as Africa with 4% of food imported, 4% of food from Asia, 4% from South America and 1% from Australasia (DEFRA, 2016).
- The UK import food from various developing countries in the Global South such as Brazil, China, Chile, Colombia, Costa Rica, Ghana, Kenya, India, South Africa and Thailand. All of these countries are net importers of potassium and some of these countries experience soil depletion problems (USGS, 2016).

# Potassium and SDGs


- SDG1. No Poverty
  - High cost of bulk materials such as potassium is linked to high cost of transportation. Poor transport infrastructure increases cost of fertilisers to farmers
- SDG2. No Hunger
  - Food security is linked to poverty. Access to fertilisers is low (Mukuve and Fenner, 2015). Per capita food production in Africa is linked to poor soil fertility (Sanchez, 2002)
- SDG3. Good Health
  - Potassium is a key mineral nutrient in human diet. The WHO suggests a potassium intake of at least 3510 mg/day (90 mmol/day) for adults.
- SDG7. Renewable Energy
  - Over the last 10 years, the demand for potash has increased due to increase in biofuel production (Canter et al, 2015)
- SDG12. Responsible Consumption
  - Up to 40% of food wastes in households in the UK. Changes in diets and increase in consumption of animal protein increases the demand for grain for animal feed and potassium fertilisers (Roberts, 2008)
- SDG15. Life on Land
  - Soil quality and land degradation in Africa continues due to overgrazing, soil erosion and ineffective cropping methods. Inorganic fertilisers are often applied at rates below the recommended levels or not at all, and further urge that urge that depletion of potassium can lead to serious losses in agricultural productivity.

# Approaches to improving potassium fertiliser supply

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1) Improving geological information and search for conventional potash mineral deposits in the regions of Africa, Asia and Latin America
2) Search for alternative sources of potash in the Global South
3) Improving farm practices and existing channels of trade between potash producing and consuming nations
4) Reduction in use of mineral fertilizers and promotion of organic fertiliser use in large-scale agricultural production
5) Departure from large-scale industrialised production to small-scale close cycle production where fertiliser nutrients are produced from farm wastes
6) Recycling all different types of food and farm waste to recover fertiliser nutrients for agricultural production

# Alterative to conventional potassium in Global South

- Large conventional potassium-bearing deposits are yet to be developed Africa and Latin America, these regions will be net importers of potassium which threatens their food security for coming years
- Project developments in Eritrea and Ethiopia
- Major capital investment is required to fund exploration and development of deep mining of conventional potash. There may be less market incentives and private funding available to develop major potash mines in the Global South for bulk commodities
- In the context of the Global South, Leonardos et al (2000) and Ciceri et al (2015) promote the ideas for multi-local production that relies on alternative potassium fertilisers to support local farmers with consideration of regional logistics and soil characteristics

# Reducing fertiliser use – Zero Fertil Growth China 2020

- Food security on top of national agenda in China
- Food security is linked to reduction of self-sufficiency in food production, population growth, limited cropland and growing urbanisation (He et al, 2017).
- Limitations on domestic supply of fertiliser input to farms is recognised in policies to stabilise fertiliser consumption (Bai et al, 2016).
- Chinese government initiative a policy “Zero Fertiliser Growth by 2020” – reduce use of inorganic fertilisers in farming. Chinese policies promote processing and recycling manure.
- Research on possibility to recover potassium nutrient from manures from intensive animal farming to apply to cropland – not yet effective in application to croplands.
- Research suggests that inorganic fertilisers cannot be fully replaced, but supplemented by recovered nutrient material (Bai et al, 2016).

# Future research directions

1) Conduct detailed research into ways of improving the supply of potassium globally by analysing market and policy constraints
2) Conduct research into policy and market opportunities for promoting technological innovation, R&D
3) Interview major stakeholders within the global potassium production network

# Global Production Network (GNP)

- Conceptual framework from economic geography applied to organization of global production and distribution of goods and services (Coe et al, 2008; Bridge, 2008; Dicken, 2011; Santos et al, 2015).
- Examines four major operations – inputs, transformation, distribution and consumption and a range of actors involved – companies, states, labour, consumers and civil society organizations.
- Analyses value, power and embeddedness in the production network.
- International business – internationalization and global market of potassium fertilizers.
- Sustainable development goals (SDGs)

# Conclusions and recommendations

- ***Changing consumption patterns*** - changing diets (reducing excessive consumption of animal protein) and reduction of food waste
- ***Nutrient recovery*** – developing effective methods for recovery of nutrients from agricultural waste
- ***Alternative farm practices*** – improvement of application of fertilisers and maintaining soil quality
- ***Search for alternative and conventional sources*** of mined potassium
- ***Leadership*** in assisting least developed countries, especially in Africa, to explore local mineral-based fertilisers

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# Thank you!

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