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Agricultural Sustainability: Can technology reduce waste and increase yield?

Agriculture takes a big toll on our planet. According to the Food Agriculture Organisation, 18% of greenhouse gas emissions comes from livestock, 70% of the water abstraction worldwide is used in agriculture and yet 40% of crop yield is lost to pests annually. With the global population growing by 1.1% every year, finding a sustainable agricultural model that produces sufficient food whilst minimising waste is undoubtedly the biggest challenge that agribusinesses must overcome.

This article looks through a patent lens at the technologies behind two key areas; wastewater reduction and reducing crop destruction, uncovering the following points:

- China dominates the competitive landscape of both wastewater and crop destruction prevention technologies, despite its high levels of pollution
- Universities in China, Korea and Japan monopolise the wastewater treatment technology landscape
- Corporate organisations lead in their investment into crop destruction prevention technologies, yet fall behind in the wastewater treatment technology space

Wastewater reduction is key to achieving sustainability goals

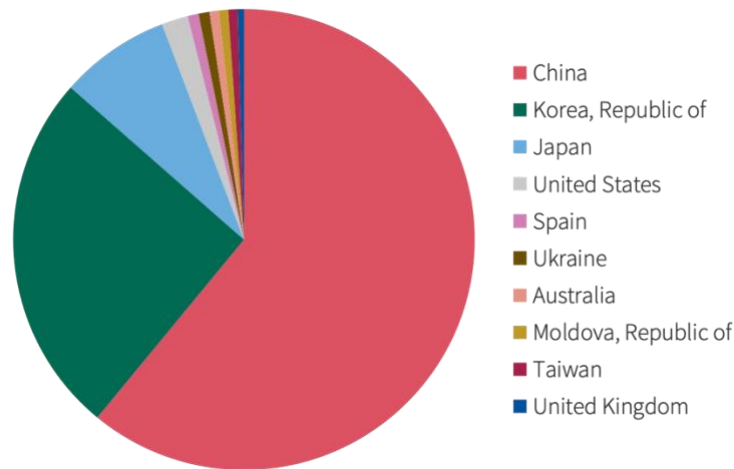
Wastewater produced as a result of agricultural activities, such as animal husbandry and farming, is responsible for a significant proportion of pollution globally. Organic waste such as manure, slaughter and milking waste, and fertiliser runoff contain many beneficial constituents. Elements such as nitrogen, phosphorus and potassium can be used as fertiliser for crops, feed additives for animals and even production of energy for human activities – but only when recycled effectively. When these organic substances are not treated properly, they can have detrimental effects on the environment.

Such environmental damage occurs, for example, when untreated animal wastewater is released into the environment. It can cause serious air pollution due to the large quantities of CO₂ and ammonia found in faeces. This subsequently contributes to acid rain and greenhouse gases. In addition, when excessive amounts of organic materials are released into the aquatic environment, murky water with heavy bottom sludge starts to accumulate and oxidate. The oxidation of these organic materials produces overabundant algae growth in surface water, thus leading to a huge reduction in oxygen that is essential for the survival of aquatic organisms. Our ecosystem also deteriorates as a consequence of the runoff from pesticides and fertilisers causing water pollution that ultimately intoxicates aquatic organisms.

In January 2021, the new US administration issued an order for the USDA to come up with a strategy in 150 days for net-zero emissions of greenhouse gases by the agricultural sector, which will be implemented in the coming years. Their goal is to “make American agriculture first in the world to achieve net-zero emissions”. We would expect to see an increase in inventions around agricultural wastewater purification systems and zero emission farmhouses to gain serious momentum in the US as a result of this goal.

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Figure 1: Geographical landscape of innovations in Agricultural Wastewater Treatment

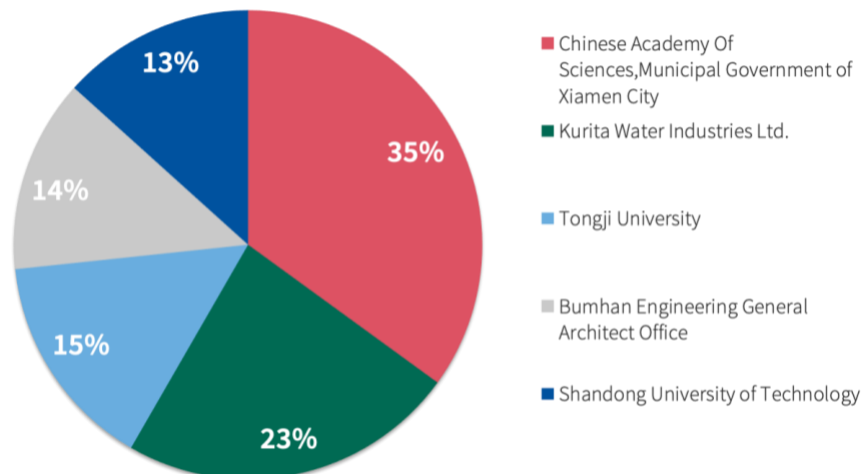


Source: Cipher, Granted patents by geography

It is therefore surprising to see only 2% of overall inventions in this technology area appearing in the US. The top three countries in wastewater purification and zero emission technology areas are China, Korea, and Japan. For the US to achieve their ambitious goal, having a national strategy that allows the agricultural sector to gain access to new technologies from abroad as well as supporting the implementation of these new technical systems should be of top priority.

Wastewater treatment plays an extremely important role in any government or agribusiness' mission to achieving sustainability. It is therefore crucial to understand the technology landscape so that organisations can identify key players and maintain a strong position in the global market of sustainability.

Figure 2: Key players in Agricultural Wastewater Treatment

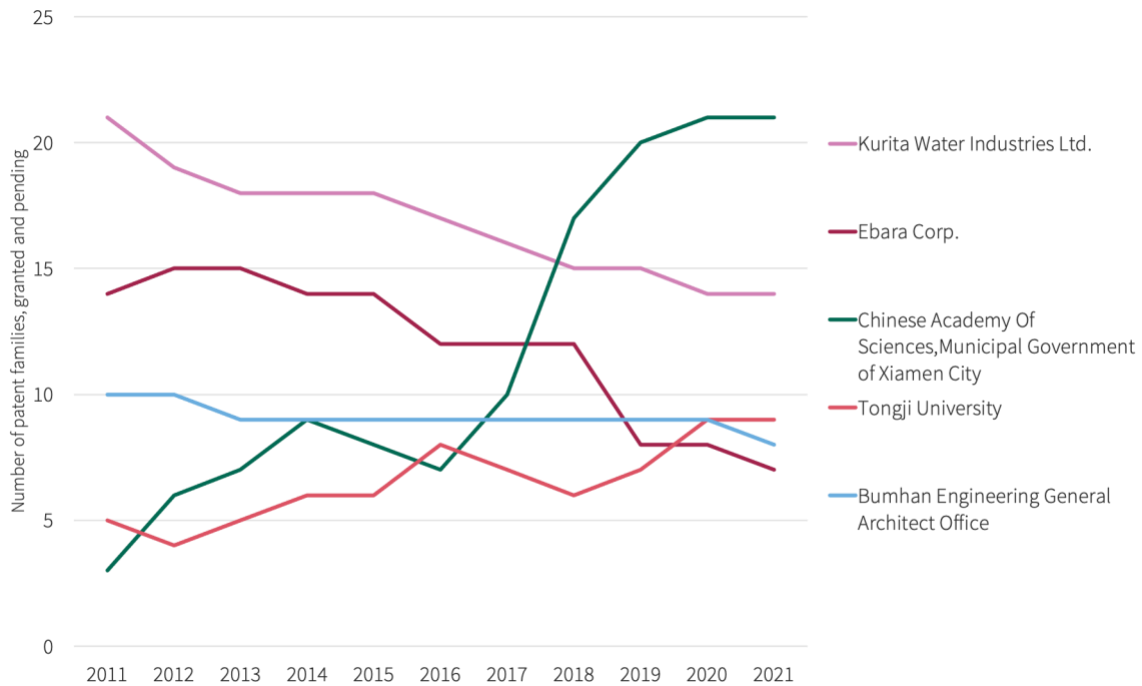


Source: Cipher, Portfolio sizes of active patent families, by organisation

With this in mind, key market players in agriculture wastewater treatment technologies are mainly found in Asia, including Chinese Academy Of Sciences, Kurita Water Industries and Bumhan Engineering General Architect Office.

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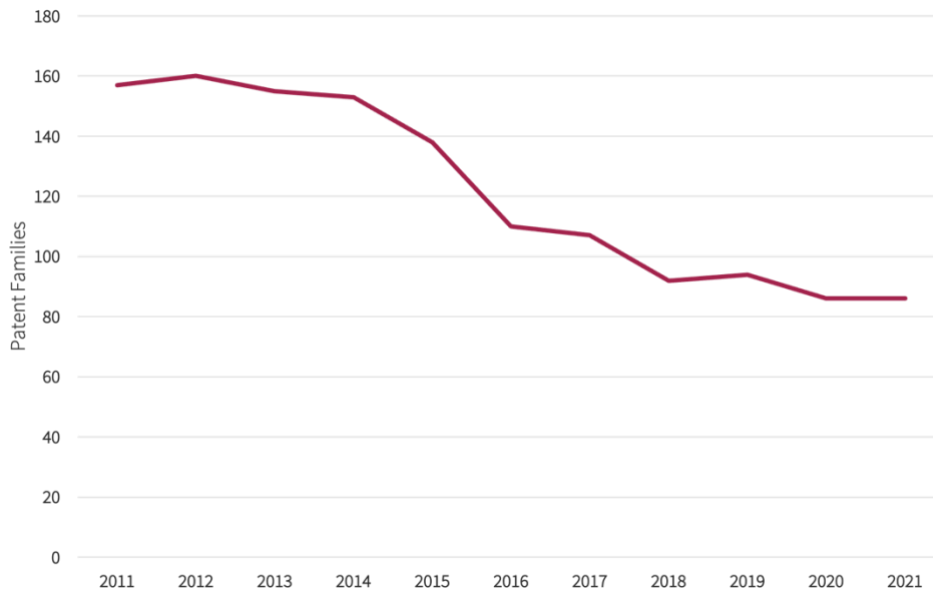
Figure 3: Patenting trends of top 5 players in Wastewater Treatment



Source: CIPHER, Portfolio trends of active patent families by year, by organisation

Despite the positive impact wastewater treatment technologies have on reducing emissions, investment in these areas by the top players over the past ten years haven't increased as much as we would expect given growing concerns over global warming. Furthermore, the global patenting trend in the wastewater treatment area shows a steady decline, with China acting as an exception to this trend.

Figure 4: Innovation trends in Agricultural Wastewater Treatment (without Chinese Innovation)



Source: CIPHER, Portfolio trends of active patent families by year

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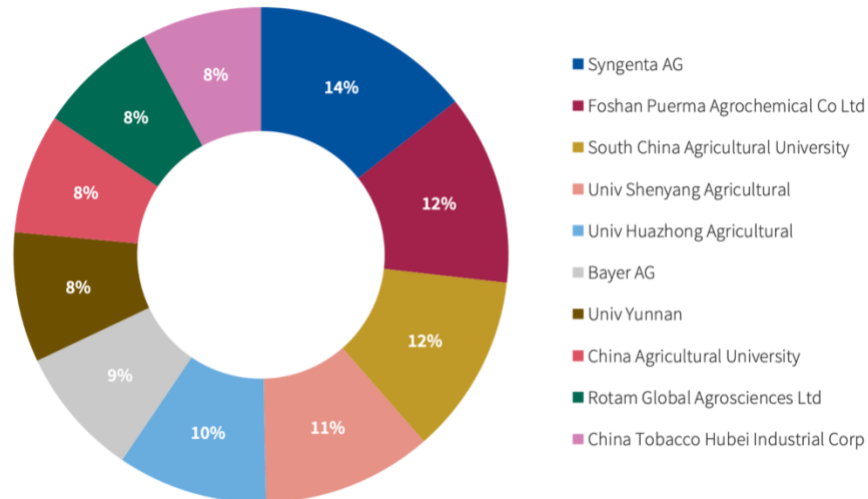
Currently, the top 10 companies in this technology area only make up 5% of the total innovative landscape, with an average 9.3 patents per organisation. The remaining 95% is owned by small organisations and private inventors.

This technology trend analysis indicates that there is a gap in the market for new innovative technologies within agricultural wastewater treatments.

Corporate organisations investing heavily in crop destruction prevention technologies

When it comes to sustainable agriculture, another important issue to look at is the treatment of nematodes. Nematodes are small worm-like creatures that plague crops at their roots. Root knot nematodes destroy crops and cause severe stunting, wilting, yellowing and even death of entire crops. Nematodes alone cause a yield loss of 12.3% annually which is equivalent to \$157 billion dollars worldwide. Nematode diseases are difficult to control because of their hidden nature, hence they are often overlooked and go untreated. However, with the growing global population, such a dramatic loss of food cannot be left unresolved.

Figure 5: Top 10 players in Nematode Prevention Technologies

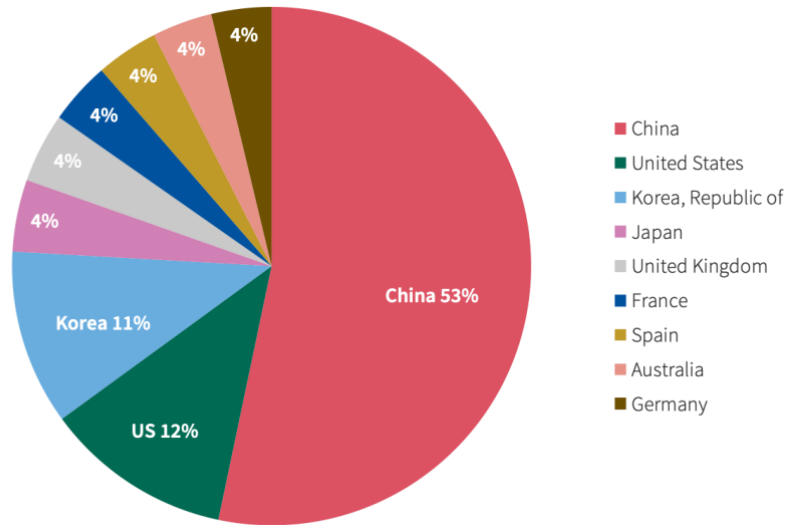


Source: CIPHER, Portfolio size of active patent families, by organisation

Figure 6 highlights the top patent owners of nematode prevention technologies; Syngenta AG, Foshan Puerma Agrochemical Co Ltd, Bayer AG and other Chinese universities are among the most active in this area.

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Figure 6: Innovation landscape in Nematode Prevention Technologies



Source: CIPHER, Active individual patent grants per country

Currently, China also has the most patent families in the field of nematode prevention followed by the US and South Korea.

With exponential population growth and a heightened awareness of the global climate crisis, investment into technologies that can improve sustainable agriculture will inevitably become a top priority and key focus area for governments and agribusiness' around the world.

Even though China is currently the world's most polluting country, it's evident they are making big strides towards sustainability. In addition, with the ongoing establishment of the International Carbon Market, countries that prioritise and know how to effectively reduce emissions will gain a competitive advantage over their peers. Having a comprehensive overview of the innovation landscape is fundamental when building an efficient strategy to achieve sustainability.

For more information on who owns what and where in the sustainable agriculture space, access CIPHER via your subscription or if you'd like to understand more about the Sustainable Agriculture taxonomy used to run this report in CIPHER, contact us directly at info@cipher.ai.

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