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Commentary

Can Agroforestry be the Future Of Agriculture In India?

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Approximately 70% of India's population is engaged in agriculture and other allied sectors (Food and Agriculture Organisation [FAO] 2015).

INTRODUCTION

The IPCC's sixth assessment report, "Climate Change 2021: The Physical Science Basis" (IPCC 2021), tells us that "the climate catastrophe timer is about to go off and we don't have much time". The report highlights that countries do not have the luxury to forgo climate concerns for the sake of economic growth. The obstacle is higher for countries like India, where human development needs to be balanced with emissions reduction. Contraraily, India was responsible for 7% of the global greenhouse gas emissions in 2018, and its GreenHouse Gas [GHG] contribution is expected to rise to 2350 million tons during the post-covid economic recovery (International Energy Agency 2021). Agriculture, the second-highest contributor to India's total emissions, is a key concern in this context (United States Agency for International Development 2019). in his speech that a committee would make MSP more effective and transparent, it remains unclear whether the government will agree to farmers' other significant demands of making MSP a legal right.

Approximately 70% of India's population is engaged in agriculture and other allied sectors (Food and Agriculture Organisation [FAO] 2015). This sector is responsible for ensuring food security for a population of 1.3 billion people (World Bank 2020). Despite the Green Revolution improving India's total food grain productivity, current agricultural methods are highly inefficient (Bahu 2014). Agriculture is a significant source of air, soil, and water pollution (Saha et al., 2017; FAO 2015; Bhattacharya et al., 2015). Even in the best-case scenario where India manages to significantly improve its yields and improve to maximum efficiency, "more than 75% of the population are at risk of falling below requirements in energy and protein availability" (Ritchie, Reay, and Higgins 2018). The problem then is to achieve food and nutritional security for a large chunk of the population while making agriculture more sustainable in the long run.

AGROFORESTRY AS AN ALTERNATIVE

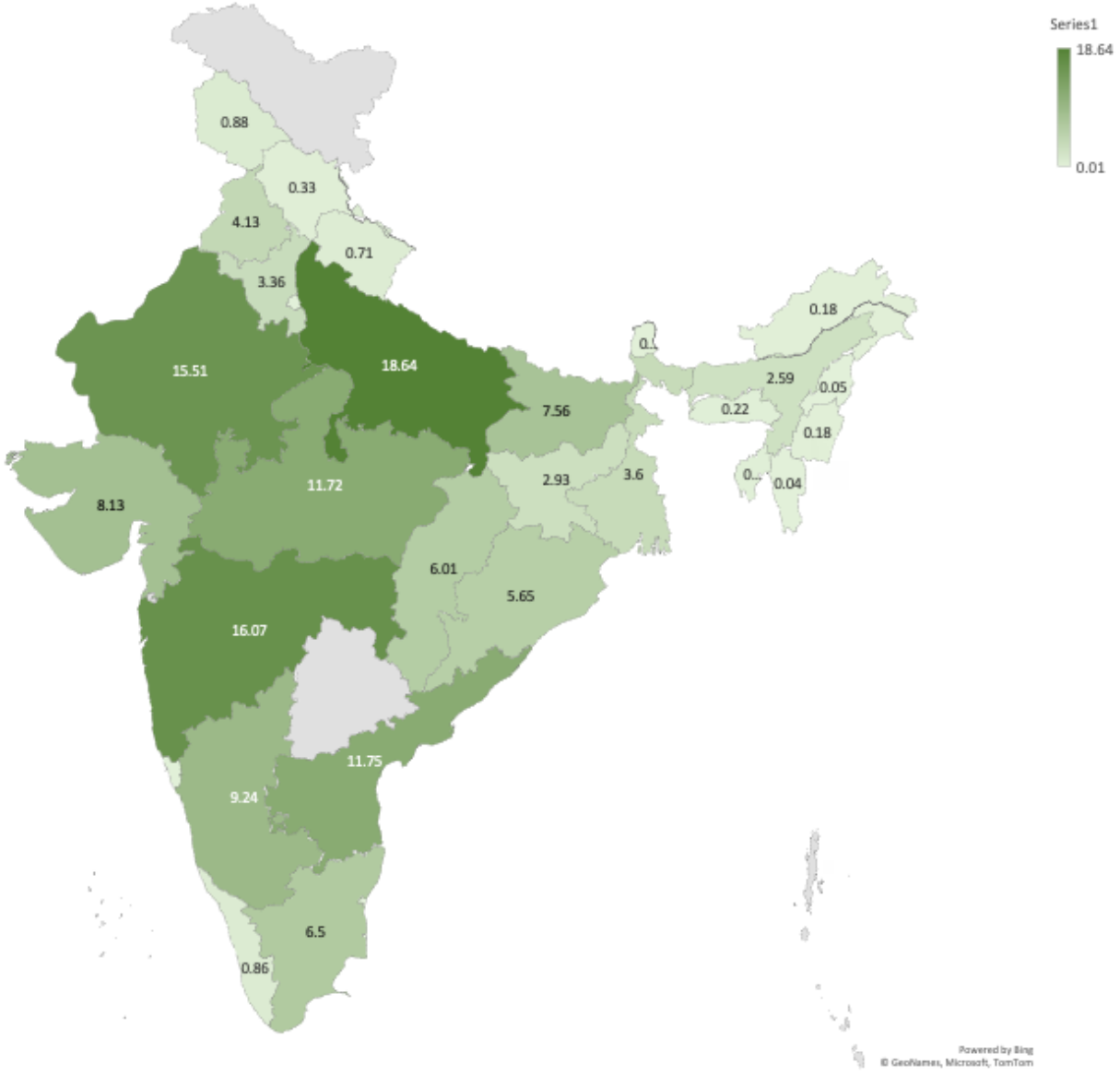
Given the challenge mentioned above, agroforestry is viable in transforming India's agriculture sector. Defined as "integrating trees and shrubs along with crops and livestock" (Department of Agriculture, Cooperation, and Farmers Welfare 2014), agroforestry is a sustainable agricultural practice that can benefit farmers by improving yield, restoring soil balance, increasing profitability, and providing alternative sources of income. It can also mitigate climate change by balancing the microclimate, conserving ecological diversity, carbon sequestration, retaining water from rainfall, and preventing soil erosion. That is to say, agroforestry can effectively address 9 out of 17 Sustainable Development Goals [SDG] related to poverty and hunger alleviation, climate change, ecological balance, responsible consumption, and production (Agroforestry Network 2018).

India currently has approximately 1.74 crore hectares under agroforestry, including fallow land, which is 10% of the available crop[1] and fallow land[2]. Uttar Pradesh, Maharashtra, and Rajasthan are the top three states in terms of land under agroforestry (Figure 1).

[1] These are the areas with standing crop as on the date of satellite overpass.

[2] Land rested from deliberate cropping, not necessarily without cultivation or grazing but without sowing. Basically, it refers to the state of land left without a crop or weed growth for extended periods, often to accumulate moisture.

Figure 1: **Area under agroforestry in India**



Source: Bhuvan (2015)

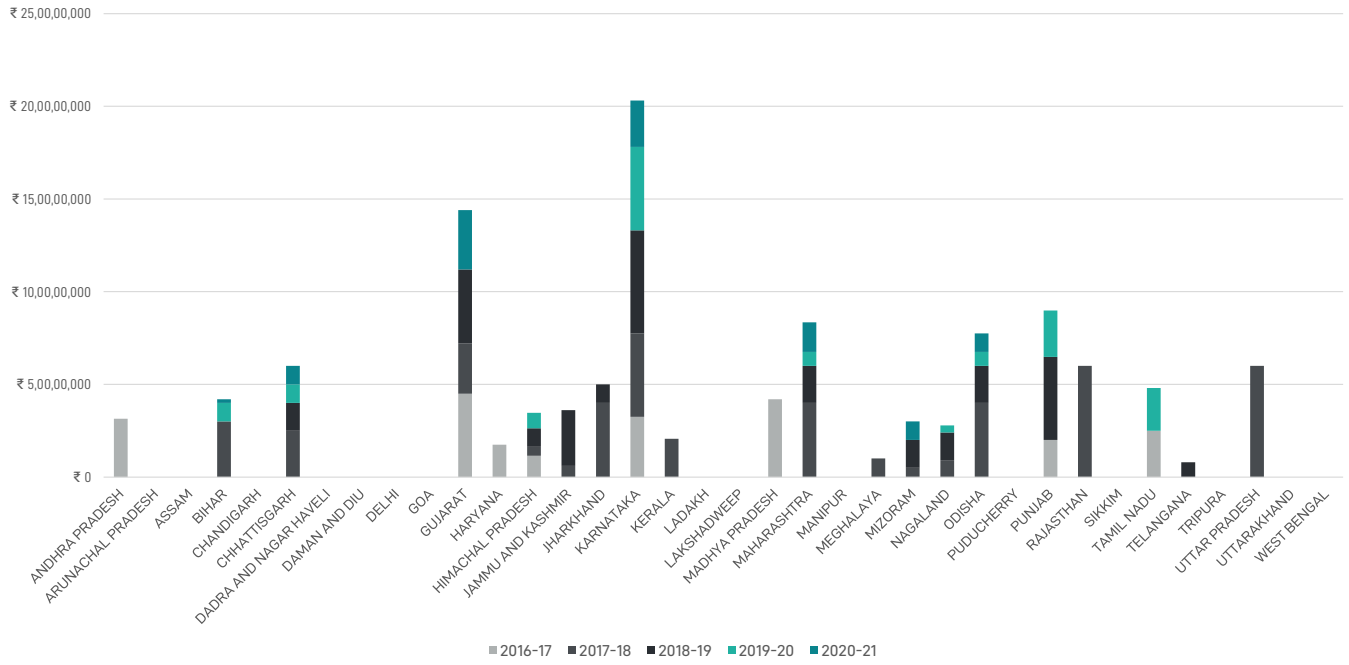
POLICY SUPPORT

In 2014, India launched the National Agroforestry Policy [NAP] to address the legal, technical, and infrastructural constraints on agroforestry and encourage it on a national scale. According to the policy guidelines, implementation would include activities and projects encouraging farmers to take up agroforestry, active monitoring and evaluation of the soil health, easing of regulatory mechanisms for tree-felling and transit, deploying human resources and technical experts, and finally, initiating capacity building (Department of Agriculture and Cooperation 2014).

Further, the Sub-Mission on Agroforestry [SMAF], headed by the National Mission for Sustainable Agriculture [NMSA], was launched in 2016-17 to realise the objectives stated by the NAP. Figure 2 shows the funds released to the states

under the Sub-Mission and it shows that Karnataka has the highest share of these monetary funds, followed by Gujarat, Maharashtra, and Odisha. Other promising states are Chhattisgarh, Punjab, Himachal Pradesh, Mizoram, and Nagaland.

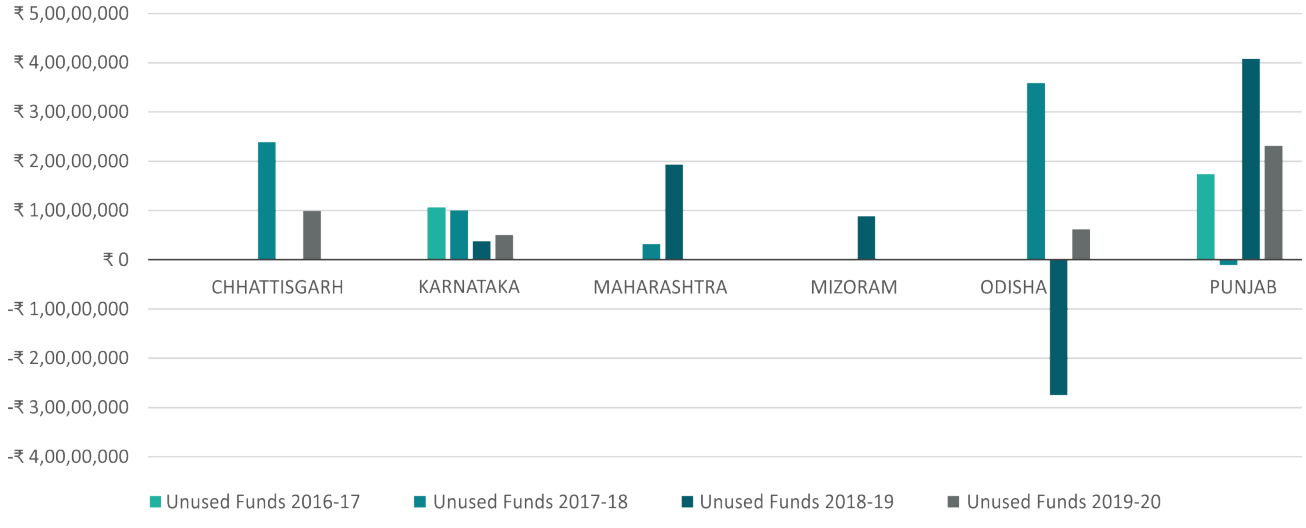
Figure 2: **Total Release of Funds over the Years**



Source: Department of Agriculture and Farmers Welfare (2021a)

However, the release of funds does not reflect the ground-level reality, as shown by the unused funds' data released by NMSA in Figure 3 below. The data released by the NMSA is only available for particular states and shows that achievements are only slowly catching up with the budget allocated by the Centre, indicating structural issues with the adoption of agroforestry.

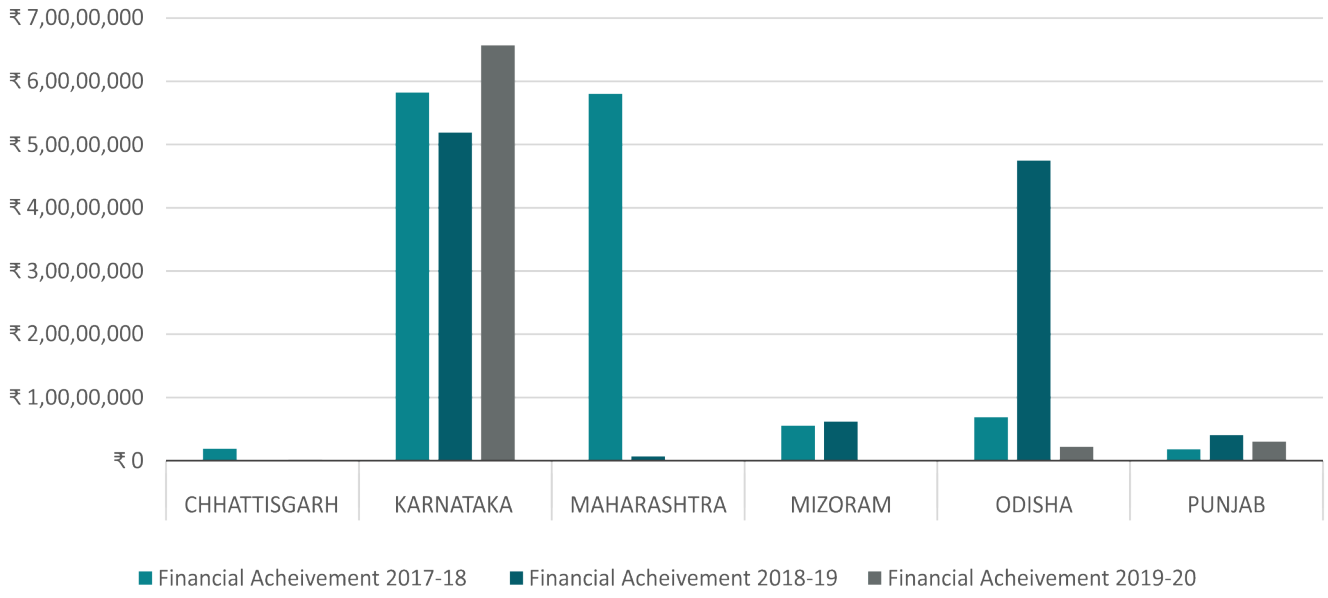
Figure 3: **Unused Funds under SMAF**



Source: Department of Agriculture and Farmers Welfare (2021b)

Figure 4 represents the financial achievements across particular states. The limited data availability highlights the lack of visibility of the progress of agroforestry under NAP. Karnataka's performance, compared to other states, has been consistent. Based on the NMSA data and the estimated agroforestry area data, Karnataka, Odisha, Punjab, Uttar Pradesh, and Maharashtra need to take a closer look at their implementation to understand what has worked and what more can be done.

Figure 4: **Financial achievement in Agroforestry in select states**



Source: Department of Agriculture and Farmers Welfare (2021c)

STATE-LEVEL INITIATIVES AND BEST PRACTICES

Karnataka is one of the most biodiversity-rich states in India, with the projected area under agroforestry at 19 lakh ha (Rizvi et al., 2018). The area under agroforestry in the state ranges from 3% to 27.2%. The state is actively promoting agroforestry with programmes like Krishi Aranya Protsaha Yojane [KAPY], where the nearest departmental nurseries provide seedlings to farmers at subsidised rates. Even the arid and semi-arid regions are moving towards adopting agroforestry, especially in large farms, because of the resilience of trees against climate variability, low maintenance, more income, and state support (Krishnakanth and Nagaraja 2020). In Punjab and western UP, wood-based industries drive agroforestry by incentivising farmers to grow trees such as poplar, eucalyptus, etc., given their high returns (Dwivedi et al., 2007; Chavan et al., 2015). Irrigation facilities and climate are the most significant components influencing the farmers' decisions, as eastern UP is more rainfed and faces more droughts (Verma et al., 2017). However, medium to large farms in this region are planting fruit trees in their farms. The highly agriculture-intensive state of Punjab is also moving towards agroforestry, with the state government dedicated to improving the tree cover by 15% (Gill et al., 2016). Farmers are growing eucalyptus, timber, and poplar, to name a few, to meet industry demands buoyed by state support, well-established nurseries, and technical knowledge.

The eastern state of Odisha adopted the Samrudhi Agricultural Policy in 2020 to advance farmers' well-being. Agroforestry is an integral part of this effort, which includes transforming lands owned by tribals and wastelands (Department of Agriculture and Farmers Empowerment 2020). The practices are fragmented and differ according to the regions and topography in the state. Higher income and productivity, increase in fuelwood, population pressure, declining land availability, and soil conditions have led farmers to adopt agroforestry (Panda et al., 2010; Tekale, Jadhav, and Thakare 2020).

A study (Doshi, Brockington, and Brook 2015) outlines a case in Maharashtra where the wadi, meaning small orchard in Gujarati, model was adopted to introduce agroforestry in tribal areas. The study found that more than half of the farmers adopted the wadi system, albeit cautiously, and successfully retained the practice 5 years after the programme was introduced.

POLICY IMPERATIVES

1. States must provide institutional support to farmers

Agroforestry is an ambitious venture and it is not easy for farmers to simply switch from their traditional practices and grow trees on their farm. Trees generally have a long gestation period and require proper irrigation facilities, nurseries, and pest control mechanisms. Moreover, the technical know-how can discourage farmers from shifting to agroforestry. Therefore, state support becomes crucial in encouraging farmers to take up agroforestry practices. The states must ensure the provision of inputs, irrigation facilities, subsidies, technical knowledge, and training to encourage farmers to switch to agroforestry from their conventional practices. For instance, initiatives such as free seed or sampling distribution in Karnataka have led more farmers to take up agroforestry (Karnataka Forest Department 2020). Policy support should extend further to easing tree-felling regulations, providing transport facilities, and improving access to markets.

2. Promote wood-based industries

Farmers' decision to adopt agroforestry depends upon expected income from tree harvest. It's the presence of wood-based industries that incentivises farmers towards agroforestry. This trend was observed in parts of Uttar Pradesh, Haryana, and Punjab (Verma et al., 2017). Western Himalayan regions, hilly areas of Uttarakhand, Northeastern regions, and Western Ghats, which grow 'shade loving' plants, also practice agroforestry indigenously (Selvan and Kumar 2017; Kala 2010). Industries involving sandalwood and hemp can be highly lucrative in these regions whilst regulating the condition of soil and water for farmers. Building infrastructure and regulations to improve these industries can benefit the agricultural sector and industries, thus contributing to the overall economy.

CONCLUSION

Agroforestry is a sustainable way of engaging in agriculture and has shown many benefits. Not only can it help restore the ecological balance, and capture and store carbon, but agroforestry also provides additional benefits to farmers in the form of extra income and improving the condition of their farmlands. However, the state needs to put in proper efforts so that a majority of farmers adopt this practice, and for that, there is still a long way to go.

It is difficult for farmers to take up a new practice requiring significant resources, technical knowledge, and uncertain returns. While, the National Agroforestry Policy of 2014 was the right step in this direction, active state involvement and proper institutional mechanisms are more important to incentivise farmers and train them in practicing agroforestry efficiently. A bright example of this is Karnataka. The state is an active participant in incentivising farmers to adopt agroforestry and this example can lead other states to become more involved. Other states such as Maharashtra, Odisha, and Punjab have also shown some engagement, but the efforts are still fragmented and slow. However, the progress of agroforestry uptake in India is slow and would require massive state investment to realise the maximum potential. It remains to be seen how soon this future can be realised.

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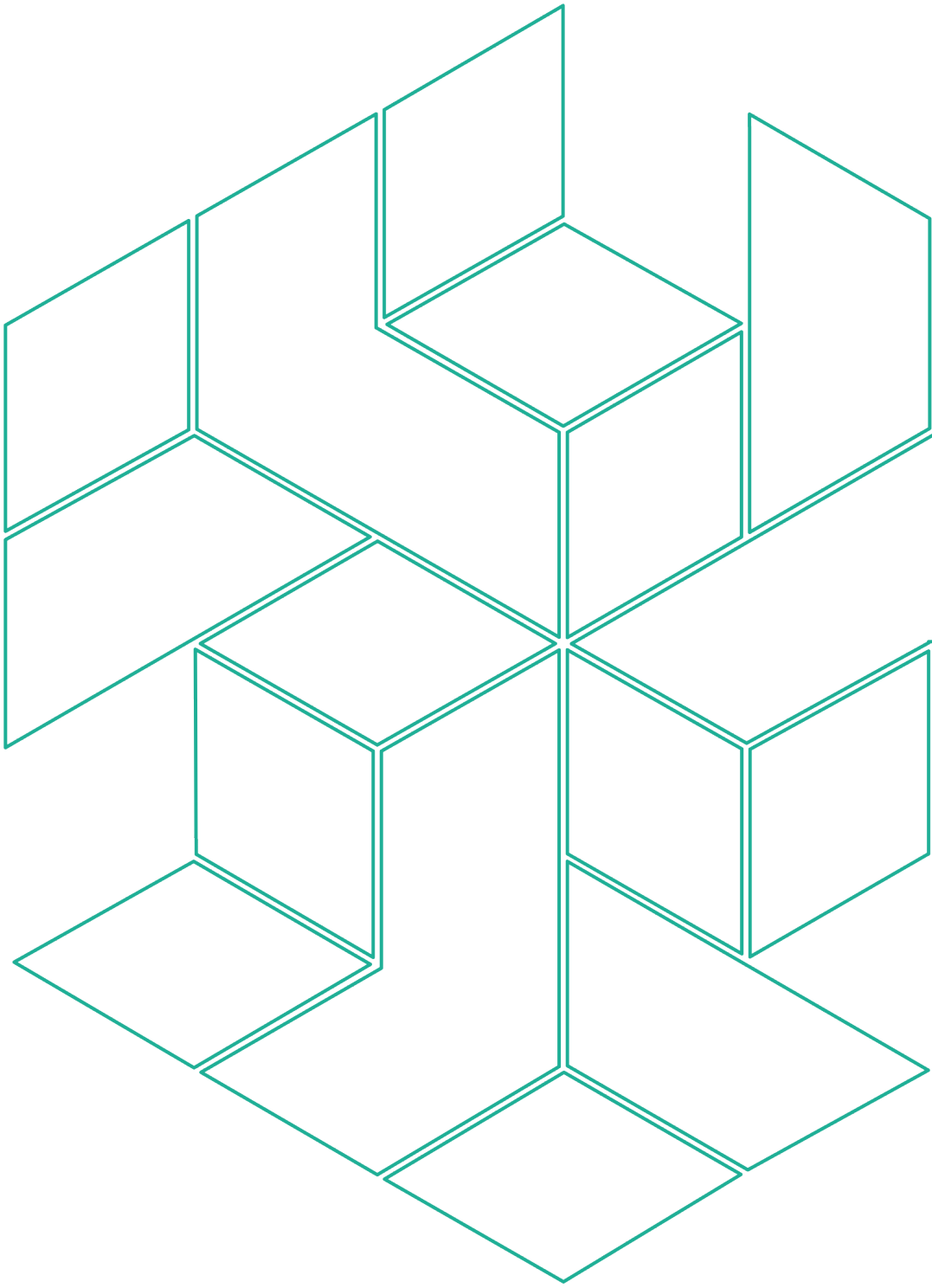

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