Pakistan Nitrogen Policy Report Summary: Policy Focus, Scientific Support and Current Interventions

This summary gives an overview of the policy report currently in development and commissioned by UKRI-GCRF-SANH for Paksitan (2022). The report, being first of its kind, gives a brief description of essential measures and steps to effectively understand the nitrogen poliy arena for Pakistan in the broader context of South Asia. It also provides a comprehesive account of issues and challenges linked with nitrogen application, its management and externalities in the form of pollution along with potential remedial measures.


Source: PT Profit (2021)

INTRODUCTION

- Nitrogen remains an essential element to support life on earth. However,an excessive amount in its reactive form (N_r) can lead to severe threats both for the environment and people and poses a major issue globally and regionally for South Asia.
- An excess amount of N_r threatens five areas – quality of soil, air and water, disturbing greenhouse-gas balance and biodiversity. The range of impacts depend on the extent of N use along with vulnerability and exposure to people and the environment.
- South Asia is a global hotspot for N_r emissions for three main nitrogen compounds: nitrogen oxide, nitrous oxide and ammonia, with emission levels above global averages.
- Multiple sectors like agriculture, industry, transportation, buildings and energy are sources of nitrogen pollution.
- As a consequence of agricultural activity and the excess application of synthetic fertilizers and manures, nitrogen pollution can pollute both surface and ground water.
- Managing nitrogen is essential for international climate change mitigation: nitrous oxide (N_2O) has 300 times more warming potential than CO_2.
- The Government and non-government measures can support and encourage efficient nitrogen management, and hence, can effectively minimize the negative impacts.
- Managing nitrogen is a major issue both for national and international policy, however, the body of information about nitrogen policies that exists at national levels is scarce.
- Improving our understanding of the existing policies, the issues they address, the types of instruments used, and how existing policies might impact nitrogen pollution can further support the drive to curb excessive N emission.

UKRI GCRF SOUTH ASIA NITROGEN HUB (SANH)

- The UKRI GCRF South Asia nitrogen Hub (SANH) aims to tackle the nitrogen challenge in South Asia by bringing together experts from leading research organizations from across South Asia and the UK. The hub focuses on four main areas: i) building the nitrogen policy arena for South

Asia; ii) finding nitrogen solutions; iii) improving understanding and awareness of key nitrogen threats; iv) integrating data and understanding of regional nitrogen flows and impacts.

- The South Asia Co-operative Environment Programme (SACEP) and SANH undertook an initial South Asian regional assessment of nitrogen emissions and policy and created a database of 966 nitrogen-relevant policies from South Asia.
- Based on this database, the SANH national report for Pakistan (In development) outlines the implications of these findings for Pakistan for policy, planning and research.

NITROGEN-RELATED POLICY ANALYSIS FOR PAKISTAN

- As of 2019, 175 active policies related to nitrogen directly or indirectly were identified for Pakistan. These policies were established between 1873 and 2019. They contribute 18% of the total number of nitrogen-related policies in the SANH South Asian policy database.
- The focus of these policies varies widely therefore, policies were classified – according to various characteristics – into environmental sink; sector; sub-sector; policy type; pollution-source type; impact direction; relevance; and impact scope.
- The majority of policies were sub-national (57%), set at the provincial level, in contrast to other South Asia countries where national policies pre-dominated.[1]
- Regarding relevance and scope of the studied policies, 41% policies demonstrate a high (direct) relevance and large impact scope to N_r management.
- Multiple sector based policies were more commonly established (16%) during the years 2011-2019. 17% of all policies addressing multiple sinks were established during 2011-2020 implying increasing levels of responsibility and focus on the environment.
- 58% of policies included reference to one or more environmental sinks such as Air, Water, Climate, Soil, and/or Ecosystems.
- For sector-focused policies, 10% of policies did not cover a specific sink.
- 35% of policies covered multiple sectors. Such features provide examples of how integrated policies and thinking across sectors could streamline policy development for N management.
- A quarter of the policies were agriculture-specific (25%) and 14% were land use change-specific (14%).
- The policy type classification considers the type of instrument – single or multiple ones – employed to realize policy objectives. For Pakistan, there are 322 policy types (one policy can have multiple policy types) viz. Regulatory (19%), Economic (13%), Framework (40%), Data & Method (13%), Pro-Nitrogen (4%), Commerce (4%) and R&D (12%).
- For expected impact on N_r, 59% policies could potentially lead to mixed or neutral impact direction whereas, 38% had potentially positive impact on N-management. Only 5 policies were identified as having a potentially negative impact on N-management.
- The majority of directly Nr relevant policies (59%) do not refer to pollution-type source to be targeted. 40% of directly relevant policies did refer to targeting point source and/or non-point source pollution or both, which is a fairly high number when compared to other SA countries.

[1] Node refers to the core 'central' policy where other associated policies could be considered as subordinate.

- Nearly 10% of policies focused on multiple sinks and multiple sectors and propose multiple policy types (hence having integrated policy objectives and approach). Such policies offer a great potential to better confront the multidimensional challenge of nitrogen management in the country. Some examples are the 'National Sustainable Development Strategy 2012' and the 'Punjab Water Policy 2018'.

REACTIVE NITROGEN EMISSION AND ITS DRIVERS

- Emissions from all three nitrogenous compounds considered in the report, viz. ammonia, (NH_3), nitrogen oxides (NOx), and nitrous oxide (N_2O), have been increasing over time in South Asia as well as in Pakistan. These emission trends highlight that current policy efforts have so far not been able to stabilize or reduce nitrogen emissions.
- Ammonia (NH_3) is the most abundant compound in 2015, followed closely by nitrogen oxides. The emissions for NH_3, NO_x, and N_2O were, respectively, 1231, 1166 and 199 Gigatonnes/year in 2015/2018.
- Nitrogen oxides (NO_x) have increased in Pakistan over the period 1970-2015 posing greater threats for, inter alia, air pollution. A rise of around +58% in NO_x emission was recorded between 2000 and 2015.
- Nitrous oxide (N_2O) emissions, rose by +63% between 2000 and 2018.
- Ammonia (NH_3) emissions have shown a steady increase overtime since 1970. However, a sharp and prominent decline in its emissions was observed in 1986 (about -75%) mainly led by agriculture sector. Nevertheless, there has been around +42% increase in NH_3 emissions since 2000 to 2015. NH_3 is the most abundant in terms of overall amounts.

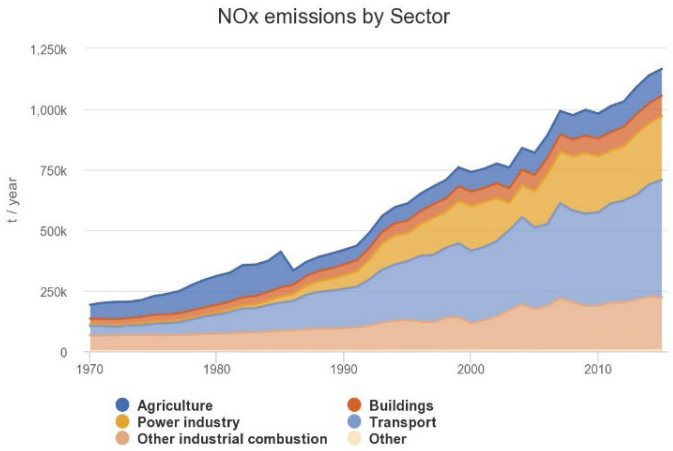

Figure 3: Trend in Nitrogen oxide (NOx) emission by main sectors in Pakistan Source: EDGAR v5.0 Global Air Pollutant Emissions data sourced from Crippa et al. (2019) (2019a)

- Agriculture contributes to all three N_r compounds. It is the major emission source for ammonia (NH_3) and nitrous oxide (N_2O) emissions by 84-85%. Agriculture contributed to 10% of overall nitrogen oxides (NO_x) emissions.
- The increased level of N pollution has also resulted from the increased demand for synthetic fertilizer as farmers generally prefer to sow crop varieties that are fertilizer-responsive to get higher yield, facilitated through irrigation water availability and farmer-focused policies in the form of subsidies on fertilizer, tubewell water and seeds.
- On the supply side, the sales of fertilizers in Pakistan are at US$3.74 billion per year[2] due to incentives in the form of gas subsidies along with friendly investment options thus spearheading the expansion of the fertilizer industry. This, in turn, can provide incentives for excessive N use and thus necessitates additional measures to combat N pollution.

[2] Ali et al. (2016) Pakistan's fertilizer sector: Structure, policies, performance, and impacts, IFPRI discussion paper, https://www.ifpri.org/publication/pakistans-fertilizer-sector-structure-policies-performance-and-impacts

- Transport's contribution to overall nitrogen oxide (NO_x) emissions has grown by +62% from 2000 to 2015, contributing 41% to overall NO_x emission in 2015, mostly from road transportation.
- The building sector has shown consistent growth in its nitrogen based emissions. For instance, NO_x emissions from this sector grew by around +42% from 2000 to 2015. Contributions to overall NO_x emission, were 7% in 2015. The emissions from this sector may further be expected grow due to the rapid conversion of agricultural land into build-up areas.[3]
- Nitrogen oxide (NO_x) emissions by industry (power and industrial combustion - combined) grew by around +30-49% between 2000 and 2015. Overall contributions were 42% in 2015.

RECOMMENDATIONS

- Current policy is not yet doing enough to tackle excessive GHGs emissions and nitrogen pollution from the agriculture sector, and other sectors, thus putting an enormous pressure on the environment.
- Despite 41% of policies being highly related to nitrogen, only a few of these specifically focused or referenced measures to control nitrogen waste. For an effective nitrogen management system, such policies should also be accompanied by direct actions, such as 'core' policies, that entail regulatory and economic policy instruments. For this, setting up of quantifiable and enforceable limits/constraints in relation to the production and consumption of nitrogen in policy is recommended.
- There is a dire need of adapting/amending existing policies to effectively and directly address the challenges of nitrogen pollution by explicitly specifying the relevant N compounds and the permitted level of pollution. For addressing nitrogen pollution issues, amendments in the existing policies – ranging from minor to major – can be an efficient approach.
- As 42% of the existing policies do not consider any environmental sink, the need arises to consider adapting those sector-based policies to consider the environmental implications, directly or indirectly, and ensure policy cohesion. This can be achieved through comprehensive coverage of potential risks, or options to mitigate negative N impacts by referring to one or more environmental sinks.
- For effective management of N pollution, nitrogen-relevant policies would perform better if they cater to multiple sectors, sinks, and policy instruments, increasing their implementation potential and reduce the chances of lapse/oversight. Currently, 11 policies meet this criterion to some degree.
- Most of the water-centric policies (18 out of total 30 policies) were formulated prior to 1990. There is thus a great room and urgency of revisiting them in the light of current challenges, options and priorities.
- For policies with high nitrogen management-relevance, amendments to specify pollution source type and the risk of nitrogen waste would be beneficial. In the case of Pakistan, it is encouraging that 31 policies meet such a benchmark to directly link with nitrogen vis-à-vis

[3] Farah et al (2019) Driving Factors Of Agricultural Land Conversion at Rural-Urban Interface In Punjab, Pakistan, Journal of Agricultural Research 57(1):55-62

pollution source (point source, non-point source or both). However, those ignoring this aspect indicate a potential policy gap.

- From amongst the sectors, agriculture is a key contributor to the national income (GDP) yet also a major contributor to national nitrogen emissions. Improving nitrogen use efficiency via the sustainable use of fertilizer inputs viz. application method, its timing and amount etc. has the potential to save considerable costs and help to maintain soil, plant and human health.
- Action is needed in emerging sectors in relation to their contribution in N emissions. As different sectors contribute to the emission of N compounds in various ways and are growing at different paces, an integrated effort is needed to specify targets and measures to contain N-pollution. The overlap in contributing sectors to different compounds indicates areas where integrated policies are needed to avoid pollution swapping and promote coordinated actions.
- In-depth research on the N-relevant policies is necessary for assessing, inter alia, their impacts and impediments/constraints in the proper implementation of such policies. This can strengthen decision making around nitrogen management.
- Stakeholders' involvement from policy formulation to implementation is the key to success of any policy instrument. There is a great need for a range of stakeholder perspectives, expertise and experiences into policy development inducing a sense of ownership among the ultimate actors and beneficiaries.
- A thorough understanding of policy requirements can be achieved through public awareness and involvement in decision processes leading to better prospects of adoption and implementation.
- Science-based decision-making is crucial to move towards N sustainability and SANH is supporting efforts to create the scientific evidence to help strengthen Pakistan's contributions to address N both nationally, regionally and beyond.

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The South Asian Nitrogen Hub (SANH) is a UKRI GCRF funded research partnership that brings together 32 leading research organisations and project engagement partners from South Asia and the UK. SANH is working towards enabling South Asia to 'adopt and champion a strategic approach to nitrogen management as a key step towards the Sustainable Development Goals'. SANH aims to provide relevant scientific insights identify barriers to change and demonstrate the economic benefits of tackling nitrogen. https://sanh.inms.international/