Review Journal of Social Psychology & Social Works
http://socialworksreview.com
ISSN-E: 3006-4724 **Volume**: 3
ISSN-P: 3006-4716 **Issue:** 2 (April - June, 2025)

Smog and Trade: Alleviating the Economic Impact of Air Pollution through Trade Policy

Dr. Adeel Irfan[1], Dr. Muhammad Hatim[2], Muhammad Faizan Aslam[3], Muhammad Ahmad[4], Muhammad Farhan Aslam[5], Elahi Umar Ranjha[6]

DOI: https://10.71145/rjsp.v3i2.226

[1] Assistant Professor, Department of politics and international relations, University of Sargodha. Email: adeel.irfan@uos.edu.pk
[2] Assistant Professor, Department of Politics and International Relations (DPIR), University of Sargodha, Email: muhammad.hatim@uos.edu.pk
[3] Scholar, Department of Politics and International Relations (DPIR), University of Sargodha, Sargodha, Email: immakee00@gmail.com
[4] Scholar, Department of Politics and International Relations (DPIR), University of Sargodha, Sargodha. Email: awanahmad881@gmail.com
[5] Scholar, Department of Artificial Intelligence, University of Management and Technology, Lahore, Pakistan, Email: fmaken1199@gmail.com
[6] Scholar, Department of Politics and International Relations (DPIR), University of Sargodha, Sargodha. Email: elahiranjha302@gmail.com

Corresponding Author: Muhammad Faizan Aslam Immakee00@gmail.com

Abstract:
This paper explores how trade policy can be harnessed to combat air pollution. By focusing on the economic perspective, it addresses environmental challenges raised by industrial sector and fossil fuels consumption. While doing the case study on a South Asian country, Pakistan, it uses economic and trade policies, past and present, linking them with smog to propose a solution. A solution that leverages those policy to incentivize the use of green technology and renewable resources in order to promote the green standards and mitigate pollution. It further outlines how different economic policies like removing import barriers, providing subsidies etc., can be proven as a legitimate solution to economic growth while keeping focus on the initial case: to get rid of air pollution and its effects. This paper also tries to bridge the gap between the existing knowledge and their practical implementation and while paper retains combating smog as its main focus, the positive influence on economic scale can be witnessed as complimentary *reward* as well.

Keywords: Climate Change, Air Pollution, Smog, Trade Policy, Green Technology, Pakistan Environmental Policy, Sustainable Trade, Renewable Energy, Economic Incentives, Tariff Reduction, Foreign Direct Investment (FDI), Greenhouse Gas Emissions, Subsidies For Green Technology, Transportation Emissions, Industrial Pollution

Introduction

Imagine a world where summers are hotter, winter is short, and storms are fiercer. Explore your surroundings and you'll observe this reality in the form of climate change. Climate change is, thus far, the most pressing issue and its impacts are felt worldwide. Especially, the country of Pakistan is *blessed*

with *overwhelming* effects of this change [1]. Despite being one of the shortest contributors to its causes, Pakistan faces harsh conditions raised by it. The small glimpse of its effects on Pakistan is *2022 flooding* which caused over $30 billion in material damages, with millions displaced, and hundreds of people dead[1][2]. And climate change is not only the environmental issues; covering varied crises affecting economic stability, human issues, and social welfare worldwide. We have to consider its impacts and how it affects other parts of our life to learn and overcome the crisis in hand. Combining all forces, we can not only combat but minimize the effects and the paper will try to do so by choosing Air Pollution/smog as the case subject. Smog is, undoubtedly, one of the biggest issues, particularly, for the countries in Asia and the Middle east [1,7]. The air quality index depicts the clear, rather *smoggy picture*, victorying the countries of south Asia. Nemesis since birth, the famous enmity of South Asia, are once again in par to become top in the list of the most polluted nations [3].Talking about the link between Air Pollution and Climate Change [4, 69] it's undeniable. The causes let it be climate change or Air Pollution are the same? The same things which cause smog i.e., burning fossil fuels, vehicular exhaust and industrial emissions, are also behind the cause of greenhouse gases emission, driving global warming.

With every action comes a reaction, and here, the reaction can already be seen in the form of changing weather patterns (flooding, drought, glacial melting), shifts in Agricultural growth and rising temperatures (heatwaves). This severity of the crisis in Pakistan demands to act urgently to protect public health, safeguard the environment, and mitigate the broader effects of climate change [5]. And as the Chinese proverb goes: "*In every crisis lies the seed of opportunity*", so does this one [6]. In this globalized world, everything is an opportunity and by a set of right measures and cautions, one can achieve the most success in this world. Similarly, trade and trade policy frameworks provide one such opportunity to tackle the growing problem of smog in Pakistan by taking different initiatives such as import of cleaner technology, export of nature friendly products and foreign investments in different "Green Initiatives".

Being specific to the cause, steps like adjusting tariffs and creating friendly passage for the electric vehicles and/or import of cleaner industrial technology can help change the course. Pakistan can reduce emission to the great extent just by focusing on those two key areas: *transportation (39% contributor)* and *industry (24% contributor)*[2] [5, 7] . Additionally, by compelling trade agreements at both local and international levels, as well as strategic trade policies on the matter of climate change, Pakistan can achieve its goals to combat the climate crisis while incentivizing the economic prosperity of the country.

> ***"****Though Pakistan has existing trade and environmental policies but neither of them correlate with each other. We try to bridge that gap between climate action and trade policy, emphasizing how Pakistan's economic and trade frameworks can serve as a blueprint for tackling air pollution.****"***

For this purpose, trade and trade policies need to be properly channeled and drafted, they need at least — economic incentives, political will, and mathematical modeling. *I believe only by combining all of those three forces, we can create an effective policy to reduce climate change, in general, and Air Pollution, in specific. By promoting economic progress; cleaner technologies, political wills; advocating for the environmental regulations (rather enforcing it), and mathematical tools; optimizing policy outcomes, Pakistan can address its emerging problem of air pollution (smog).*

The paper will analyze one of those aspects i.e., *economic progress*, before concluding thoughts on the matter and through these steps, a cohesive trade policy framework can be formalized that would not

[1] *World Bank, "Pakistan: Flood Damages," October 28, 2022*.

[2] Government of Punjab. (2024). *Smog Mitigation Plan 2024*. Environmental Protection Department.

only improve air quality but would also support sustainable economic development while fulfilling the international environmental commitments.

Economic Considerations:

Impacts on Economy

Smog isn't just the problem affecting our environment but concerns every aspect of our lives [8]. One can't stress enough on its burden on health and economic prosperity and how it affects both of those sectors. From the healthcare sector to industrial costs, the economic burden associated with air pollution is no less.

In Pakistan, hospitals and clinics in major cities are often overwhelmed with patients suffering from asthma, bronchitis, and other ailments directly linked to poor air quality. Just alone in the healthcare sector from increasing prevalence of respiratory diseases, cardiovascular conditions, and other pollution-related health issues air pollution is causing damage to our health at a great staggering cost. For instance, in 2024, the ratio of such cases has gone up to as far as *60~70%* in some urban cities such as Lahore, and Karachi and that being without any economic stress is impossible[3] [8]. According to one report by WHO (World Health Organization), smog related health issues cost Pakistan, about *6.5%* of its GDP annually[4] [9]

> ***"****With constant lockdowns, economic cost is just going to increase. Businesses face disruptions, daily wage earners lose their livelihoods, and healthcare systems are pushed to the brink. Without immediate intervention, Pakistan risks a vicious cycle where pollution-driven lockdowns further cripple its economic growth.***"**

Beyond healthcare, it's also having a profound effect on productivity. The people of Pakistan are mostly dependent on daily wages and due to being frequently ill, or suffering from chronic illness, caused by smog, productivity decreases, leading to loss of working days, hence the decline in overall economic output. According to one study by *Ghani et al., 2019*, 18% of residents in Karachi alone are regularly suffering from effects of smog[5] [10]. This figure has since then increased with increase of pollution in the region. Not only based on the health of the worker, air pollution is also one of the leading causes behind the corrosion of the industrial equipment, paralyzing the working of the industry. Where the productivity in industries has declined, the agriculture sector is no less harmed by the effects of this crisis. As pollutants of smog can not only damage the crops but also affect the photosynthesis process, severely impacting the food security and livelihood of the farmers. For example, a study has shown the effects of ozone a common pollutant leading to staggering 20% decline in crop productivity under severe conditions[6] [11]. Those are just the damages caused by one single greenhouse gas. When combined with other CO gases, the range of effects are just getting worse. Furthermore, Food and Agriculture Organization (FAO) estimates the overall decline of 10~15% by 2030 if the current situation persists[7][12].

Trade Policies for Economic Incentives

To play safe, Pakistan can implement policies such as import of cleaner technology, air purification plants, etc., which could help Pakistan towards the adoption of cleaner technologies while also promoting environmentally sustainable practices. Those policies can further be aligned to achieve both national goals and international environment standards.

[3] Asian Development Bank, *Pakistan National Urban Assessment*, August 2024.

[4] Centre for Development Policy Research, *Pakistan's Air Pollution*, October 2023.

[5] Mohammad Perwaiz Iqbal, "Air Pollution: Challenges to Human Health in Pakistan," *Journal of the College of Physicians and Surgeons Pakistan* 34, no. 5 (May 2024)

[6] Stockholm Environment Institute, *Ozone: A Threat to Food Security in South Asia.*

[7] Food and Agriculture Organization, *Climate Change and Food Security: Risks and Responses.*

Reducing tariffs

One effective way to achieve these goals is by reducing tariffs and duties on import of cleaner technology, like the import of electric vehicles (EVs). One of the main reasons behind smog is high release of toxins to air by vehicles *(39% contributor)* [5]. Pakistan, being the fifth most populous country in the world, is highly dense on roads and the preference of locals for their own rides rather than public transport further ignites the matter.

As backed by **Environmental Kuznets Curve (EKC)** hypothesis; *at the beginning of economic growth, population grows but soon comes to an equilibrium and towards decline, as the economy grows* (via technological innovation and policy interventions)[8] [13, 49]. The Pakistani government can implement strategies like *reducing duties* and *providing subsidies* on buying as well as import of *EVs*. This step would not only strengthen the *EVs* market in Pakistan but would also generate interest of the people to this side (Strengthen the economy). So, by focusing on growth in positive initiatives would not only grow our economy but would help reduce pollution as well.

"In this regard, there are some initiatives been introduced by provincial governments as well as federal government but the working and adoption to this technology is still a long way to go."

There are various ways to achieve this goal:

- **Making cleaner technology more affordable**: Tariffs on imported goods raise the cost of the product, hence raising the hardship ratio to adapt such products. By reducing and removing tariffs on environmentally friendly products like *EVs*, *renewable energy equipment*, and *air filtration systems*, the government can increase the reach of such products directly into the hands of common people.
  For example, if Pakistan were to remove its existing outstanding duty of 25% on imported goods such as EVs[9] [14], the upfront cost of EVs would decrease, increasing the competition for traditional fossil-fuel powered vehicles. This hypothesis is backed by "**The law of Demand**": as *when the price of goods decreases, its demand increases*. So, by increasing the demand of EVs, we can create a very competitive market against the traditional fuel powered vehicles, hence standing against one of the leading causes of smog in Pakistan [8-10, 16].
- **Encouraging Industry Modernization:** Tariffs on importing air pollution-control technologies such as air scrubbers, carbon capture systems and filters make it harder and unprofitable for the producers and industries to adapt and modernize their production processes. Removing those tariffs would, in turn, help industries reconsider their stance and give them a viable path to invest and adapt to cleaner technologies. Industries such as steel, cement and textile— which are significant contributors of smog in Pakistan— would benefit from reduced cost when upgrading their facilities.
- **Facilitating FDI:** Jacob Viner's **trade creation theory** suggests that the reduction in trade barriers can lead to increase in imports of more efficient goods and services, improving welfare. In this context, Pakistan's efforts toward tariff reduction could signal Pakistan's goodwill towards the environment friendly investments (in terms of different services). When the tariffs are reduced, it becomes cheaper for foreign companies to invest and export their initiatives and services to the country. So, the policy shift of tariff reduction can increase the foreign direct investment (FDI) in sectors like renewable energy and green manufacturing [56-57], driving an upward scale of economy, further innovations and adoption of cleaner technologies.

[8] Nnyeneime Usenata, "Environmental Kuznets Curve (EKC): A Review of Theoretical and Empirical Literature," *MPRA Paper No. 85024* (February 10, 2018).

[9] Federal Board of Revenue, *SRO 297 of 2023 Dated 08.03.2023: Imposition of Enhanced Rate of 25% Sales Tax on Import and Supply of Luxury Goods*

- **Promoting International Environmental Collaboration:** Amongst all, this step (tariffs reduction on environment friendly products) also aligns with the trade policies of the global goals and agreements. Agreements such as Paris agreement[10] [15] stress the importance of green technologies and by focusing on trade policies as prescribed, Pakistan can enhance its global standing and encourage international collaboration on such issues.
  Many developed nations also provide incentives and subsidies on green technology exports. So, by posing as prescribed i.e., importing such technologies without tariffs would create synergies, allowing Pakistan to access those technologies at the much lower cost.
- **Long-Term Economic and Environmental Gains:** Tariffs removal might cut the government revenue in short terms but the long-term economic benefits far outweigh the initial losses. Improved air quality (Environmental gain) can lead to lower healthcare costs with increased labor productivity (Economic gains). Different studies have shown how tariffs reduction has added to GDP rather than cutting from it in the long run. Like **OCED[11]** (Organization for Economic Co-operation and Development) [16] and **WHO[12]** (World Health Organization) [17] highlights the economic cost of air pollution, including healthcare costs and workspace productivity, are relatively higher than the revenue generated from tariffs.

So, by removing tariffs on green technologies, Pakistan can position itself for long-term growth by facilitating a cleaner, more efficient industrial base with healthier workforce.

Subsidies

Moreover, Pakistan can also further improve this by providing a tax relief as well as further preferential international trade agreements to those local industries and companies which are adhering to green initiatives. This approach would help combat the air pollution while also increasing the demand of the Pakistani products in the market where sustainability is the first choice.

Followings are some of the ways to achieve this goal:

- **Lowering the Cost of Cleaner Technologies:** The **Environmental Economics Theory of Externalities** suggests using *government intervention in form of taxes and subsidies to counter the effects made by spillover*. Pollution is one of the most common byproducts of that spillover. And by using subsidies, **A. C. Pigou** suggests, we can *counter those market failure and correct the negative externalities*, like pollution[13] [18].
  In the context of Pakistan, one of the primary barriers in adoption to such technologies is high upfront cost. Subsidies can work as a counter effect by reducing the cost, making it affordable for industries to invest in environment friendly technologies like *EVs*, *solar panels*, and other pollution control equipment.
  For example, if the government uses a strict policy of installing the *air filtration systems* in industrial bases, but also provides the subsidy on the cost, let's say *30%*, for the limited time. It would generate a positive influx of installation of that technology because industries see incentive to do so *(Cost benefit analysis)*. The above example also shows how subsidies can incentivize the positive externalities of cleaner technologies by mitigating the cost borne by the firms, which would otherwise lead to over pollution in the free market.
- **Encouraging Innovation:** Subsidies also encourage innovation by lowering the financial risk for the firms that are investing in green technologies. Well driven environmental policies, such

[10] *United Nations, "The Paris Agreement," 2015*

[11] Organisation for Economic Co-operation and Development (OECD), *The Cost of Air Pollution: Health Impacts of Road Transport*, OECD Publishing, 2014.

[12] *World Health Organization, Health Benefits Far Outweigh the Costs of Meeting Climate Change Goals, December 5, 2018.*

[13] *Pierre Lemieux, "The Threat of Externalities," Regulation 44, no. 3 (Fall 2021)*

as removing barriers (tariffs) and subsidies can lead to technological innovations that improve not only the environment but also our economies and industrial competitiveness.

In Pakistan, subsidies can also stimulate the R&D (Research and development) in green technologies. By offering subsidies to R&D sector such as manufacturing and energy, Pakistan can take address its outstanding issues like energy crisis[14] [19] along with smog.

- **Promoting Scale and Market Penetration:** In countries like China and India, subsidies on *EVs* have shown positive impacts on *EV* market[15] [16] because Subsides help scale up the production and adoption of technologies through **economies of scale** [20-21]. As the demand for subsidized products such as *EVs*, or renewable energy resources increases, the production cost's burden of such products fall. This makes those technologies more profitable in the long run.

  This **virtuous cycle,** where initial subsidies increase adoption, and reduces the upfront cost for the consumers, eventually ends with increased demand, reducing the need for continued government support. Pakistan can follow the similar pattern, allowing subsidies on the cost of *EVs* (from manufacturer to consumer), leading to the reduction in fuel emission vehicles— one of the largest contributors of smog.

- **Shifting Market Behavior:** Pakistan is not the land of affluent people, but the significant population of Pakistan depends on others for their meal[17] [22]. In such conditions, a little light is more than enough to gain the attention of the people. And if that helps with resolving two at once, it won't hurt. In the absence of subsidy, people might continue to use cheaper and more polluting products, raising pollution with every passing day [18]. However, by providing subsidies on environmentally friendly choices, the PK government can change the behavior of individuals and industries, showcasing more financially attractive alternatives.

  For example, today's inflation rates have made it impossible for people of Pakistan to make financially independent choices[18] [23]. A large number of people are dependent on the cheapest alternative as their best choice. So, if the government were to take advantage of the situation, the fate of this developing nation might change for the better.

- **Empirical Evidence:** Countries around the world are taking measures to mitigate the effects of climate change and some have been very successful in their endeavors. Countries like Germany and Norway have been very successful in using subsidies to promote green products. In Germany [24], subsidies on solar energy have led to rapid acceleration on solar energy usage, making Germany one of the global leaders in renewable energy[19]. Similarly, in case of Norway [25, 67], the subsidies on electric vehicles have led to groundbreaking 50% of overall sales constitute of EVs in previous year, taking a dramatic turn in favor of environment while reducing emissions from transportation sector[20].

Pakistan can draw from all of those examples and introduce the trade policy with policies advocating both, the reduction/emission of trade barriers and targeted subsidies to encourage the adoption of green technology and reducing smog.

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[14] *Abdul Waheed Bhutto, "Pakistan's Power Crisis: A Perfect Storm of Policy Failures," The Diplomat, August 20, 2024*

[15] Yiran Liu, Xiaolei Zhao, Dan Lu, Xiaomin Li, Impact of policy incentives on the adoption of electric vehicle in China, Transportation Research Part A: Policy and Practice, Volume 176, 2023,

[16] R. Hema, M.J. Venkatarangan, Adoption of EV: Landscape of EV and opportunities for India, Measurement: Sensors, Volume 24, 2022,

[17] World Food Programme, "Pakistan,"

[18] Mehtab Haider, "Economy in Trouble Due to Higher Fuel Prices, Poverty, Inflation, Floods," *The News International*, September 3, 2024

[19] SolarStone, "Solar Subsidies in Germany," October 4, 2023

[20] Avi Mersky, Frances Sprei, Constantine Samaras, and Sean Qian, "Effectiveness of Incentives on Electric Vehicle Adoption in Norway," *Transportation Research Part D: Transport and Environment* 46 (2016): 56-68

Export Policies and Green Standards

To create an effective strategy to combat climate change and to reduce smog while focusing on export policies and green standards, one needs to understand both the current **legal framework** and the **potential improvements** that can be made.

Next would be an effort to evaluate current policies while offering enhanced green projects to improve air quality:

Current Environmental Regulations in Trade and Export Policies:

Pakistan has several laws on environmental standards [27-29, 68] but *they are not enforced to their best*. Especially when it comes to regulation of industries that contribute to smog, those laws are present, but poorly enforced.

Some of those notable laws include:

- **Pakistan Environmental Protection Act (PEPA) 1997:** This act is established on environmental standards and the framework for environment protection[21] [26]. However, when it comes to enforcing this act, it remains non-existent in one sense, as it is poorly enforced. Specifically, when it comes to trade related industries i.e., textile industry, the enforcement of this act is so weak. Like many industries fail to meet **National Environmental Quality Standard (NEQS)[22]** [27]**,** but remains functional to this day[23] [28]. This poor regulation is adding pollution to our air and deteriorating our environment with every passing day.
- **National Climate Change Policy (NCCP) 2021[24]:** NCCP [29] outline the strategic policies to combat climate change. But it lacks the basic link between trade policy and climate change. Though there is a little recognition of the need for cleaner technology, it rarely focuses on how to bridge both into action.
- **Trade Policy Framework 2020-2025 [25]**: Similar to NCCP, this policy framework only focuses on one, ignoring the other. This policy framework outlines Pakistan trade potential for the next five years, but doesn't prioritize sustainability in its working. Economic prosperity, and economic growth through trade in fields like agriculture, textile etc., is emphasized but there is no integration of environmental factors— one of the most vocal factors in western world— in this policy framework [30].

A little **Reality Check** can be seen in practice of those policies. On one turn is Bangladesh, known for its garments around the world. Bangladesh has strictly implemented environmental regulation for exporting textile goods which has, in turn, helped Bangladesh gain, the title of global leader in **green garments production[26]** [31]**.** Bangladesh has introduced incentives for the industries to obtain **Leadership in Energy and Environmental Design (LEED)** certification. This has led to over 260 LEED certified companies, as of 2024[27], which are not only helping Bangladesh combat the environmental issues but also gaining it a place in eco-friendly markets [32].

[21] *Pakistan Environmental Protection Act, 1997*, December 6, 1997.

[22] Ahmad Rafay Alam, *Situational Analysis of National Environmental Laws and Policies, Non-Compliance of These Laws, Resource Efficiency Issues and Gaps in Implementation*, World Wide Fund for Nature - Pakistan, 2018.

[23] WWF Asia, *Review of Existing Environmental Laws*, accessed December 19, 2024

[24] Ministry of Climate Change, Pakistan, *National Climate Change Policy*

[25] Trade Development Authority of Pakistan, *Strategic Trade Policy Framework 2020-25*

[26] Bangladesh Now Global Leader with 229 LEED-Certified Green Factories," *Textile Focus*, accessed December 19, 2024

[27] Ashraful Haque, "Turning Over a New (Green) Leaf," December 31, 2023.

On the contrary is the Pakistan: Pakistan's textile industry has little to no integration of green initiatives or green certifications for export policies[28] [33]. Given this, despite having textile as a major contributor to Pakistan's GDP, it remains not that well known in the world, despite being a major polluter in the country.

Weaknesses in Current Trade Policies Regarding Green Standards:

One who knows his weakness is the true master, this quote should fit right to Pakistan's situation. Though the exact reasons are many and every upcoming page increases the count to both sides, there are some very visible reasons hindering the ability of Pakistan to mitigate the effects of air pollution in export regulations.

Those reasons include:

- **Lack of Green Certifications**: Unlike the **EU's Eco-Label** or the **U.S. Energy Star program**, Pakistan got no such specific national green certification to coordinate its export sector. The absence of it makes it relatively difficult for Pakistan's products to compete in eco-conscious markets such as the EU, which put their main focus on sustainability.
- **No Incentives for Sustainable Production:** In this capitalist world, everything is measured by their profit ratio and the failure of Pakistan's government to provide incentives to industries which adopt green technologies makes it harder to achieve the goals of sustainability. While other countries offer tax credits, incentives and subsidies to industries complying with green standards[29] [34], Pakistan's trade policy lacks the basis of it. For instance, the **trade policy mechanism 2020-2025** fails to offer any subsequent incentives to industries which adapt to better green standards such as installing air purification systems, or basing on renewable energy.
- **Weak Monitoring and Enforcement**: Pakistan is blessed with creative thinkers. *So, with every passing day, we get endorsed by new ideas and start working on them, leaving the previous ones unchecked.* Similar is the condition with our checks and balance of institutions[30] [35]. The **Pakistan Environmental Protection Agency (Pak-EPA)** which is responsible for monitoring the harmful emissions from industries, its enforcement remains very poor[31]. Industries often fail to meet *NEQS* but face no heavy penalties [36] and since no positive rewards or strict punishment is done, the industries are most likely to continue on that path, damaging the environment to the worst. This weak enforcement of policies also damages a country's reputation in the international world, undermining the environmental efforts, if any, linked with trade policy.

Those weaknesses trigger one warning: Pakistan lacks long-term strategy linking environmental standards with trade policy, making it harder for Pakistan to compete in international markets, especially eco-friendly ones.

[28] Jian-guo Du, Yasir Ahmed Solangi, "Sustainability in Pakistan's Textile Industry: Analyzing Barriers and Strategies for Green Supply Chain Management Implementation," *Environmental Science and Pollution Research* 30, no. 20 (March 2023)

[29] George E. Lent, *Tax Incentives for Investment in Developing Countries*, vol. 1967, issue 002 (Washington, DC: International Monetary Fund, Research Dept., 1967), 196

[30] Sakib Sherani, *Institutional Reforms in Pakistan: The Missing Piece of the Development Puzzle*, November 2017

[31] Sardar Sikander Shaheen, "Pak-EPA, Ministry Flayed for 'Poor' Performance," *The Business Recorder*, August 24, 2021

Proposed Green Standards and Export Policy Reforms:

World is moving toward sustainability and to align with global green practices to reduce air pollution Pakistan must use global green standards in its export policies. Some of the basic reforms Pakistan can do to kickstart are:

- **Introduction of Green Export Certifications**: Pakistan should adopt a way to certify the industries following the environmental best practices (more than necessary) and should give them incentives in form of tax credits, first-priority, subsidies etc. This certification should be something like **Made in Green**, **EU's Ecolabel,** rewarding products made by following the green standards [72].
- **Incentives for Green Exports**: For issues specific to air pollution, this can be further sanitized by integrating emission caps with export incentives. Taking the textile industry, for example, would need to limit its release of particulate matter (PM) and NO_x emissions below the set threshold to qualify for export benefits.
- **Tying Environmental Performance to Export Quotas**: Government of Pakistan can make it more competitive by tying environmental progress with export quota. In industries like cement and textile, the government can introduce a quota system, by allowing high quota to the industries with higher environmental standards and lower to otherwise. For example, the industries which show reduction in emission to their counterparts receive high quota and preferential access to certain markets.
- **Strengthening Environmental Governance**: *Ideas without hard work are just an illusion*. Same is the case with existing environmental laws. Pakistan needs to strengthen the enforcement of those laws. Strengthening the Laws like **Pakistan Environmental Protection Act (PEPA) 1997** and the **National Environmental Quality Standards (NEQS)** would start a self-disciplinary action, leading towards the betterment. Strengthening the **Pakistan Environmental Protection Agency (Pak-EPA)** and introducing the audit system would further incentivize the check and balance in export-oriented industries, improving the credibility of green standards of Pakistan.

Made under **Article 192(1)** of the TFEU, **European Union's Carbon Border Adjustment Mechanism** (CBAM) introduces tariffs on goods exported to EU based on their carbon footprints[32] [37]. This step has led to several countries adapting to better green standards, reducing emissions to avoid penalties. Pakistan's inclusion in GSP+ has already shown a better result, with trade in textile reaching to *16.5bn USD*, accounting up to *60pc* of the total exports[33] [38]. This shows how little efforts on sustainability practices can have great upscale in our economies. Further adhering to best practices would incentivize this growing figure and now is the better time than ever, when the biggest competitor of Pakistan in textile industry is going through turmoil.

Economic Modeling

Economic modeling is an essential step to justify the investment necessary for the project to progress and its long-term benefits. Economic models can be scaled using different methods and some of the ways are adapted to showcase our needs and their probability of success. And one of those prominent models include *cost benefit analysis*.

[32] *European Commission, "Carbon Border Adjustment Mechanism."*

[33] *"GSP+ Helps Double Pakistan Exports to EU: Envoy," Dawn, September 11, 2024*

Cost-Benefit Analysis (CBA):

Cost benefit analysis is the crucial tool to determine the economic feasibility of the trading policies in tackling air pollution. To conclude a concrete cost-benefit analysis, a hypothetical study of reducing tariffs on *EVs* and renewable technologies in Pakistan is being taken. This policy would be based on addressing air pollution in major cities, particularly from the transportation and energy sector.

Basically, we can take cost benefit analysis by differencing estimated cost from the estimated profits/benefits.
Cost benefit Analysis = Estimated benefits Estimated costs

"It is necessary to remember that those costs/benefits are tentative and mostly are based on average, calculated through mathematical analysis or taken from secondary

- **Estimating Costs:**
  The costs initial and annually involved in implementing those policies would approximately be:

  a) Tariff Revenue Loss

  - **Initial Policy:** Using the current rates, the tariffs to import electronic vehicles are 25%[34] [14]. And if the import spikes from 2k annually to 20k annually *(on average)* after the tariff's removal. And the cost per electronic vehicle is $30,000[35] [41], the losses in terms of revenue loss would be:

    Tariff revenue loss = 20,000×30,000×25% = $150 million annually

  - **Renewable Energy Equipment**: The current standing of Pakistan energy [40] comes from 59% thermal, 25% hydro, 7% renewables and 9% nuclear[36]. To improve the dependence of the energy sector more towards renewable energies, Pakistan would need to buy renewable energy equipment and provide subsidies to raise public interest towards renewable energies like solar panels etc. Estimating the reduction of import tariffs by 20% increases the annual imports to up to 2-billion-dollar worth of green technology, the cost of this process would approximately be:

    2 billion × 20% = $400 million annually

    This figure is deemed to change with every progressing year, as new ways are introduced and local industries strive to come into the competition.

Thus, the tentative total tariffs loss would be:
Total Tariff Loss = $150 million + $400 million = **$550 million dollar annually**

b) Subsidy Costs:
Along with 20% reduction in import tariffs, providing further 20% subsidy on such products would further incentivize the cause and if done so, our annual cost on subsidies would be:
Subsidy cost = 2,000,000,000×20% = $400 million annually

[34] *FBR, SRO 297 of 2023: Imposition of Enhanced Rate of 25% Sales Tax on Import and Supply of Luxury Goods.*
[35] *"How Much Will an Electric Vehicle Really Cost You? Here's What to Know," CBS News, August 14, 2024.*
[36] International Trade Administration, Pakistan Country Commercial Guide: Renewable Energies.

So, another 400 million dollars would be needed to spare in the form of subsidy cost, provided to raise the imports of renewable resources. Similar to import tariffs, subsides would also be needed for the short terms.

c) Infrastructure Cost:

Infrastructure costs are the fixed one-time costs needed to build the operational sites and to carry out functions of the production. In our case, infrastructure costs would come in the form of charging stations. Let's suppose, to begin a fully functional operation, Pakistan would need to have at least 5,000 charging stations in the major cities (out of 20k) and each charging station would cost [39] around $50,000 [37]. So, the total fixed cost would be:

Infrastructure cost = 5,000×50,000 = $250 million (one-time cost)

d) Other Unseen Costs:

In every operation, there are other costs which are not known at the time like relocation costs, training costs, global trading costs, corruption etc... Assessing such costs to be up to **500 million dollars** annually, we would conclude our estimates of cost.

e) Opportunity Cost:

This probably is the most important to consider, as the opportunity cost is the cost of taking such initiatives on the cost of other sectors. Those are the funds which could have been used elsewhere. Like the cost of buying solar panels or giving reliefs/subsidies might come from the funds diverted from other sectors like education or healthcare. So, it is very important to consider opportunity cost to not cause another harm in the process.

Total Estimating Costs:

So, the total estimated cost would be:

Annual Estimated Cost = Tariff Loss + Subsidies Cost + Other Unseen Cost
= $550,000,00 + $400,000,00 + $500,000,00 = **$1.45 Billion** annually**,**
With **additional $250 million** as **one-time cost.**
Still, those annual costs are to decline with every passing year as the benefits start to kick in.

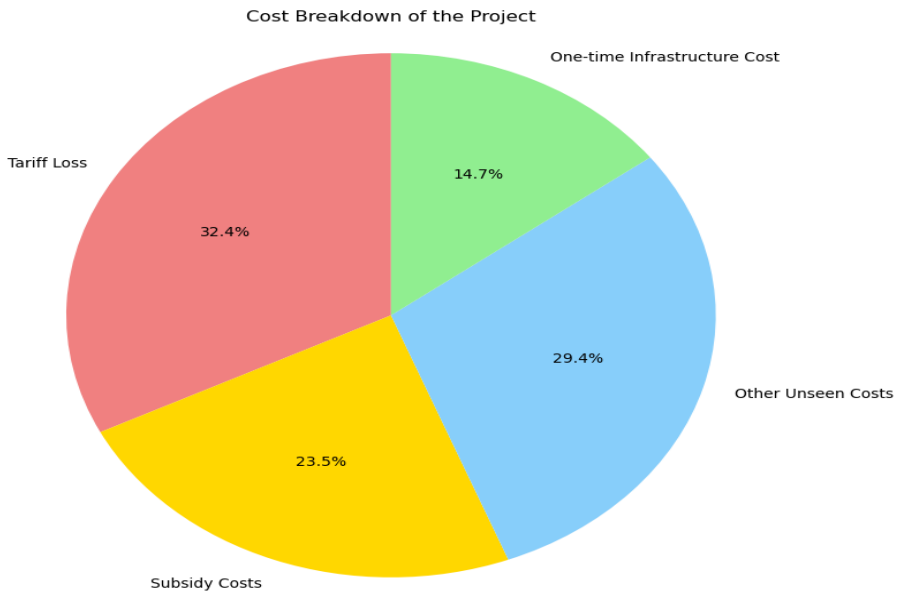

Figure 1. Estimating Costs

[37] Bacancy Systems, "Cost to Install EV Charging Station," accessed December 19, 2024

- **Estimated Benefits**

  It is given to expect benefits when you are giving a lot in terms of cost. Here are some of the expected benefits out of this trade policy.

  a) **Healthcare Savings:**

  The world health organization (WHO) has designated air pollution as the single biggest environmental threat [42] to human health[38]. It is one of the significant contributors to respiratory illnesses, leading to higher medical costs. According to Pakistan EPA (Environment Protection Agency), air pollution cost about *6%* of Pakistan's total GDP [43] in different expenses[39]. It can be in the form of healthcare facilities or lost productivity. The above-mentioned plans would significantly reduce air pollution as a compliment. And given even the 10% reduction in smog would largely reduce the illnesses (caused by smog) and the cost associated with it. According to world Bank (WB), 10% reduction in air pollution would save around $1 billion annually in healthcare for Pakistan(*average*) [44], which is more than 2/3rd of the costs associated with initiatives to eradicate this harm[40].

  Healthcare savings = **$1 billion** annually

  b) **Increased Labor Productivity**

  Cleaner air, in turn, reduces the sick leaves, increases labor productivity. According to the studies conducted by *Harvard T.H. Chan School of Public Health and others*, a *10%* reduction in particulate matters (PM2.5) can lead to *1%* increase in workforce productivity[41] [45]. So, assuming that the use of *EVs* and renewable energies with stricter law enforcements, the air pollution reduces by *10%*, increasing *1%* in workforce productivity and the current GDP of Pakistan is about $350 billion USD [71], the increasing labor productivity added to GDP would be:

  Increased productivity = 350,000,000,000×1% = **$3.5 billion** annually

  c) **Economic Growth via Green Technology Adoption**

  The adaptation to green technology leads to long term growth because of increased energy efficiency and innovation. **Porter hypothesis** suggest that the environmental regulations increase competitiveness, with studies showing *0.1%* boost in GDP as energy efficiency improves by *1%*[42] [46].

  Given the adoption of renewable energy increases the energy efficiency by *5%* over the next decade, the economy of Pakistan could grow by $1.75 billion dollars annually.

  d) **Other Unseen Benefits:** Similar to costs, there are also hidden benefits of such policies as well. They can be calculated in the form of new jobs, savings in crude energy import cost[43] etc. [47].

[38] World Health Organization, "Air Pollution: The Invisible Health Threat,"

[39] Pakistan EPA, *PCAP - Pakistan Clean Air Programme*

[40] World Bank, Cleaning Pakistan's Air, http://dx.doi.org/10.1596/978-1-4648-0235-5

[41] *Harvard T.H. Chan School of Public Health, Office Air Quality May Affect Employees' Cognition, Productivity, September 9, 2021.*

[42] Stefan Ambec et al., "The Porter Hypothesis at 20: Can Environmental Regulation Enhance Innovation and Competitiveness?" *CIRANO Working Papers* 7 (2010)

[43] Haider, Mehtab. "Economy in Trouble Due to Higher Fuel Prices, Poverty, Inflation, Floods." *The News International*, September 3, 2024

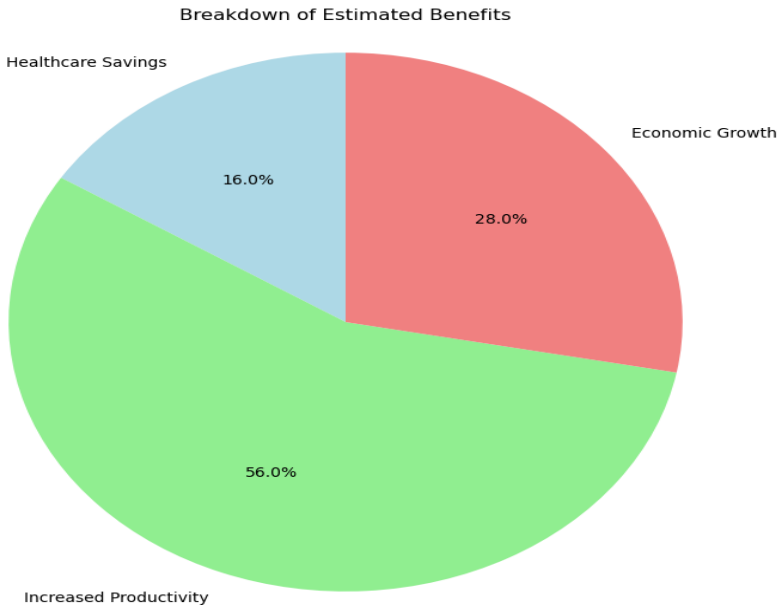

Figure 2. Estimated Benefits

- **Final CBA:** Weighing the Costs and Benefits
  Total annual costs = **$1.45 billion** + **$250 million** (one-time cost)
  Total Annual Benefits = $1 billion + $3.5 billion + $1.75 billion = **6.25 billion**

  Net Profit = $6.25 billion – 1.45 billion = **$4.8 billion Annually**
  This cost benefit analysis clearly shows a surplus. Furthermore, CBA also employs the graphical illustration as depicted in Figure 1, Figure 2 and Figure 3 to give a better understanding of the mathematical analysis. It shows how different variables add up to give a positive probability of benefits, highly outweighing the costs. The trade policy, if carefully crafted, could yield money in public health savings, enhanced labor productivity, upraising the long-term economic scale. This analysis also shows how such approach could be both viable and profitable for Pakistan to effectively address the air pollution.

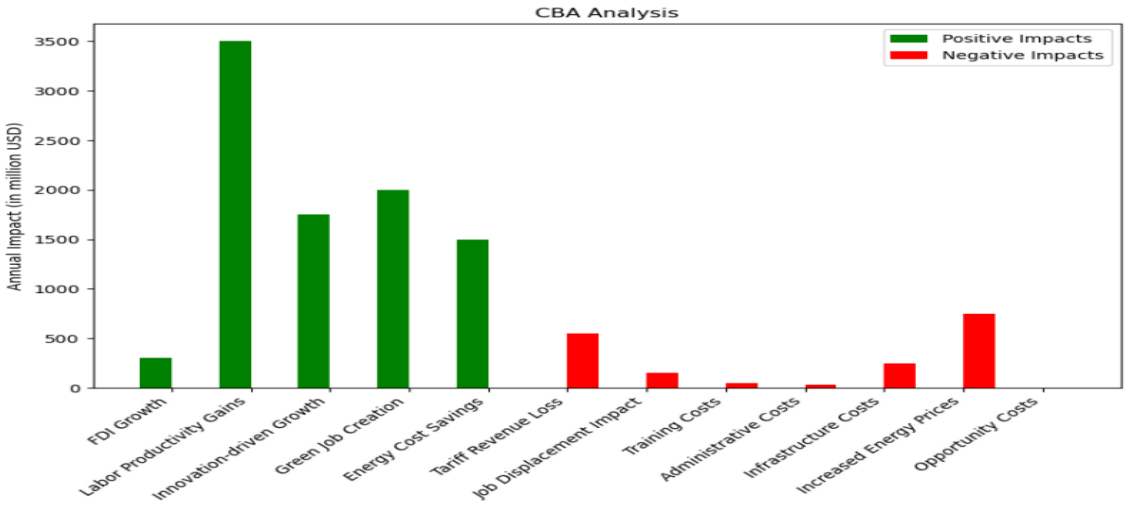

Figure 3. Weighing the Costs and Benefits

Political and Mathematical Considerations (Conclusion)

Economic considerations are just a visible part of all of this, where background gets a lot messier. From political games such as lobbying, policy recommendation and strategy to mathematical analysis such as data analysis for smog and trading trends, Optimization Models for Trade Policy and Quantitative Metrics for policy success all play an important role in crafting best trade policy, incorporating the knowledge and finding of all of the variable from different methods. By employing economic considerations with political and mathematical analysis, a well driven policy can be formulated, allowing Pakistan to design and implement trade policy which effectively addresses air pollution while maintaining economic growth.

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