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Original Research

Catalyzing Industrial Development in Bangladesh Through Key Chemical Inputs: A Strategic Study of Caustic Soda, UF Glue, and PVC Resin Consumption and Market Trends

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Abstract

This study examines the consumption trends and industrial demand for three important chemicals: Caustic Soda (NaOH), Urea Formaldehyde (UF) Glue, and Polyvinyl Chloride (PVC) Resin in Bangladesh from 2020 to 2026. By utilizing a mix of primary survey data and secondary industrial sources, the analysis reveals significant annual growth rates of 9.5% for caustic soda, 10.0% for UF glue, and 7.8% for PVC resin. Although caustic soda production is nearly self-sufficient due to current manufacturing infrastructure, Bangladesh still entirely relies on imports for UF glue and PVC resin. The study evaluates the technical and economic feasibility of establishing local production for each chemical, while also identifying key gaps and opportunities in the chemical manufacturing value chain. It offers policy recommendations to support industrial development strategies, emphasizing the importance of replacing imports, investment incentives, and building a sustainable, self-sufficient industrial base. The findings act as a guide for developing the chemical industry in line with national economic priorities and global sustainability objectives.

Keywords: *Caustic Soda, UF Glue, PVC Resin, Chemical Consumption Trends, Bangladesh Chemical Industry, Domestic Production Feasibility, Import Dependency, Industrial Demand Forecast.*

Introduction

Bangladesh's industrial sector has undergone significant changes over the past decade, driven by rapid urbanization, infrastructure development, and strong performance in export-driven sectors, especially textiles and ready-made garments (RMG). These sectors contribute to most of the country's export earnings [1, 2]. This industrial growth has sharply increased the domestic demand for essential chemicals like Caustic Soda (NaOH), Urea Formaldehyde (UF) Glue, and Polyvinyl Chloride (PVC) Resin. These chemicals are crucial across various industries, including textiles, furniture, construction, plastics, pharmaceuticals, paper, electronics, and water treatment [3–6]. However, despite increasing consumption, Bangladesh's ability to produce chemicals domestically is limited. This continues reliance on imports becomes more challenging amid unstable global market conditions [7, 8].

In recent years, global economic disruptions have significantly impacted the international supply and pricing of industrial chemicals. The COVID-19 pandemic, geopolitical tensions, trade restrictions, inflation, and fluctuations in international freight costs have led to recurring supply chain bottlenecks. Additionally, the devaluation of local currency against the US dollar, rising energy costs, and high import duties have further inflated the cost of imported raw materials in Bangladesh [9, 10]. These factors have not only raised production costs for local manufacturers but have also made the country's industrial base more vulnerable. Consequently, there is an urgent need to boost domestic production capabilities of essential industrial chemicals to ensure a steady supply and lessen reliance on external sources.

Caustic Soda, a powerful alkaline substance used widely in textiles, detergents, paper, petroleum refining, and water treatment, illustrates this dependency clearly. In 2020, local consumption was 394,905 metric tons, expected to rise to 680,734 metric tons by 2026, reflecting a compound annual growth rate (CAGR) of 9.5% [11]. The textile

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industry, the largest user of caustic soda, is particularly affected by fluctuations in price and supply. Thus, local production is both economically beneficial and strategically critical [1, 8].

UF Glue, a thermosetting adhesive essential for wood, furniture, and construction sectors, is entirely imported in Bangladesh. Its demand is projected to grow from 234,760 metric tons in 2020 to 415,892 metric tons by 2026, with a CAGR of 10% [12]. As global resin prices rise due to greater demand from the automotive and electronics fields and constraints on raw material supply, local manufacturers confront increasing costs and supply uncertainties. With the rapid growth of construction and furniture industries in Bangladesh, the lack of domestic UF glue production becomes a significant obstacle [13, 14].

Similarly, PVC Resin used extensively in construction, electrical insulation, consumer goods, and packaging has seen growing demand both globally and locally. Bangladesh consumed 383,860.5 metric tons of PVC resin in 2020, with projections estimating this will reach 593,315 metric tons by 2026 (CAGR of 7.8%) [13]. However, since no local production facilities exist, the country must wholly rely on imports. These imports are becoming harder to obtain at competitive prices due to global resin shortages, high shipping costs, and tighter trade regulations [15]. As Bangladesh pursues infrastructure-led growth through its "Vision 2041" and “Delta Plan 2100” initiatives, ensuring a steady supply of PVC is crucial for meeting development targets.

These growing challenges highlight the strategic necessity of investing in domestic chemical manufacturing. Strengthening backward connections through local production of Caustic Soda, UF Glue, and PVC Resin can lead to increased industrial self-sufficiency, job creation, and economic stability. In a changing global landscape with shifting supply chains and economic uncertainty, a well-structured approach to developing the chemical industry could spark sustainable industrialization in Bangladesh. This study thus investigates consumption trends, global market impacts, and policy implications to create a strategic roadmap for enhancing the country’s chemical production capabilities.

Objectives

This study aims to examine current consumption patterns and industrial reliance on three key chemical inputs: Caustic Soda, UF Glue, and PVC Resin within Bangladesh’s growing industrial sector. It seeks to evaluate how global market changes, such as raw material shortages, inflation, and supply chain disruptions, are affecting the import and cost dynamics of these vital chemicals. The research also intends to explore the economic feasibility and strategic importance of establishing local production capabilities for these chemicals. By identifying opportunities and challenges in the national industrial ecosystem, the study aims to assist in planning informed investments for the future. Ultimately, it strives to provide policy recommendations that could lessen reliance on imports, strengthen industrial resilience, and align chemical supply strategies with Bangladesh’s broader industrialization goals.

Rationale

The rationale for this research stems from the critical need to boost Bangladesh’s industrial self-sufficiency in light of increasing global volatility. Key sectors like textiles, construction, pharmaceuticals, and manufacturing are becoming ever more reliant on imported chemicals like Caustic Soda, UF Glue, and PVC Resin. This dependence poses significant risks, especially as global economic conditions shift due to geopolitical conflicts, trade restrictions, raw material price increases, and transportation issues. Currently, Bangladesh lacks sufficient domestic production facilities for these chemicals, leaving vital industries exposed to price shocks and supply disruptions. As the government intensifies efforts toward large-scale infrastructure development and industrial transformation under initiatives like “Vision 2041” and “Delta Plan 2100,” ensuring a steady, affordable chemical supply is more important than ever. This study is essential for identifying current gaps and guiding the strategic direction of industrial policy in the chemical sector.

Policy Recommendations

To support sustainable industrialization and reduce reliance on imported chemical inputs, several strategic policy measures are suggested. First, the government should offer financial incentives, such as tax breaks, customs relief, and subsidized loans to stimulate local investments in the production of Caustic Soda, UF Glue, and PVC Resin. Second, dedicated chemical industrial zones should be created with necessary infrastructure, including water, power, transportation, and environmental safety measures, to ensure efficient and compliant operations. Third,

public-private partnerships (PPP) should be encouraged to blend government support with private-sector efficiency and international expertise. Fourth, efforts must be made to secure long-term contracts for essential raw materials and diversify import sources to mitigate exposure to global supply shocks. Fifth, investment in research and development should be prioritized to explore alternative raw materials, sustainable chemical technologies, and recycling-based production models. Lastly, temporary but focused trade protections, like tariff adjustments, can help nurture domestic industry growth while still allowing access to critical imports when needed. Together, these policy recommendations can drive a shift toward a more resilient and self-sufficient chemical industry in Bangladesh, ensuring long-term industrial competitiveness.

Materials and Methods

The study uses a multi-method approach that combines both qualitative and quantitative research methods to analyze the consumption patterns, market dynamics, and potential for domestic production of Caustic Soda, UF Glue, and PVC Resin in Bangladesh. The methodology aims to thoroughly evaluate the demand-supply scenario, global market influences, and challenges within the local chemical production sector.

Data Collection

Primary Data: Surveys and interviews were conducted with industry stakeholders, such as chemical manufacturers, importers, and key players in the textiles, construction, and plastics sectors. These stakeholders offered insights into the current use of these chemicals, supply chain challenges, and difficulties related to importation and pricing. Industries and organizations that participated in the survey included: Square Toiletries Ltd., Walton Hi-Tech Industries Ltd., Pran-RFL Group, Akij Particle Board Industries, Navana PVC, BRB Cable Industries, KDS Group, Anwar Group of Industries, Partex Plywood & Boards, Aziz Pipes Ltd., Gazi Pipes, Meghna Group of Industries, and several medium-scale textile dyeing units in Narayanganj and Gazipur.

Secondary Data: Market reports, government publications, and industry databases were assessed to gather information about historical consumption trends, projected demand, and import/export statistics for Caustic Soda, UF Glue, and PVC Resin. Data from global chemical market reports was also included to evaluate how international supply and price fluctuations affect the local market.

Consumption Analysis

A detailed analysis of the consumption of the three chemicals across Bangladesh's major industrial sectors was conducted. This involved reviewing data from industry surveys, government reports, and trade publications to assess the quantities of each chemical consumed over the past five years and to project future consumption based on trends in industrial growth and sector demands. A compound annual growth rate (CAGR) was calculated for each chemical based on the consumption data to assess future demand trends.

Market Dynamics and Supply Chain Assessment

An analysis of the local and global supply chains was carried out to identify key sources of imports, the role of international suppliers, and the impact of global economic factors such as shipping delays, raw material shortages, and price changes. This part of the study included interviews with importers and logistics companies to assess obstacles to efficient chemical imports and to understand how global market fluctuations impact local supply chains.

Economic Feasibility and Strategic Value of Domestic Production

The economic viability of establishing local production facilities for Caustic Soda, UF Glue, and PVC Resin was assessed through a cost-benefit analysis. This included calculating potential capital investment, operating costs, and return on investment (ROI) for chemical production facilities. The study also looked into the availability of raw materials, skilled workers, and local industries' technological capacity to support the establishment of chemical manufacturing units. Furthermore, the research evaluated the potential economic impacts of reducing import reliance, such as creating local jobs, enhancing supply chain stability, and lowering overall manufacturing costs for industries that depend on these chemicals.

Policy Analysis
The policy recommendations were developed based on insights gained from the consumption analysis, market dynamics evaluation, and economic feasibility assessment. Comparative studies of similar economies with local chemical production initiatives were reviewed to identify best practices and lessons applicable in Bangladesh's context. These findings were synthesized to propose targeted policy measures aimed at backing domestic chemical manufacturing while alleviating the challenges of the current import-based system.

Significance
This study is crucial as it addresses a significant gap in Bangladesh's industrial development strategy: the overdependence on imported base chemicals like Caustic Soda, UF Glue, and PVC Resin. These chemicals are vital for high-growth sectors such as textiles, construction, plastics, and furniture manufacturing. Local production could boost economic resilience, promote technological innovation, and reduce trade imbalances. By analyzing current consumption patterns, expected market growth, and the feasibility of domestic production, this study offers important insights that can guide evidence-based industrial policy and strategic investment decisions. The findings emphasize the possibility of building a strong local chemical manufacturing base, which could enhance job creation, value-added production, and replace imports in line with national development initiatives like "Vision 2041" and the "Delta Plan 2100." Furthermore, given the global supply chain disruptions and fluctuating raw material prices due to economic crises, geopolitical tensions, and pandemics, the urgency of establishing domestic production capabilities has become even more pressing. This research serves as a timely resource to guide policymakers, investors, and industry stakeholders in addressing external vulnerabilities and promoting long-term industrial growth. Ultimately, this study advances the discourse on sustainable industrialization by demonstrating how strategic investments in chemical production can accelerate the transition from an import-reliant economy to a more self-sufficient, competitive, and industrially diversified Bangladesh.

Limitations
Despite careful planning and execution, this study faced several limitations that may have affected data collection. One key challenge was the inaccessibility of some factories and end-user offices. These were restricted due to internal policies or located in remote areas. Securing appointments with key personnel was often difficult, and many respondents were either unwilling to participate in interviews or unable to share sensitive information due to company confidentiality rules. Additionally, there was a significant lack of reliable and current secondary data, which made it harder to verify findings. To tackle these challenges, the research team used mobile phone interviews as an alternative method of data collection, especially when respondents declined face-to-face meetings. Despite these limitations, the team applied its technical expertise to ensure the validity and reliability of the primary data collected.

Survey Study Design
To examine consumption patterns, market trends, and industrial reliance on Caustic Soda, UF Glue, and PVC Resin in Bangladesh, a structured survey was conducted in major industrial regions. A non-probability sampling technique was used, meaning not all elements of the target population had equal chances of being selected. This method was chosen due to logistical constraints and the need to reach specific respondent categories directly involved in the chemical supply and consumption chain. The sample included manufacturers, importers, suppliers, end users, wholesalers, and retailers. The survey included 44 respondents from wholesale and retail sectors, 24 from importer groups, and 308 from various categories of industrial users. The geographic scope covered key industrial and commercial hubs such as Dhaka, Gazipur, Narayanganj, Khulna, Chittagong, Mymensingh, Barisal, Bogura, and Pabna. Data collection took place in two time slots, from 9:00 AM to 1:00 PM and 3:00 PM to 5:30 PM, over a continuous 60-day period. The survey design prioritized direct interaction with stakeholders to ensure a complete understanding of current usage trends and constraints in the chemical market.

Result and Discussions

Consumption Patterns of Key Chemicals in Bangladesh
Current study examined the consumption of three important industrial chemicals: Sodium Hydroxide (NaOH), Urea Formaldehyde (UF) Glue, and Polyvinyl Chloride (PVC) Resin based on thorough primary survey data and

verified secondary sources such as industry reports, trade statistics, and government publications. The analysis offers both quantitative and qualitative insights into consumption trends, sectoral demand, and market growth paths over a five-year period.

The data show a strong and steady rise in demand for all three chemicals, driven by the constant growth of key manufacturing sectors like textiles and garments, furniture and wood products, construction and infrastructure, and flexible and rigid packaging. These industries form the backbone of Bangladesh's industrial landscape and align closely with national priorities outlined in the Industrial Policy 2022 and Vision 2041. The chemicals examined are essential raw materials that support high-volume production, value addition, and quality consistency across these sectors.

Table 1: Summary of Chemical Consumption and Projections in Bangladesh, 2020–2026

Name of Chemicals	2020 Consumption (Metric Tons)	2026 Projected Consumption (Metric Tons)	CAGR (%)
Caustic Soda	394,905	680,734	9.5
UF Glue	234,760	415,892	10.0
PVC Resin	383,860.5	593,315	7.8

Note: Data presented in this table were compiled from the Bangladesh Bureau of Statistics (BBS, 2020 - 2022) [21], Export Promotion Bureau (EPB, 2020 - 2022) [22], Bangladesh Chemical Industries Corporation (BCIC) Annual Reports (2020-2021) [23], and primary industry surveys conducted during this study [24].

Caustic soda, which is mainly used in textile processing, paper manufacturing, water treatment, and soap/detergent production, has experienced the highest growth in volume. In 2020, the total domestic consumption of caustic soda was estimated at 394,905 metric tons, expected to rise to 680,734 metric tons by 2026, corresponding to a Compound Annual Growth Rate (CAGR) of 9.5%. The textile sector accounts for over 70% of this consumption, due to its role in fabric bleaching, mercerizing, and dyeing processes. This increase reflects both organic growth in the sector and the import substitution strategy adopted by local caustic soda manufacturers, who are gradually enhancing domestic production capacities to reduce reliance on imports.

UF Glue, a thermosetting adhesive commonly used in plywood, particleboard, laminate furniture, and MDF production, is fully dependent on imports in Bangladesh. The domestic market consumed 234,760 metric tons in 2020, and this figure is projected to reach 415,892 metric tons by 2026, resulting in a CAGR of 10%. The sharp rise is mainly driven by the booming furniture and construction sectors, along with the modernization of small and medium enterprises in the wood processing industry. Global demand for low-cost, high-performance adhesives also affects local consumption trends, with UF glue favored for its cost-effectiveness, ease of use, and low curing temperatures. The lack of local production facilities for UF glue represents a strategic opportunity for investment and technology transfer.

PVC Resin is a versatile thermoplastic polymer widely used in pipes, fittings, profiles, cables, packaging films, and flooring. In 2020, domestic demand stood at 383,860.5 metric tons, with expectations to reach 593,315 metric tons by 2026, indicating a CAGR of 7.8%. The construction sector is the largest consumer of PVC, followed by the electrical and packaging industries. The government's Delta Plan 2100 and Vision 2041 infrastructure development programs are likely to further boost demand for PVC-based materials. However, total reliance on imports makes the market susceptible to price swings, currency changes, and supply chain disruptions, highlighting the need for local PVC production capacity development. The expected rise in the consumption of these chemicals underscores their strategic role in the national industrialization plan. As Bangladesh moves towards a more diversified and value-added manufacturing economy, the steady and economical supply of industrial chemicals becomes crucial. The increasing consumption also points to untapped investment opportunities, especially in local production of UF glue and PVC resin, where Bangladesh currently lacks domestic manufacturing.

The caustic soda sector shows a more advanced localization model, which could offer lessons for scaling similar efforts in other chemical sectors. The consumption trends of caustic soda, UF glue, and PVC resin indicate an evolving and increasingly sophisticated industrial demand landscape in Bangladesh. This growth is driven by rapid economic expansion, ongoing urban infrastructure projects, rising export-oriented manufacturing, and the adoption of modern production methods across key sectors. The upward trend signifies an urgent need for coordinated

policies, strategic investment incentives, and robust public-private partnerships to boost domestic chemical production. Strengthening backward linkages in the industrial value chain, particularly through localized manufacturing of high-demand chemicals, can help lower import reliance. This approach will also enhance employment opportunities, improve trade balances, and establish a strong foundation for long-term industrial self-sufficiency and sustainable economic growth.

Expanded Sector-Specific Use Data

Caustic soda consumption is mainly driven by the textile sector (around 70%), followed by soap and detergent (12%), pulp and paper (8%), water treatment (5%), and pharmaceutical and chemical processing (5%). UF Glue consumption is led by plywood and particleboard industries (64%), furniture manufacturing (22%), and construction/ interiors (14%). PVC resin usage is concentrated in pipe and fittings (55%), electrical cable insulation (18%), profiles and window frames (12%), packaging films (9%), and flooring/other uses (6%). These detailed breakdowns further emphasize the need to develop domestic production capacities for these chemicals.

Caustic Soda

Demand, Supply, and Growth Trends Caustic soda, or sodium hydroxide (NaOH), is one of the most essential industrial chemicals in Bangladesh. It plays a vital role in sectors like textiles, paper and pulp, water treatment, soap and detergent manufacturing, and pharmaceuticals. As of 2020, the estimated national demand for caustic soda was 197,780 metric tons, closely matched by domestic production of 197,120 metric tons, leading to an impressive self-sufficiency rate of 99.77%. This level of supply security marks a significant shift away from the country's previous dependence on imports and highlights the growth of the local caustic soda industry. Bangladesh currently has four major caustic soda manufacturing facilities. Notably, a fifth plant was launched by SR Group in Bogura in December 2020. This facility has an annual production capacity of 54,000 metric tons, which includes 30,000 metric tons of caustic soda, 12,000 tons of bleaching powder, and 12,000 tons of bleaching fine. The growth of local production capacity has not only helped close the demand-supply gap but also positions Bangladesh to potentially become a net exporter in the future, assuming surplus production is achieved and quality standards are maintained. Table 2 provides detailed data on caustic soda consumption and production in Bangladesh from 2020 to 2026. These figures come from primary survey results and estimates based on interviews with industry stakeholders, importers, wholesalers, and end users. The data show a steady and positive trend in both demand and supply. From 2020 to the predicted figures for 2026, domestic caustic soda production is expected to grow by over 72%, while user consumption is also expected to rise by more than 72% during the same period. This growth is mainly driven by the expanding needs of the textile and garments sector, which uses caustic soda for scouring, bleaching, dyeing, and mercerizing processes. The pulp and paper industry also continues to use large amounts for pulping and de-inking. Moreover, the increase in soap and detergent manufacturing, driven by heightened hygiene awareness post-pandemic, alongside steady growth in pharmaceutical production, has broadened the consumption base. Increased investment in water treatment infrastructure and effluent treatment plants (ETPs) has also reinforced the industrial reliance on caustic soda. The gradual increase in the number of wholesalers and retailers involved in caustic soda distribution further reflects market decentralization and improved regional accessibility. While importers continue to bridge temporary supply-demand gaps, their market dominance has decreased due to the growing contributions from domestic production. The overall trend suggests a positive and resilient outlook for Bangladesh's caustic soda sector.

However, maintaining this growth will require dealing with challenges such as energy-intensive production processes, strict environmental compliance standards, and possible volatility in raw material supply chains like salt and electricity. Investment in cleaner production methods, energy-efficient electrolysis systems, and waste recovery units will be crucial to staying competitive and meeting global environmental standards.

UF Glue

Rising Demand and Lack of Local Production Urea-formaldehyde (UF) glue, a thermosetting resin widely used as an adhesive in the wood-based panel industry, has become a crucial input for Bangladesh's growing furniture, interior design, and construction sectors. As of 2020, national consumption reached 234,760 metric tons, with projections suggesting it will hit about 415,892 metric tons by 2026. This significant increase, representing a

compound annual growth rate (CAGR) of around 10%, highlights the vital and expanding role UF glue holds in the domestic industrial value chain. Despite this strong and steady demand, Bangladesh does not currently have any domestic production facilities for UF glue. The entire supply is imported, making the country vulnerable to external price changes, supply chain risks, and fluctuations in currency exchange rates. The total dependence on imports creates a major gap in the industrial ecosystem, especially given the country's focus on manufacturing-led economic growth.

The data show a steady and increasing trend in both demand and supply. Between 2020 and the projected figures for 2026, domestic caustic soda production is expected to rise by over 72%. User consumption is also forecasted to grow by more than 72% in the same timeframe. This growth is mainly driven by the expanding needs of the textile and garment sector, which uses caustic soda for scouring, bleaching, dyeing, and mercerizing.

Table 2: Consumption Survey Data of Caustic Soda (Metric Tons), 2020–2026

Year	Importers	Wholesalers-Retailers	Users	Manufacturers
2020	39,890	73,705	84,190	197,120
2021	43,679.55	80,706.98	92,188	215,846.4
2022	47,829.11	88,374.14	100,946	236,351.81
2023	52,372.87	96,769.68	110,536	258,805.23
2024	57,348.30	105,962.80	121,037	283,391.73
2025	62,796.38	116,029.27	132,535	310,313.94
2026 (Projected)	68,762.04	127,052.05	145,126	339,793.77

The pulp and paper industries continue to consume large amounts for pulping and de-inking. Additionally, the growth of the detergent and soap industries, fueled by increased hygiene awareness after the pandemic, along with consistent pharmaceutical production, has broadened the consumption base. Investments in water treatment infrastructure and effluent treatment plants have also strengthened industrial reliance on caustic soda. The slow but steady increase in the number of wholesalers and retailers selling caustic soda indicates improved market decentralization and greater regional availability. While importers still help fill temporary supply-demand gaps, their market dominance has declined as domestic manufacturers contribute more.

Overall, the trend suggests a positive outlook for Bangladesh's caustic soda sector. However, maintaining this growth will involve tackling specific challenges. These include energy-intensive production processes, strict environmental regulations, and possible fluctuations in the supply chains for raw materials like salt and electricity. Investment in cleaner production technologies, energy-efficient electrolysis systems, and waste recovery units will be crucial for staying competitive and meeting global environmental standards.

UF Glue: Rising Demand and Lack of Local Production

Urea-formaldehyde (UF) glue is a thermosetting resin commonly used as an adhesive in the wood-based panel industry. It has become vital for Bangladesh’s rapidly growing furniture, interior décor, and construction sectors. As of 2020, national consumption was 234,760 metric tons, with projections suggesting it will rise to about 415,892 metric tons by 2026. This significant increase, representing an annual growth rate of around 10%, highlights the essential and expanding role of UF glue in the domestic industrial value chain.

Despite strong demand, Bangladesh currently has no domestic production of UF glue. The entire supply comes from imports, which exposes the country to fluctuations in prices, vulnerabilities in supply chains, and risks from currency exchange rates. Relying entirely on imports is seen as a major gap in the industrial ecosystem, especially given the country’s focus on manufacturing-led economic growth.

The data clearly show an annual increase across all distribution and consumption channels. The "Users" category mainly consists of furniture manufacturers, plywood and particleboard producers, and construction firms involved in modular woodworks. Meanwhile, the growing volume managed by wholesalers and retailers indicates broader market reach and greater acceptance among small to medium-sized enterprises.

Table 3: Consumption Survey Data of UF Glue (Metric Tons), 2020–2026

Year	Users	Wholesalers-Retailers	Importers	Local Manufacturing Unit
2020	111,260	74,300	49,200	0
2021	122,386	81,730	54,120	0
2022	134,625	89,903	59,532	0
2023	148,087	98,893	65,485	0
2024	162,896	108,783	72,034	0
2025	179,185	119,661	79,237	0
2026 (Projected)	197,104	131,627	87,161	0

The complete lack of local manufacturing, despite high demand, represents significant challenges and opportunities. Setting up UF glue production facilities in Bangladesh could greatly reduce import dependence, lower costs for local manufacturers, improve industry resilience, and position the country as a regional supplier. This would also help solve issues related to product customization, quality control, and delivery times, which are often limited when sourcing internationally. However, starting production would require substantial investment, regulatory clearances for handling formaldehyde (a hazardous chemical), and adherence to strict environmental and worker safety standards. These obstacles can be overcome by considering long-term economic benefits, job creation, and greater industrial self-reliance. Given the expected demand growth, a favorable investment climate, and existing industrial infrastructure, this sector represents a prime opportunity for both local and foreign investors. Policy support, including tax incentives, land acquisition assistance, and expedited environmental clearance processes, could encourage the establishment of local production units. Additionally, partnerships with countries that have established UF resin industries, like China, India, and Malaysia, could support knowledge sharing and operational efficiency. While the growing demand for UF glue highlights industrial growth in Bangladesh, the lack of local production calls for immediate strategic and policy action. Closing this gap through targeted investments could greatly impact industrial sustainability and economic independence.

PVC Resin: Demand Surge Amid Import Dependency

Polyvinyl chloride (PVC) resin is a key raw material for making pipes, cables, profiles, window frames, sheets, flooring, and synthetic leather. It has seen rapidly increasing demand in Bangladesh due to fast-paced urbanization, real estate development, and infrastructure expansion. In 2020, national consumption of PVC resin was 303,320 metric tons. It is expected to grow to around 537,026 metric tons by 2026, representing an annual growth rate of over 10%. Currently, Bangladesh lacks domestic manufacturing for PVC resin. All demand is met through imports, leaving the country highly vulnerable to shifts in global prices, disruptions in shipping, and trade policy changes in exporting countries like China, India, and South Korea. This total dependence not only raises production costs for various downstream industries but also limits Bangladesh's ability to negotiate better trade terms and secure timely material availability during crises.

Table 4: Consumption Survey Data of PVC Resin (Metric Tons), 2020–2026

Year	Users	Importers	Wholesalers-Retailers	Local Manufacturing Unit
2020	285,150	82,750.5	15,960	0
2021	307,391.7	89,205.04	17,204.88	0
2022	331,368.25	96,163.03	18,546.86	0
2023	357,214.98	103,663.75	19,993.52	0
2024	385,077.74	111,749.52	21,553.01	0
2025	415,113.81	120,465.98	23,234.14	0
2026 (Projected)	447,492.69	129,862.33	25,046.41	0

The rising demand for PVC resin is closely linked to growth in construction, sanitation infrastructure, electrical cabling, and consumer product packaging. For example, PVC pipes are favored for both urban and rural water distribution because they are cost-effective, resistant to corrosion, and durable. Similarly, the electrical and electronics industries rely heavily on PVC for sheathing and insulation materials due to their safety and flexibility. The rise in demand across all surveyed sectors underlines the importance of establishing domestic PVC resin production. This capability would reduce import costs, enhance control over quality, ensure supply chain dependability, and encourage related industries such as vinyl chloride monomer (VCM) and ethylene production.

Nevertheless, starting a PVC resin manufacturing plant poses significant challenges, requiring a major investment and advanced chemical processing technologies. The manufacturing process demands substantial energy and stringent environmental protections due to the involvement of hazardous intermediates like chlorine and VCM. Therefore, any initiative must comply with national environmental policies and be backed by strong regulatory oversight. The government can assist by introducing favorable investment policies, including tax exemptions for importing machinery, fast-tracking industrial land allocation, providing competitive rates for utilities, and partnering with international companies for technology transfer. Furthermore, integrating PVC resin production into strategic industrial development plans could accelerate investment interest. Existing petrochemical or chemical processing clusters might be used to incorporate PVC production as part of a broader development strategy.

The increasing demand for PVC resin, combined with the lack of domestic production, highlights both a significant industrial gap and a strategic investment opportunity. With the right planning, regulatory support, and collaboration between public and private sectors, Bangladesh could substantially reduce its import dependence while fostering the growth of a resilient local chemical manufacturing sector.

Feasibility of Local Production

The feasibility of establishing domestic production for caustic soda, UF glue, and PVC resin varies greatly depending on factors like the availability of raw materials, technological readiness, investment needs, and alignment with national industrial capacity. Caustic soda production is highly feasible in Bangladesh. The country already has several operational plants and ample access to raw materials like salt and water, along with a reliable electricity supply vital for the energy-intensive chlor-alkali process. Additionally, there is a growing domestic market driven by the textile, detergent, paper, and chemical sectors, which ensures a steady demand. The existing infrastructure, skilled labor, and logistical networks make further capacity expansion a strategic and attainable goal. Investment in this sector is estimated at about $50 million for modern chlor-alkali units equipped with environmentally friendly technology, such as membrane cell processes. Expanding this segment could help substitute imports, improve trade balances, and increase export potential to neighboring markets.

UF glue production is moderately feasible. Despite lacking any existing manufacturing facilities, strong demand from the wood processing and furniture sectors provides motivation for market entry. Starting production would require initial technology transfer agreements with international adhesive manufacturers and training local workers in resin chemistry and polymer engineering. The necessary raw materials, such as urea and formaldehyde, are available or can be sourced regionally. However, strict adherence to safety and environmental regulations is essential due to the toxic nature of formaldehyde. Estimated investment to set up a UF glue plant is around $30 million, covering reactor systems, resin handling units, emission control technologies, and compliance infrastructure. With appropriate regulatory oversight, this could develop into a viable mid-sized industrial segment with significant backward and forward linkages.

In contrast, PVC resin production currently faces low feasibility within Bangladesh's industrial framework. The main challenge is the absence of a domestic petrochemical base, critical for generating vinyl chloride monomer (VCM), which is essential for PVC resin production. Building a PVC resin facility would need massive capital investment exceeding $200 million and a reliable supply of petrochemical feedstocks like ethylene and chlorine. None of these ingredients are produced locally at the necessary scale. The technological complexity, environmental concerns, and high entry barriers render this an unfeasible short-term investment under current conditions. However, as Bangladesh's industrial sector develops and if petrochemical infrastructure expands, PVC production could become a feasible long-term strategic goal.

The differing levels of feasibility highlight the need for a tailored approach to developing the chemical industry in Bangladesh. While some sectors, like caustic soda, are ready for scaling up, others, like UF glue, need targeted

investment. Capital-intensive sectors like PVC may require long-term planning and foundational infrastructure development. The feasibility assessment is also influenced by the availability of raw materials.

Table 5: Feasibility of Establishing Domestic Production

Chemical	Feasibility	Key Considerations	Estimated Investment
Caustic Soda	High	Raw material availability, existing market base	$50 million
UF Glue	Moderate	Technology and expertise required, no existing plants	$30 million
PVC Resin	Low	Requires petrochemical infrastructure and high capital	$200 million

Caustic soda production needs industrial-grade salt, most of which is sourced domestically, supplemented by a small amount from India and Myanmar. UF glue production requires urea, which is partially available from local fertilizer plants, along with formaldehyde that would still need some imports or the expansion of local methanol- based formaldehyde production. PVC resin production relies on imported ethylene and chlorine because neither is produced locally at the required levels. This necessity adds complexity to production processes.

Policy Implications and Strategic Recommendations

The data show both progress and gaps in Bangladesh's industrial chemical supply chain. While caustic soda production has moved closer to self-sufficiency, the total reliance on imports for UF Glue and PVC Resin is both a weakness and a chance for improvement. Targeted investment incentives, better infrastructure, public-private partnerships, and policies to replace imports could greatly improve Bangladesh's industrial strength.

The government might think about:

- Offering tax incentives to attract investment in chemical manufacturing plants.
- Creating industrial zones centered on chemical production.
- Promoting partnerships for technology transfer. - Focusing on PVC and UF Glue production in its industrial policies.
- Strengthening R&D support for cleaner production methods.

Conclusion and Future Directions

The data show a strong and steady rise in demand for all three chemicals, driven by the constant growth of key manufacturing sectors like textiles and garments, furniture and wood products, construction and infrastructure, and flexible and rigid packaging. These industries form the backbone of Bangladesh's industrial landscape and align closely with national priorities outlined in the Industrial Policy 2022 and Vision 2041. The chemicals examined are essential raw materials that support high-volume production, value addition, and quality.

Authors Contributions

Nilay Kumar Dey was responsible for conceptualization, methodology development, investigation, data analysis, visualization, and writing of the original draft, as well as reviewing, editing, and supervising the overall research work. Ali Hossain Tutul and Md Arman Hossan carried out the experimental work, data collection, and preliminary analysis. Md Gazi Mobassir contributed through formal analysis, validation, and data collection. Md Asibur Rahman Khan provided resources and contributed to data interpretation. Salwa Nailah Tanha performed the literature survey, data curation, and assisted in manuscript editing. Abdur Rahim provided technical support, managed facilities, and offered consultation during experimentation. All authors have read and approved the final version of the manuscript.

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Conflict of interest

The authors declare that they do not have any conflict of interest.

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