# FEASABILITY STUDY OF UREA FORMALDEHYDE PLANT

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I Ammar Haider hereby state that my MS thesis titled "**Feasibility Study of Urea Formaldehyde Plant**" is my own work and has not been submitted previously by me for taking any degree from National University of Sciences and Technology, Islamabad or anywhere else in the country/ world. At any time if my statement is found to be incorrect, even after graduation the university has the right to withdraw my MS degree.

Name: Ammar Haider

Date: 04/08/2024

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# ABSTRACT

Urea Formaldehyde is one of the main raw material used in Haidery Boards. Every product firm manufactures, urea formaldehyde is used in its manufacturing. The current method of sourcing urea formaldehyde from multiple suppliers has been instrumental in sustaining our particle board manufacturing operations. However, in order to enhance operational efficiency and cost-effectiveness, a comprehensive analysis of the existing system was conducted. This report presents a detailed overview of the current supply chain, an analysis of its strengths and weaknesses, and a compelling recommendation to consider establishing an in-house urea formaldehyde plant. Different marketing, competitive, financial perspectives have been covered. Further literature review is conducted to get a better understanding of the manufacturing process of urea formaldehyde. In financial analysis, all possible costs are considered so that a safe side return on investment time period can be calculated.

# CHAPTER 1

## 1 Introduction

Haidery Boards is a wood processing industry. Its mission is to provide superior quality products and services to its consumers in the construction industry, dealers and suppliers, utilizing state of the art machinery, technology and processes.

Haidery Board's journey began 27 years ago in 1994. Since then, it is evolving and transforming into a technologically advanced particle board manufacturing company in Pakistan. Its products are widely used in kitchens, furniture, wardrobes, building materials and much more. Haidery Boards aim to provide quality boards to the clients while simultaneously fostering good relations with government bodies, professionals, contractors and suppliers.

Haidery Boards manufactures three types of boards at one of its manufacturing units in Hattar, Pakistan:

- Chip Board
- Vin Board
- High pressure Lamination

Haidery Boards commits to cater all kind of client needs in terms of quality. It produces high quality but expensive boards, and medium quality but comparatively cheaper boards. All three products are of different quality.

Three different units are being run for each product. Chipboard is the main product which is sold in raw form and is also further processed to manufacture Lamination and Vin board.

### 1.1 Products

1. **Chipboard**

Chipboard, also known as particleboard, is a type of engineered wood product made from wood chips, sawmill shavings, and other wood scraps that are compressed together with a resin binder under heat and pressure. The resulting material is a dense and strong panel that can be used in a variety of applications, such as furniture, cabinetry, flooring, and construction.

Chipboard is known for its affordability and versatility, and is often used as a more cost-effective alternative to solid wood. It comes in different grades, with higher grades being more durable and able to withstand heavier loads.

## Manufacturing Process

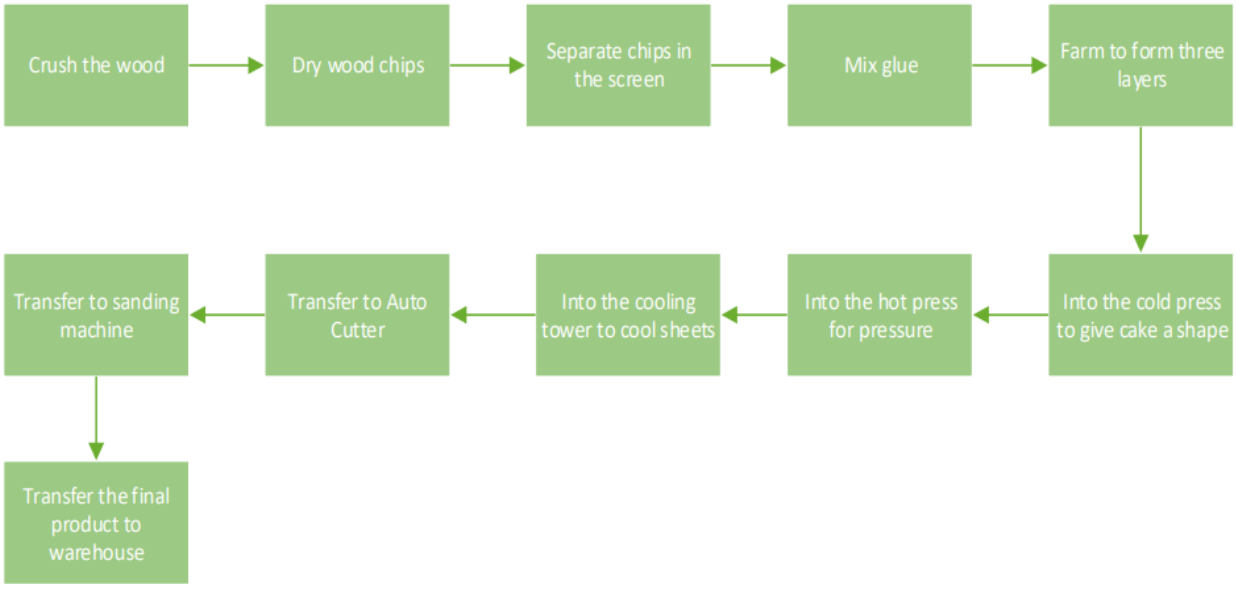


**Figure 1.1 Summarized Chipboard process**

**Figure 1.2 Chipboard**

## Raw materials

- Wood
- Glue

2. **Lamination**

Chipboard manufactured is further transferred to lamination unit for paper pressing. Hot press is used for paper pressing. Paper is imported from China so proper stock inventory is required so that paper is ordered on time.

**Raw Material:**

- Chipboard
- Paper

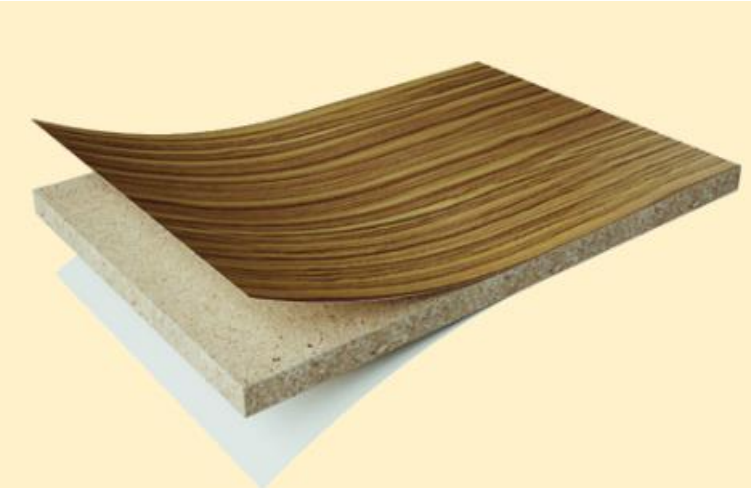

**Figure 1.3 Lamination**

3. **Vin Board**

Chipboard is also used in manufacturing of Vin board. A glue roller machine and hot press are used for further processing. Vineer is imported from China. Glue and Maida are purchased locally.

**Raw material**

- Chipboard
- Vineer
- Glue

4. **Shuttering Ply**

Beside Chipboard, Haidery Boards also manufacture Shuttering ply. It has a separate unit. It is mostly used for construction purposes.

Shuttering plywood, also known as formwork plywood, is a type of plywood that is specifically designed for use in concrete formwork or molds. It is made by bonding multiple layers of thin wood veneers together, with each layer oriented at a right angle to the adjacent layers, to provide excellent strength and dimensional stability.

Crafting shuttering plywood involves several meticulous steps:

**Choosing Quality Materials:** We start by handpicking prime hardwoods like birch or eucalyptus. Only the finest logs, chosen for their excellence, make the cut.

**Peeling and Drying:** Next, these chosen logs undergo a gentle peeling process using a rotary lathe. The resulting thin veneers are then gently dried to achieve just the right moisture balance.

**Bonding with Care:** Coating the dried veneers with adhesive, we stack them, ensuring each layer crosses the others at a right angle. This stack then heads into a hydraulic press, where under intense pressure and heat, the layers fuse into a robust bond.

**Refinement:** Post-pressing, we trim the plywood to precision and polish it to a flawlessly smooth texture. We don't forget the edges either; they receive a waterproof sealant, guarding against any moisture intrusion.

**Stringent Quality Checks:** Every inch of the finished product undergoes thorough scrutiny for imperfections like knots, cracks, or gaps. Sorted into various grades based on their excellence, the plywood is meticulously packed for shipping to our valued customers.

In essence, crafting top-notch shuttering plywood demands the utmost care in selecting materials, precision in processing, strong bonding, and impeccable finishing, ensuring a durable product fit for concrete formwork.

**Raw Materials**

- Core
- Vineer
- Shuttering Paper
- Glue

## 1.2 Current System

Our particle board manufacturing owes much of its success to the current practice of sourcing urea formaldehyde from several suppliers. Nonetheless, to boost efficiency and cut costs, we recently conducted a thorough review of our sourcing system. This report outlines the ins and outs of our supply chain, evaluates its strengths and weaknesses, and proposes a compelling idea: setting up our own urea formaldehyde plant.

Presently, our company depends on about three to four key suppliers for obtaining urea formaldehyde, a pivotal ingredient in crafting chipboard, lamination, vinboard, and ply. The process involves placing orders with these external suppliers, managing lead times, and tackling the various challenges that come with dealing in the external market.

### 1.2.1 Analysis of Current System

While our current setup has served us admirably, it's not without its vulnerabilities. Relying solely on external suppliers exposes us to various risks—think market shifts, geopolitical tensions, and supplier hiccups—that could lead to price swings and supply chain snags. Plus, there's always the gamble of external suppliers not quite hitting the quality mark, which can impact our end products.

- Market Shifts: As stated, earlier urea formaldehyde is one of the main raw materials for wood processing industry so whatever happens it has to be purchased to keep plant running. Therefore, its market is very volatile. Depending on demand its price fluctuate on weekly basis. So, it depends a lot on market shifts.
- Price Swings: As discussed in previous point that due to demand it price fluctuates a lot. Another reason is that its raw material is imported so its price depends upon dollar. If dollar goes up prices goes up drastically but if price goes down there is not much change.
- Delay: Few time it had happened that suppliers were not able to deliver glue on time as per there commitment due to which emergency shut downs were placed. This leads to huge losses.
- Credit period: Advantage of current system is that all firms give credit of month for payment. Due to which its easy to run the circle smoothly.
- Barter System: Another advantage is that barter system exists. We have two/three suppliers who provide us with glue and in return purchase our products. Although there price is 1or 2 rs higher but its easier to give away product compared to cash.

- Quality issues: Currently, quality is not upto the mark. For cost saving suppliers are using more salt to increase the weight which results in more wastage. Further, solid content 1 – 2% less than ordered.

### 1.2.2 Problem Statement

As discussed earlier that Haidery Boards is manufacturing four main products and urea formaldehyde is raw material for each product. Therefore, establishing a Urea formaldehyde plant will reduce manufacturing cost of each product. Hence, it will help to survive in competitive market of Pakistan. Further, manufacturing own glue will help to improve the quality of board by making it more hard, flexible and gas free. Moreover, government regulations are getting stricter by time so by production of urea formaldehyde these emissions can be controlled as per defined by government by adjusting molar ratios (discussed in literature review). So, for cost competitiveness, eco friendly environment and strict government regulations Haidery Boards top management will have to look in to setting up own plant. Therefore, market and financial analysis is required to convince top management. This report will help them to take step.

## 1.3 Objective

The main goal of this report is to thoroughly examine our current supply chain for urea formaldehyde and propose a strategic solution involving setting up our own production facility. Currently, we heavily rely on three to four main suppliers for urea formaldehyde, and our aim is to boost efficiency and cut costs in the production of chipboard, lamination, vinboard, and ply.

- Understanding How Urea Formaldehyde is Made:

We'll start by diving deep into the production process of urea formaldehyde. This will include a detailed look at the technical side of things, the key steps involved, the equipment needed, and any potential challenges we might face in bringing production in-house. Our focus here is on ensuring efficiency, maintaining quality, and meeting industry standards every step of the way.

- Checking Raw Material Availability:

Next, we'll explore the current market landscape and see what's available in terms of raw materials needed for making urea formaldehyde. We'll carefully analyze the risks associated

with sourcing these materials, including how market changes, geography, and supplier reliability could impact us.

- Understanding the Costs of Setting Up:

A big part of our report will be breaking down all the expenses involved in getting our own urea formaldehyde plant up and running. We'll look at things like building infrastructure, buying equipment, meeting regulations, and training our workforce. Our aim here is to give a clear picture of what kind of financial investment we're looking at for this big move.

- Figuring Out the Costs of Manufacturing:

We'll also dig into the nitty-gritty of what it'll cost us to actually make urea formaldehyde in-house. This means taking a close look at things like raw materials, energy use, maintenance, and any other day-to-day expenses we'll encounter. The idea is to get a good handle on the overall cost structure of bringing production in-house.

- Making the Numbers Work:

Of course, we need to show that this is a smart investment. So, we'll crunch the numbers to figure out the expected rate of return on our investment for the new plant. We'll look at metrics like how long it'll take to recoup our investment, the current value of future returns, and the internal rate of return. All this to make a solid case to our management that this is a financially sound move.

- Understanding Our Market:

We'll use some strategic frameworks to analyze the urea formaldehyde market as a whole. This means looking at things like the bargaining power of suppliers and buyers, how much competition we're up against, and the possibility of new players entering the market. We'll also do a SWOT analysis to see where our strengths and weaknesses lie, and what opportunities and threats we need to be aware of as we make this transition.

- Looking to the Future:

Finally, we'll take a forward-thinking approach and explore other potential markets and industries that could benefit from urea formaldehyde. By analyzing market trends and demand

forecasts, we'll identify opportunities to expand our sales and make the most of our new production capabilities.

- Conclusion and Next Steps:

In conclusion, the report advocates for the establishment of an in-house urea formaldehyde plant as a strategic move to optimize the supply chain, enhance product quality, and achieve significant cost savings. The next steps involve securing necessary approvals, identifying suitable locations, and initiating the procurement of equipment and resources. Key stakeholders, including production, finance, and supply chain management teams, will actively participate in the decision-making and implementation process. This proposed initiative positions our company for sustained growth and resilience in the face of dynamic market conditions.

# CHAPTER 2

## 2 Literature Review

The development of urea formaldehyde resin dates back to the 1930s, as indicated by Dinwoodie in 1979, and has become widely utilized in the composites industry. According to Dinwoodie (1979), UF resin is instrumental in the production of ninety percent of the global particleboard. Pizzi (1994a,b) delineated various benefits associated with UF resins, encompassing:

- The resin's inherent hardness.
- Its minimal flammability.
- Favorable thermal properties.
- The absence of color in the cured polymer.
- The resin's versatility in adapting to diverse curing conditions.

Despite the initial water solubility that renders UF resins suitable for cost-effective mass production, they do possess drawbacks. The primary challenge lies in the susceptibility of UF resin to hydrolytic degradation when exposed to moisture and/or acids. This degradation primarily results from the hydrolysis of the amino plastic and the methylene bridges.

Urea formaldehyde resin, a key component in the manufacturing of particle board, is produced through a complex chemical process. This literature review aims to provide a detailed understanding of the steps involved in urea formaldehyde production, considering the various parameters and factors that influence the quality and efficiency of the process.

### 2.1 Production Process

- Raw Material Selection: The process begins with the selection of high-quality raw materials. Urea and formaldehyde are the primary precursors. Urea, derived from natural gas or synthetic ammonia, and formaldehyde, typically in the form of formalin, are carefully chosen to ensure the desired characteristics of the final resin (Wood ahesives,2002).
  - Urea
  - Formaline
  - Castic Soda
  - Acid

- Sea Salt

- **Reaction Mechanism:** At the heart of it all is the chemical reaction between urea and formaldehyde, often catalyzed by acidic or basic agents. This reaction is exothermic and results in the formation of methylene linkages, which give rise to a robust three-dimensional resin structure (Phenol/formaldehyde Resins, 2005).
- **Temperature and Pressure Control:** Maintaining precise control over temperature and pressure within the reaction vessel is paramount. Specific conditions are required to achieve the desired molecular weight and reactivity of the resin. These parameters significantly influence the kinetics of the reaction and the properties of the final product.
- **pH Regulation:** Optimal pH levels are crucial in urea formaldehyde production. Careful monitoring and adjustment of the reaction mixture's pH are necessary to optimize resin properties. Acidic or alkaline additives are introduced as needed to regulate pH levels and catalyze the reaction.
- **Condensation and Polymerization:** The initial condensation of urea and formaldehyde produces oligomers, which undergo subsequent polymerization. The degree of condensation and polymerization determines the molecular weight and viscosity of the resin, key factors that impact curing behavior and final resin performance (Phenol/formaldehyde Resins, 2005).
- **Post-Condensation and Filtration:** Additional post-condensation steps may be employed to further refine resin properties. Filtration is utilized to remove by-products and impurities, ensuring the purity of the urea formaldehyde resin.
- **Cooling and Storage:** Following the reaction, the mixture is cooled, and the resulting resin is often stored to allow for maturation. Maturation enhances resin performance by promoting optimal cross-linking and curing properties.
- **Quality Control and Optimization**: Rigorous quality control measures are implemented throughout the production process to maintain consistent resin properties. Advanced analytical techniques, such as infrared spectroscopy and rheological analysis, are employed to monitor key parameters and optimize production processes.

## 2.2 Detailed Review

Urea-formaldehyde resins (Phenol/formaldehyde Resins, 2005) are formed through diverse reactions between urea and formaldehyde. Under varying reaction conditions, a wide range of condensed structures can be produced. These resins, classified as thermosetting, consist of a mixture of linear or branched oligomers and polymers, often retaining some monomers. Unreacted urea is deliberately retained for specific effects like improved storage stability. However, free formaldehyde, crucial for hardening reactions, can lead to formaldehyde emissions during pressing (Adhesives in wood, 2003). Advances in resin composition over the last two decades have effectively addressed the issue of subsequent formaldehyde emissions.

Once hardened, urea-formaldehyde (UF) resins form insoluble, three-dimensional networks and cannot be melted or thermoformed. In their application stage, UF resins are still soluble or dispersed in water or presented as spray-dried powders (Phenol/formaldehyde Resins, 2005), often redissolved and redispersed in water for application.

Despite urea and formaldehyde being the primary components, UF resins offer a broad array of possible reactions and structures. At the molecular level, key characteristics include high reactivity, water solubility, and dispersibility, making them ideal for the woodworking industry. The aminomethylene link's reversibility contributes to low resistance against water and moisture, particularly at higher temperatures, leading to subsequent formaldehyde emissions (Adhesives in wood, 2003).

The urea-formaldehyde reaction involves a two-step process: alkaline methylolation followed by acidic condensation. The methylolation step, typically performed at a high formaldehyde-to-urea molar ratio (F/U = 1.8 to 2.5), results in the formation of methylolureas. The subsequent acid condensation step, also at a high F/U molar ratio, transforms the methylolureas, urea, and residual free formaldehyde into linear and branched molecules, forming polydispersed UF resins with varying molar masses(Adhesives in wood, 2003)..

To adjust the low molar ratio of the final UF resin, a second urea, often added in multiple steps, is introduced during acid condensation. Care and expertise are required to produce high-performance resins, especially at the low molar ratios prevalent in the production of particleboard and MDF (Adhesives in wood, 2003)..

The bridges formed between urea molecules in the resin depend on reaction conditions. Methylene ether bridges (-CH2-O-CH2-) and more stable methylene bridges (-CH2-) are

formed in different proportions, with methylene ether bridges rearranging to methylene bridges with the release of formaldehyde. The type of bridges influences resin stability.

While various resin preparation procedures are described in the literature, the composition and manufacturing processes are often proprietary. The resins may contain different chemical species, including free formaldehyde, monomeric and oligomeric methylols, and molecules with higher molar masses (Adhesives in wood, 2003).

Efforts to limit subsequent formaldehyde emissions have led to a progressive decrease in the F/U molar ratio. The differences between high and low formaldehyde content UF resins lie in reactivity and the degree of crosslinking in the cured network. The choice between low and high F/U molar ratios depends on the specific application and process parameters, often determined through trial and error.

The content of free formaldehyde in UF resins is influenced by the F/U molar ratio, aging reactions, and further reactions of free formaldehyde. The balance between free formaldehyde and molar ratio is critical for resin performance and subsequent formaldehyde emissions. Table 4 summarizes the influences of the molar ratio on various wood-based panel properties, and Table 5 presents the F/U and F/(NH2)2 molar ratios for pure and melamine-fortified UF resins used in the wood-based panels industry (Phenol/formaldehyde Resins, 2005).

**Lowering molar ratio leads to**

- Diminished formaldehyde emission in the production of wood-based panels.
- Reduced subsequent formaldehyde emissions.
- Diminished mechanical properties.
- Diminished degree of hardening.

**Increased Molar ratio leads to**

- Increased thickness swelling and water absorption.
- Heightened susceptibility to hydrolysis.

**Different Molar Ratios**

- 1.55 to 1.85: Traditional plywood UF-resin, which sets at low temperatures; suitable only with specific hardeners and additives, such as melamine-containing adhesive blends for improved water resistance.

- 1.30 to 1.60: UF-plywood resin designed for interior boards with no specific water resistance requirements; to minimize subsequent formaldehyde emissions, the incorporation of formaldehyde catchers is essential.
- 1.20 to 1.30: Resin for plywood or furniture with a low formaldehyde content; even without the addition of catchers, it enables the production of products with minimal subsequent formaldehyde emissions.
- to 1.10: Resins for El-particleboard and El-MDF, particularly in MDF production where additional catchers may be required. If modified or fortified with melamine.
- Below 1.00: Special adhesive resins for boards with extremely low formaldehyde emissions; often modified or fortified with melamine (**Phenol/formaldehyde Resins,** 2005)..

## 2.3 Advantages of Urea Formaldehyde in Particle Board

- Hardness: Urea formaldehyde resin adds some serious toughness to particle boards, making them super durable and able to withstand wear and impacts.
- Low Flammability: One big plus is that the resin doesn't catch fire easily, which means particle boards made with it are safer in case of fire. That's a big deal for a lot of different uses.
- Good Thermal Properties: Urea formaldehyde resin provides particle boards with favorable thermal properties, ensuring stability and performance under different temperature conditions.
- Colorless Cured Polymer: The cured resin doesn't mess with the color of the particle boards, so they end up looking pretty neutral. That makes them a great choice for all sorts of applications where you want things to look clean and natural.
- Adaptability to Curing Conditions: This resin is pretty flexible—it can handle all sorts of curing conditions, which gives manufacturers a lot of freedom in how they make their particle boards.
- Cost-Effectiveness: And let's not forget about the cost. Using urea formaldehyde resin often saves money compared to other options, which is a big win for manufacturers looking to keep their production costs down.
- Excellent Adhesive Properties: This resin is seriously sticky stuff, which means it's great at bonding wood particles together. That's what gives particle boards their strength and stability.

- Versatility in Formulations: Urea formaldehyde resin formulations can be adjusted to meet specific requirements, offering manufacturers flexibility in tailoring particle board properties for diverse applications.

## 2.4 Disadvantages of Urea Formaldehyde

- Hydrolytic Degradation: One big issue is that when urea formaldehyde resin gets wet or meets some acids, it starts to break down. This weakens the resin and can make the particle board perform less effectively overall (Phenol/formaldehyde Resins, 2005).
- Formaldehyde Emission: Another concern is the release of formaldehyde fumes, especially when the resin is curing. Even though we've made strides to reduce these emissions, it's still something to watch out for because of potential health and environmental impacts (Phenol/formaldehyde Resins, 2005).
- Limited Water Resistance: Even though it starts out soluble in water, UF resin's vulnerability to breaking down when it gets wet means particle boards made with it aren't the best choice for places where they might get really wet.
- Aging Aesthetics: Over time, particle boards made with urea formaldehyde resin might change color, which can affect how they look and where they're suitable to use.
- Environmental Impact: he production and use of urea formaldehyde resin can have some environmental consequences, especially when it comes to formaldehyde emissions. We're working on finding alternatives that are gentler on the planet.
- Brittleness Over Time: he production and use of urea formaldehyde resin can have some environmental consequences, especially when it comes to formaldehyde emissions. We're working on finding alternatives that are gentler on the planet.
- Sensitivity to Processing Conditions: Making sure the resin cures just right can be a bit tricky. The process is sensitive to changes in temperature and humidity, so we've got to keep a close eye on things to get the particle boards to turn out the way we want them to.
- Limited UV Resistance: If particle boards made with urea formaldehyde resin are left out in the sun for too long, they might start to change color or even break down a bit because they're not great at resisting UV rays.
- Potential Formaldehyde Exposure: Even though we're working hard to reduce emissions, there's still a risk of being exposed to formaldehyde during the making and

using of these particle boards. That's why it's important to handle them carefully and make sure there's good ventilation.

- Challenges in Achieving High Density: Making really dense particle boards with urea formaldehyde resin can be tough. Sometimes, it's easier to use different resins if we need the boards to be super dense.

Understanding both the advantages and disadvantages of urea formaldehyde resin in particle board production is crucial for making well-informed decisions in the woodworking industry. Continual advancements in resin technology are actively addressing the challenges associated with UF resins, with the aim of enhancing performance and minimizing environmental impact (Phenol/formaldehyde Resins, 2005).

# CHAPTER 3

# 3 Market Analysis

## 3.1 SWOT Analysis

### 3.1.1 Strengths

- Abundant Raw Materials: Pakistan's got plenty of urea and formaldehyde, the key ingredients for making urea formaldehyde resin. With this steady supply, we can keep our production process running smoothly and consistently.
- Growing Woodworking Industry: The woodworking scene in Pakistan is really taking off, thanks to more construction projects and a higher demand for furniture. Setting up a Urea Formaldehyde plant fits right in with this growth, giving us a local source of the resin we need.
- Cost Efficiency and Competitiveness: Making our own urea formaldehyde resin in-house can save us some serious cash compared to importing it. This cost advantage makes our particle board manufacturing process more competitive overall.
- Local Market Demand: More and more people in Pakistan are looking for particle boards for all sorts of projects. Having our own urea formaldehyde plant means we can quickly respond to what customers want, without relying too much on suppliers from outside the country.
- Skilled Workforce: Pakistan's got a bunch of talented people in the chemical and woodworking fields. Bringing in local experts can help us run our plant smoothly and make sure everything's running like clockwork.
- Strategic Location: Being right in the heart of things gives us a leg up when it comes to reaching nearby markets. With easy access to other countries in the region, there's a big opportunity to grow and even export our particle boards made with locally sourced urea formaldehyde resin.
- Potential for Research and Development: Putting some effort into research and development can lead to some pretty cool resin formulas. This means we can make particle boards that perform even better, keeping up with what customers want and meeting all the rules and regulations.

- Government Support: The government's got our back when it comes to boosting the manufacturing sector, including woodworking. With their support and incentives, setting up and running a Urea Formaldehyde plant becomes even more doable.

### 3.1.2 Weaknesses

- Environmental Concerns: Producing urea formaldehyde resin can lead to formaldehyde emissions, which raise environmental worries. To address this, we need to stick to strict environmental rules and adopt sustainable practices to minimize our impact.
- Technological Challenges: Setting up and running a urea formaldehyde plant requires some pretty fancy tech. We might hit a few bumps along the way as we figure things out, but with the right approach, we can overcome these challenges and get our production process running smoothly.
- Dependence on Wood Supply: Wood is a big part of what we do, so making sure we have a steady and sustainable supply is key. Keeping our wood chain strong and stable ensures we can keep making particle boards without any hiccups.
- Market Sensitivity to Economic Fluctuations: The demand for particle boards can change with the economy. When things get shaky or people start spending differently, it can affect how much we're making and how profitable we are.
- Energy Consumption: Producing urea formaldehyde resin can use up a lot of energy. Finding the right balance between being efficient with our energy use and keeping our production costs in check is a challenge we're working on tackling for the long haul.
- Limited Product Diversification: Relying solely on urea formaldehyde resin can put a cap on the kinds of products we can make. Looking into other resin options or product lines can help us expand our offerings and stay competitive in the market.
- Supply Chain Vulnerability: Putting all our eggs in one supplier's basket for key materials can be risky. Diversifying our suppliers or teaming up strategically with others can help us avoid any supply chain snags down the road.

### 3.1.3 Opportunities

Export Growth: Setting up an efficient urea formaldehyde plant opens up doors to the global market. This means we can start thinking about selling our particle boards internationally, which could lead to some serious growth in exports (future market insights).

Research and Development Investment: Investing in research and development lets us get creative with our resin formulas. By coming up with new and improved recipes, we can make particle boards that perform even better and meet all the latest standards (Mordor Intelligence).

Strategic Partnerships: Teaming up with other companies—both locally and internationally—can really boost what we're capable of. Whether it's sharing tech, reaching new markets, or just learning from each other, partnerships can take us to new heights.

Sustainable Practices: Going green isn't just good for the planet—it's good for business too. By adopting eco-friendly practices in our resin production, we can attract customers who care about the environment and even earn certifications that make us stand out from the competition. (future market insights).

Customization for Niche Markets: Sometimes, one size doesn't fit all. By tweaking our resin formulas to suit specific markets or uses, we can create products that really speak to our customers' needs and expand our customer base in the process.

Government Incentives: The government's got our back when it comes to going green and selling abroad. By taking advantage of incentives and subsidies, we can boost our bottom line and stay competitive in the market.

Integration with Wood Processing Industry: Bringing our Urea Formaldehyde plant into the fold with existing wood processing facilities makes a lot of sense. It helps us work smarter, not harder, and streamlines things all the way from production to delivery.

Evolving Consumer Trends: Keeping our finger on the pulse of what customers want is crucial. As preferences change—like the growing demand for eco-friendly products—we can adapt our production to match, keeping us ahead of the curve.

### 3.1.4 Threats

Regulatory Changes: When the rules around formaldehyde emissions shift, it can throw a wrench in our operations. Keeping up with these changes and making sure we're on the right side of the law is key to keeping our business running smoothly.

Competition from Alternatives: There are always new kids on the block, and alternative resin technologies are no exception. If they start stealing our spotlight with lower emissions, we've got to roll up our sleeves, get creative, and show why urea formaldehyde resin is still the best choice.

Economic Instability: When the economy gets shaky or raw material prices start bouncing around, it can throw our production costs and profits for a loop. Having some solid risk management strategies in place helps us weather the storm and keep moving forward.

Global Market Dynamics: What's happening across the globe can have a big impact on our business. Changes in demand, supply, or prices of raw materials can all affect us, so staying flexible and keeping an eye on the big picture is crucial.

Public Perception and Health Concerns: If folks start worrying about formaldehyde emissions and how they might affect their health, it can put a dent in our sales. We've got to be proactive about addressing these concerns and building trust with our customers.

Natural Calamities: When disaster strikes, it can throw a wrench in our plans big time. Having solid backup plans in place helps us bounce back quickly and keep things running as smoothly as possible, even when Mother Nature isn't cooperating.

Technology Obsolescence: Tech moves fast, and if we're not careful, we can get left in the dust. Regularly investing in upgrading our technology helps us stay ahead of the curve and stay competitive in the market.

Exchange Rate Fluctuations: When exchange rates start bouncing around, it can mess with the cost of bringing in machinery and raw materials from abroad. Having some savvy financial strategies in place helps us keep our costs in check, no matter what the currency market throws our way.

This thorough SWOT analysis gives us a deep dive into our internal strengths and weaknesses, as well as the external opportunities and threats we face in setting up a Urea Formaldehyde plant for particle board production in Pakistan. To succeed in this ever-changing industry, we need strategic planning, ongoing monitoring, and the ability to adapt to whatever comes our way (future market insight).

### 3.2 Porter Five Forces Analysis

Porter's Five Forces Analysis for Urea Formaldehyde Plant

1.0 Threat of New Entrants:

The potential for new entrants to the industry is relatively low due to significant barriers to entry. Establishing a Urea Formaldehyde plant demands substantial initial investment, technological access, and adherence to stringent environmental regulations. Established

players benefit from economies of scale, presenting challenges for new entrants to compete effectively. Further in Hattar its difficult for anyone to setup this plant.

2.0 Bargaining Power of Suppliers:

Suppliers of key raw materials such as urea and formaldehyde wield moderate bargaining power. While these materials are indispensable, multiple suppliers exist in the market. However, supplier negotiation leverage may increase in the event of limited supplier options or significant raw material cost fluctuations.

3.0 Bargaining Power of Buyers:

Buyers, encompassing particle board manufacturers and end-users, possess moderate bargaining power. Despite the presence of numerous buyers, they retain influence over pricing and quality standards. Nevertheless, the standardized nature of urea formaldehyde resin may constrain the extent of buyer bargaining power.

4.0 Threat of Substitutes:

The likelihood of substitutes displacing urea formaldehyde resin in particle board production is relatively low owing to its distinctive properties and contributions to the final product. Nonetheless, the emergence of alternative resin technologies boasting reduced formaldehyde emissions could pose a moderate threat. The industry's capacity for innovation and adaptation will determine the magnitude of this threat.

5.0 Intensity of Competitive Rivalry:

Competitive rivalry within the urea formaldehyde resin and particle board manufacturing sector is high. Multiple entities vie for market share, complicating differentiation efforts and intensifying price competition. The industry's maturity and the prevalence of established incumbents contribute to the elevated level of competitive intensity.

**Additional Factors:**

1.0 Regulatory Environment: The regulatory landscape holds significant sway, particularly concerning environmental standards and formaldehyde emissions. Compliance with these regulations is non-negotiable, and any shifts in these standards can have profound effects on operations and market reception.

2.0 Technological Advancements: The rate of technological progress in resin production and woodworking technologies can heavily influence competitiveness. Ongoing investment in research and development is essential to maintain a leading edge and retain technological superiority.

3.0 Global Economic Factors: Global economic conditions, encompassing raw material prices, exchange rates, and international demand for particle boards, exert notable influence on the industry. Economic instability or fluctuations may impact costs and profitability.

In conclusion, establishing a Urea Formaldehyde plant for Particle Board in Pakistan is set against a backdrop of formidable industry challenges and competition. Strategic management must prioritize innovation, regulatory compliance, and efficient cost control to effectively navigate these dynamics (future market insight). Continuous vigilance and adaptability to market shifts are paramount for achieving enduring success in this sector.

## 3.3 PESTEL Analysis

### 3.3.1 Political Factors

- Regulatory Compliance:

  Making sure we stick to all the environmental rules and standards set by the government is super important. That means we've got to watch our emissions, handle waste properly, and keep our workplaces safe. If the government changes the rules, it could mean we have to change how we do things too.

- Government Stability:

  Having a stable political scene and consistent leadership is a big deal for us. If things get shaky in the political arena, it can create a lot of uncertainty for our business. Planning for the long term and making investments becomes a lot trickier when politics are up in the air.

- Government Incentives:

  Sometimes, the government offers perks like subsidies or incentives to businesses that are doing good things for the environment or focusing on research and development. Taking advantage of these incentives can really give us a leg up in the industry.

### 3.3.2 Economic Factors

- Currency Exchange Rates:

  Changes in how much our money is worth compared to other countries' currencies can have a big impact on our costs. Keeping an eye on these fluctuations and having strategies in place to deal with them, like hedging, is crucial for us.

- Economic Growth:

  When the economy is doing well and people have more money to spend, it usually means good news for us. A growing economy means more demand for particle boards, which is great for our business (future market insight).

- Raw Material Costs:

  The cost of getting our hands on stuff like urea and formaldehyde, which are key ingredients for us, can really affect our bottom line. Keeping tabs on these costs and finding ways to manage them is essential for keeping our profits up.

### 3.3.3 Social Factors

- Consumer Trends:

  Keeping up with the latest social trends and understanding what consumers want, like being more environmentally conscious, can really drive up the demand for eco-friendly products. It's crucial for us to stay in tune with these trends to make sure our products are well-received in the market.

- Workforce Demographics:

  Having skilled workers who know their stuff in the chemical and woodworking industries is a big deal for us. Making sure we've got a motivated team with the right skills keeps our plant running smoothly and efficiently.

- Health and Safety Awareness:

  More and more people are becoming aware of health and safety issues, both for themselves and for the folks making the products they use. It's important for us to have practices in place that keep everyone safe and healthy on the job.

### 3.3.4 Technological Factors

- Research and Development:

  Investing in research and development is key for us to keep improving our resin formulations, making our production processes better, and staying ahead of the curve in our industry.

- Automation and Process Efficiency:

  Using the latest technology to automate tasks and make our manufacturing processes more efficient can really help us out. It not only improves how well our plant runs but also helps us cut down on production costs (future market insight).

- Data Security and IT Infrastructure:

  With so much of our operations relying on IT systems, keeping our data safe and our systems running smoothly is crucial. We've got to have strong cybersecurity measures in place to protect sensitive information and keep everything running smoothly without any hiccups.

### 3.3.5 Environmental Factors

- Sustainability Practices:

  More and more people are caring about sustainability, so adopting eco-friendly production practices can really boost our plant's reputation (future market insight). It's important for us to be seen as responsible stewards of the environment.

- Waste Management:

  Properly managing our waste, like making sure we dispose of it in ways that are good for the environment and recycling whenever possible, is really important. We've got to stick to environmental standards to make sure we're not leaving a big ecological footprint behind.

### 3.3.6 Legal Factors

- Environmental Regulations:

  Making sure we follow all the environmental laws and regulations, especially when it comes to stuff like formaldehyde emissions, is really important. If the rules change, it could mean we have to change how we do things too.

- Labor Laws:

  We've got to stick to all the labor laws and regulations, including things like how many hours folks can work, how much they get paid, and making sure our workplaces are safe. Breaking these laws can get us into big trouble and damage our reputation.

This thorough PESTEL analysis takes into account political, economic, social, technological, environmental, and legal factors that could affect setting up and running a Urea Formaldehyde

plant for Particle Board in Pakistan. Planning ahead and taking action to deal with these external factors are key for making sure we do well in this industry in the long run.

### 3.4 Competitor Analysis

To comprehensively understand how our business is impacted by market dynamics and to gain insights into the strategies adopted by our competitors, we conduct an in-depth analysis of the industry landscape. This allows us to make well-informed predictions about how the market will respond to our initiatives.

In the landscape of urea formaldehyde manufacturing in Pakistan, it's notable that Hattar Industrial Estate, located in Khyber Pakhtunkhwa (KPK), currently lacks a significant presence in this industry. The closest competitors, such as Wah Nobel in Wah Cantt and Dynea in Gadoon, are relatively distant. Other notable competitors are primarily situated in more central regions, notably Lahore and Faisalabad.

The geographical gap between Hattar and the existing manufacturing hubs presents a unique advantage, particularly concerning transportation costs. With a nominal transportation cost of around 4 to 5 PKR per kilogram, our location in Hattar allows us to potentially capitalize on a reduced cost structure compared to competitors situated farther away from key industrial clusters.

This geographic advantage not only provides logistical benefits but also creates opportunities for cost competitiveness. By strategically positioning ourselves in Hattar, we can leverage our proximity to key markets, potentially gaining a competitive edge by offering cost-effective solutions to our customers. Additionally, the local context in Hattar may offer unique advantages in terms of local workforce expertise and resource availability, further enhancing the overall feasibility of establishing a urea formaldehyde plant in this region.

### 3.5 Human Resource

Human Resource Planning guarantees the availability of vital resources for a company's future endeavors. Establishing a framework that consistently aligns the company's overarching strategy with its human resources is crucial to maintaining seamless business operations. The reality is that a well-crafted HR system is pivotal for a company's growth and prosperity, and the lack thereof can lead to detrimental outcomes. Hence, HR stands as an indispensable element for the success of any company.

Plant Manager and Chemical Engineer: This person will be responsible for all the operation being executed on plant and to manage the work force.

Production Team: Approximately three person will work with the manager to obey his commands and carry on the chemical process.

Maintenance Team: This includes mechanical and electrical team. As they are already working in the plant so no separate team is needed for this.

Supply chain and logistics: This includes procurement officer, supply chain manager. These officers are already working for other departments so this additional department can be added to their task.

Lab and testing: Chemical Engineer can perform required test so no need to hire a separate lab staff.

Cleaning: One person will be hired for the cleaning of plant.

**Wages**

**Table 3. 1 HR Wages**

| Position | Wage |
|---|---|
| Chemical Engineer | 100000 |
| Production staff | 45000 |
| Production staff | 35000 |
| Production staff | 35000 |
| Cleaning | 32000 |

## 3.6 Potential Customers

In the current landscape of products similar to ours, there are five active factories. What's interesting is that all of these factories heavily depend on urea formaldehyde as a crucial raw material for their processes. Surprisingly, none of them have their own urea formaldehyde plants; instead, they opt to purchase this essential component from external sources. This situation creates a strategic opening for us to approach these factories as potential customers.

The significant advantage we bring to the table is a cost-effective transportation setup, with costs amounting to 4/5 PKR per kilogram. This cost efficiency positions us favorably to provide urea formaldehyde to these factories at a more competitive rate.

To narrow down our focus, here's a detailed list of industries that have been identified as potential customers in light of this opportune situation:

- Islamabad Board
- Rehmat Board
- Haidery Ply
- Al Qaim Ply
- AA ply

By capitalizing on this opportunity, we aim to establish meaningful partnerships with these factories, offering them a reliable source of urea formaldehyde while leveraging our cost advantages for mutual benefit.

# CHAPTER 4

# 4 Financial Analysis

One of the most important steps now is to do some MATH works to convince the management by showing them the expenditure, saving and return on investment.

## 4.1 Expenditure:

1. **Land:**

**Requirement**

- Around an area of 2/3 canal is required to setup urea formaldehyde plant.
- Plant should be near to water bore.
- Plant should be near to glue storage tanks as this will help to reduce transportation cost.
- Sewage Line should be near to dispose of the water or other chemicals

**Solution**

We have the required area available with in the factory premises near chipboard manufacturing unit. That area satisfies all the requirements. It has near by water bore, sewage line just outside wall and most importantly near the glue storage tanks which means glue can be easily transferred through pipes. Only one issue is that it is nearest to main road so while urea formaldehyde processing gases can affect the people passing outside.

Therefore, there will be no expense for land. Which is a very positive point.

2. **Glue Reactor:**

Glue reactor is main equipment required for the processing of urea formaldehyde. There are various sizes in which it is available depending on the requirement. According to daily chipboard production 10 TON reactor or 20 TON reactor suits the most. In 10 Ton reactor two batches can be produced to meet the requirements where as for 20 Ton reactor one batch is enough. But in future considering the current political situation if production is reduced than 10 Ton batch would be enough per day. So, producing 10 Ton batch would be expensive in 20 Ton capacity as it is designed according to it.

**Table 4. 1 Glue Reactor and Price**

| Reactor | Price |
|---|---|
| 10 TON | 11500000 |
| 20 TON | 15500000 |

Above table shows the prices for reactor taken from local manufacturer in Faisalabad. There are second hand plants available but not in good condition. They require a lot of maintenance and are out dated according to technology.

Huge price difference can be seen between 10 Ton and 20 Ton reactor. As our requirement can be satisfied with 10 ton so no need for extra expense. Even in future our demand for urea formaldehyde increases we can increase the manufacturing by increasing the number of batch produce. As approximately according to research a batch can be produced in 4 hours so easily 4/5 batch can be produced per day.

Therefore, 10 TON reactor is suggested and taken into expenditure account.

**Figure 4.1 Glue Reactor**

**Platform**

Glue reactor is of cylindrical shape as shown below. This has to be held vertically in air. So, proper platform will be required to hold the reactor in air and further an area at top for engineer and staff to carry on the reaction.

**Figure 4.2 Platform**

Above picture shows the reactor and platform around it holding the reactor and giving the walking space at top to supervise and carry on the reaction.

For building platform there are two options:

Concrete platform:

- Time consuming
- Expensive
- Fixed area
- Solid work

Iron Platform:

- Less time consuming
- Expensive but later on iron can be sold at a higher rate
- Platform can be dismantled in future

Iron platform therefore is more viable option and little bit cheaper compared to concrete platform.

**Table 4. 2 Platform Material and Rate**

| Item | Weight | Rate | Amount |
|---|---|---|---|
| 16'' and 8" 10 ft pipe | 5000kg | 250 | 1250000 |
| Plate 6mm | 1620 kg | 245 | 396900 |
| 26" * 4ft 2 plates 20mm | 250 kg | 260 | 65000 |
| 10 channel | 407.5kg | 250 | 101875 |
| ETC | | | 186225 |

Above table shows the estimated material required to build platform. It's an estimate by our engineer. Amount of material can vary. Rates of items are taken from Lahore market as Haidery Boards is already purchasing items from there

Approximately two million will be required to build a platform. Once we have the material our engineers can work on it and assemble it with in one month.

**Steel Tanks**

One raw material for urea formaldehyde manufacturing is Formaline. It is in liquid form and it is required to be stored. So, for its storage steel tank is the best option. At start one tank is required but with passage of time extra tank will make work more efficient.

Ordering a new tank and building it from scrap would be expensive so for tank it would be better to purchase a used oil tanker as we just need it to store Formaline.

Faisalabad is main hub for tanks so price quotations are taken from there. For tankers in good condition demand is around 2.5 million pkr. But it's a type of investment, it can be sold any time at a higher rate.


**Figure 4.3 Steel Tank**

By reaching out to tank dealers in Faisalabad we get rate of approximately 2.5 million pkr.

**Oil heater:**

Chemical reaction will take place in reactor for which a specific temperature is required. For this purpose, oil heater will be needed which will heat the oil and that oil will move through pipes to coils in reactor and will heat the reactor as much required.

Instead of buying or ordering a new one, many good options for used oil heater are available. S per our requirement we have ¾ options available with an average price as calculated below.

3000 kg @ 300 = 900000pkr.

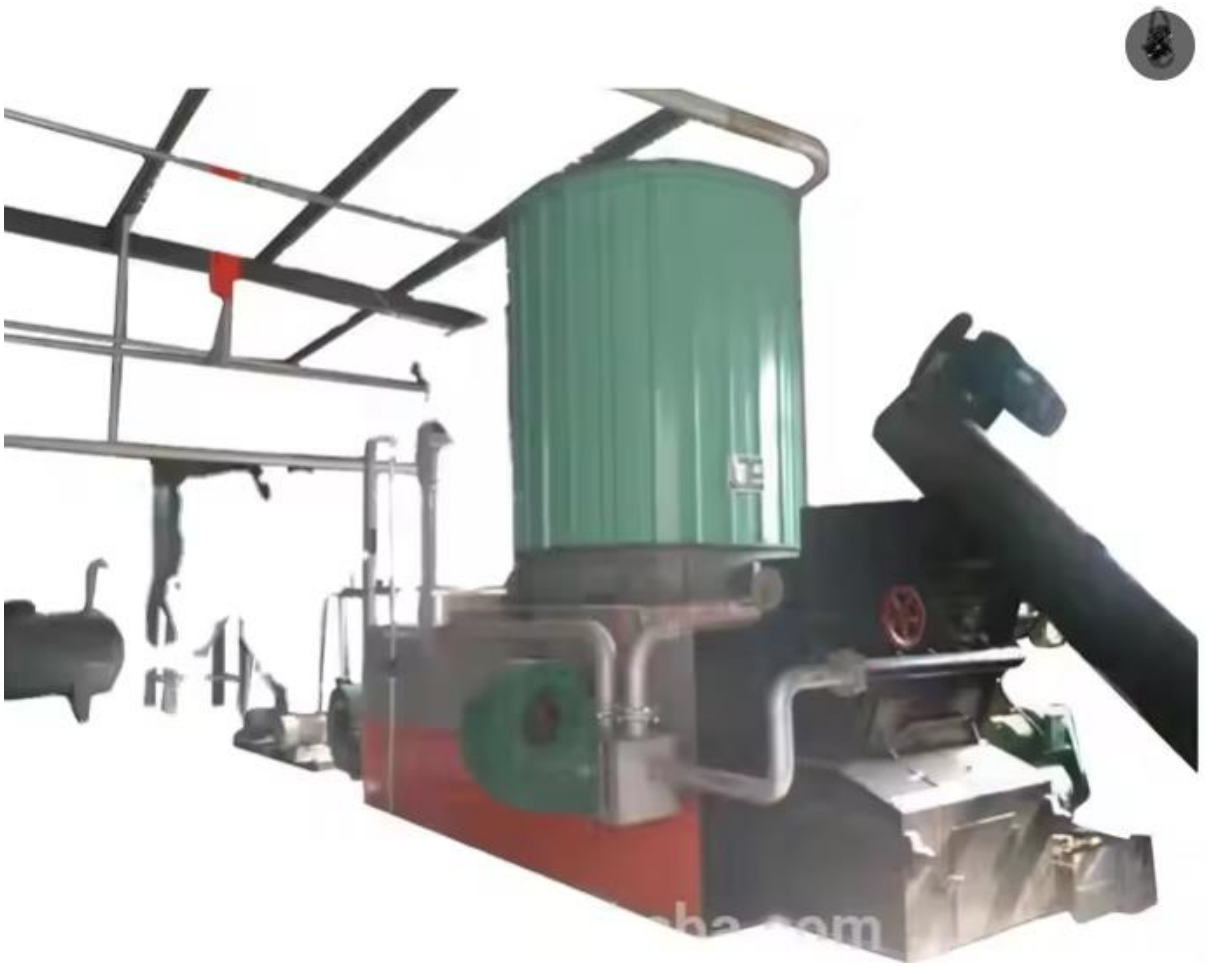

**Figure 4.4 Oil Heater**

Above picture shows the oil heater. Further there are two expenses related to it. First is that heat is transferred through oil so at least 2 drums of heat transfer oil will be purchased.

Each liter cost around 600pkr and each drum contains 210 liter. So, it will cost around 250000pkr.

Next expense related to it is of pipes which are used to transfer oil from oil heater to coils of reactor. These pipes help to maintain the required temperature. As, its just a proposal so exact required distances are not known. Therefore, estimates are done. Two pipelines will be attached to the oil heater. One will flow the oil to reactor and other to the tank storing Formaline as in winters below 25 Celsius can form para formaldehyde which will make the Formaline useless.

8” dia pipe will be required for flow of oil. Around 40 lengths of 6 ft pipe will be required making a weight of around 300kg. Estimated expenditure for pipes will be 62500pkr.

### Generator

Once the reaction has started the process can't be stopped. The procedure will require constant heat and constant mixing so that proper reaction can take place. If in between mixing stops it can cause batch to be gel and destroyed. This will be a huge loss as ten-ton batch is approximately of 1 million pkr. Further, it can cause the reactor to damage as the solution inside will get hard which will be impossible to flow out through pipes. Therefore, generator is required for backup which can carry on the process in case of electric loadshedding.

### Storage Tanks

Once the glue is manufactured. Next step is to store it to free the reactor for next reaction. As Location suggested is just near the glue storage tanks used for chipboard. So, once the glue is produced it can be simply transferred from a 2 ft dia pipe to the tanks. Hence, no cost for building new underground storage tanks.

### Electric motors and pumps

**Table 4. 3 Electrical Items**

| Motor/Pump | Power |
|---|---|
| Formaline Pump | 15KW |
| Water Pump | 7KW |
| Oil Pump | 15KW |
| Lefti pump | 3KW |
| Cables | |

Table above mentions the required motors and pumps to run the plant. These are not much heavy and does not consume much electricity. These motors and pumps will cost around 7.5 lacs as quotation is taken from Lahore market.

## 4.0 Initial Investment

**Table 4. 4 Initial Investment**

| Item | Amount |
|---|---|
| Land | None |
| Reactor | 11500000 |
| Platform | 2000000 |
| Steel Tank | 2500000 |
| Oil Heater+ oil+ pipe | 1300000 |
| Generator | 700000 |
| Motor +Pumps | 750000 |
| Storage Tank | None |
| ETC | 2000000 |
| **Total** | **20662500** |

Amount of PKR 20750000 is required initially in the starting phase for procurement of materials. It will not be required at the same time. For example, for reactor 50% payment will be done in advance, rest after delivery. Similarly, for pipes oil heater payment will be in portions. Whereas for steel tank and motors cash payment would be required. So, this amount will be utilized in 2/3 months.

## 4.3 TimeLine

Week 1: Finalizing the reactor design and specifications as per requirements after consulting engineer.

Bargaining for the price

Signing of the contract

Week 2: 45 days' time is required to manufacture customized reactor. It is approximately duration of 7 weeks.

Week 2 – Week 9: Mean while waiting for the reactor to manufacture. Other tasks can be done in parallel. Which includes purchasing of steel tank, pipes motors, material for building platform, generator etc

Week 10: Buffer week. Spare week if there is delay in reactor or any other material.

Week 11- Week 15: Once reactor is received, platform erection will start. It will approximately take3-4 weeks. In between steel tank and oil heater will be placed at its place. Other small works will be carried out.

Week 16- Week 17: After everything is placed at its place. Next step will be the connection of pipes from oil heater to reactor and tank. At same time electrical connection will be completed.

Week 18: Buffer Week

Week 19- Week 20: Trial of the reactor such as pipe connections, electrical connections. Further reactor performance. Everything will be finalized in this time period.

Above time line shows that it will take approximately 20 weeks (5months) for the completion of project. After 5 months project will be inn running phase.

### 4.4 Raw Material Purchase

As discussed earlier there are 5 main raw materials for production of urea formaldehyde as listed below:

- Formaline
- Urea
- Sea Salt
- Acid

➢ Formaline:

There are two main Formaline suppliers near us:

- Wah Nobel
- Dynea

Haidery Boards is already purchasing glue from these two suppliers so purchasing Formaline is not an issue.

➢ Urea:

There are many fertilizers companies such as Fauji fertilizer, Engro manufacturing Urea but it cannot be directly purchased from them. So, nearest 4 to 5 dealers are suggested by companies and a word have been done with them. At the time of need best price giver will be opted.

- Sea Salt:

Salt is available in KPK and Punjab but its not pure sea salt which will affect the quality. So, it will be purchased from Karachi. There are many suppliers and 2-3 of them have been identified who have a good reputation in market.

- Acetic Acid and Castic Soda:

Acid and Soda will be required in very small quantity per batch. So, it can be purchased from local Pindi or Lahore market.

Availability of raw materials is therefore not an issue. To be on safe side for every raw material order must be placed most late with a week stock left in hand.

## 4.5 Raw material Cost

All costing is done on current market rates as economy is unstable so rates might be very different at time of urea formaldehyde production.

- Urea: Sona urea a product of Fauji fertilizer is the best option available due to its quality. Its cost around 5000 pkr for 50kg bag.
- Formaline: Both suppliers almost have the same rates. Both give a quotation of 100 rs/kg for 41%.
- Sea Salt: In Karachi salt costs around 4rs/kg but freight is too high so it will cost around 14rs/kg delivered at our door.
- Acid: It costs around 500rs/kg.

**Table 4. 5 Cost of Raw Material**

| Product | Cost (PKR) |
|---|---|
| **Urea** | **5000 per 50 kg bag** |
| **Formaline** | **100 per kg** |
| **Sea Salt** | **14 per kg** |
| **Acid** | **500 per kg** |
| **Castic Soda** | **150 per kg** |

## 4.6 Batch Cost

There is defined formula as discussed in literature review for production of formaldehyde. Therefore, costing can be estimated beforehand.

As reactor suggested is of 10 Ton so costing is carried out with respect to a 10 Ton batch.

In literature reviews its discussed that for board Formaline to urea ratio will be 1.50. This can be adjusted as per board requirement.

After discussion with chemical engineer following quantity were suggested to make a 10 Ton batch.

**Table 4. 6 Quantity of Raw Material**

| Product | Quantity(kg) |
|---|---|
| **Formaline** | **5500** |
| **Urea** | **3000 = 60 bags** |
| **Sea Salt** | **750** |
| **Acid** | **0.7** |
| **Castic Soda** | **7** |
| **Water** | **800** |

Above table shows an addition of raw material, Water. It is added to adjust the solid content as per requirement mostly its 50%. Addition of water reduces the cost further as its free of cost.

Further labor cost is discussed in HR section, It's approximately 250,000pkr. One batch will take around 4-5 hours so daily 2 batch can be produced. So labor cost can be estimated as 1pkr/kg.

Another expense is the electric cost. As motors and pumps are not much heavy so after consultation with electrical head it was approximated .50pkr/kg.

Overhead cost is approximated as 1pkr/kg. It's an extra cost being considered to be on safe side.

**Table 4. 7 Cost of Batch**

| Product | Cost (PKR) |
|---|---|
| **Urea** | **300000** |
| **Formaline** | **550000** |
| **Sea Salt** | **10500** |
| **Acid** | **350** |
| **Soda** | **90** |
| **Water** | **-** |
| **Labor** | **1** |
| **Electric** | **.5** |
| **Overhead** | **1** |
| **Total for batch (10 Ton)** | **860942.5** |

Above table shows us individual cost of each raw material and at last total cost for manufacturing a 10 Ton batch.

Price /kg = 860942.5/10000

**Price /kg = 86.1pkr/kg**

**Comparison**

Currently we are purchasing urea formaldehyde at a rate of 94pkr/kg. Above calculation shows us that it if we manufacture our own it will cost around 86pkr/kr. So, **per kg 8pkr** can be saved.

## 4.7 Return on Investment

As discussed, earlier glue is our main raw material in all departments especially chipboard.

Below table summarizes the glue consumption in all products being manufactured and monthly production of each product.

**Table 4. 8 Glue Consumption**

| Product | Glue consumption (kg/sheet) |
|---|---|
| Chip Board | 6 |
| Vin Board | 0.5 |
| Lamination | 0.5 |
| Shuttering Ply | 5 |

**Table 4. 9 Monthly Consumption**

| Product | Monthly Production | Glue Consumption(kg) |
|---|---|---|
| Chip Board | 50000 | 300000 |
| Vin Board | 15000 | 7500 |
| Lamination | 10000 | 5000 |
| Shuttering Ply | 3000 | 15000 |

Above table shows average monthly production of each product and with help of its monthly glue consumption is calculated in above table.

Monthly consumption of all products all together: 300000+7500+5000+15000

= **327500kg**

## 4.8 Cost saving

Currently we are purchasing glue from 3/4 suppliers at an average rate of 94pkr. Above calculation shows that glue manufacturing will cost around 86pkr. Approximately 8pkr will be saved per kg. To be on safe side we consider it 6pkr.

**On monthly basis 1965000pkr approx. 2 million can be saved if we go with the same production.**

With the average monthly production considered approx. 2 million per month can be saved.

Currently we are not considering selling it to nearby industries in which approximately 3-4rs can be earned per kg even by selling it at a lower price.

Investment = 20662500pkr

Per month save = 2000000pkr

Investment will be recovered in = 20662500/2000000 = 10.3 month

Above calculation shows that if we go with the same production and everything our investment will be returned in approximately 11 months. After that it will be the profit. But it depends upon production. If production will decrease, ROI time will increase.

Further, if we sell the glue to other factories in Hattar, we can earn 3/4rs per kg as we have advantage of transportation cost.

# Chapter 5

## 5 Conclusion

Considering current situation of Pakistan if a business wants to survive it will have to reduce its manufacturing costs as much as possible. One of way to reduce cost is vertical integration which is suggested in this report. This method will help to survive in competitive market.

Haidery Boards is purchasing it's one of main raw material urea formaldehyde from outside suppliers. The almost keep 4/5 rs per kg. So, erection of urea formaldehyde plant will reduce the production cost a lot as discussed in the report.

For production of urea formaldehyde, a separate HR team will be hired led y the chemical engineer. But its important to know the process of manufacturing so that basic knowledge is there. For that literature review is done in which detailed procedure is discussed with advantages and disadvantages. Further different molar ratios are discussed which can vary according to formula effecting the cost, quality and environmental aspects.

Marketing analysis for the urea formaldehyde production is also done in detail. Different techniques such as SWOT analysis, PESTEL analysis, Competitor analysis have been done to get an idea of market. Further potential customers are identified which can be targeted in future. We have an edge of transportation cost which can be very positive aspect in future

Initial Investment for the project will be required. Almost 60% at start and rest payment with in 3-4 months. Total time frame for project is 5 months if any unusual circumstances are not faced. Week wise time allocation is discussed above in the report.

Costing is another important aspect which is discussed in detail in section 4. Each possible expenditure is taken into consideration. For each expenditure 3-4 different markets were surveyed to get the best possible price. To be on safe side higher prices are quoted to calculate return on investment. Once initial investment is estimated than cost for production is calculated on rough basis. Cost of raw materials are considered as current market rate which can be varied till the time of production.

Most importantly Return on investment is calculated which is the biggest factor which can motivate top management to invest and enjoy the returns.

Overall, this project has provided a roadmap for erection of Urea Formaldehyde plant in Haidery Boards which can make a significant effect on board costing.

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