

## CAPACITY AND PRODUCTION PLANNING OF VERITAS WATER COMPANY/ FACTORY IN ABUJA

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**Abstract:** Capacity planning and production management are vital administrative functions within manufacturing industries, especially in sectors responsible for producing essential consumer goods such as bottled and sachet water. In developing nations like Nigeria, the demand for packaged drinking water has risen considerably due to population increase, accelerated urbanization, and the inadequacy of government-provided water supply systems. This research examines the capacity and production planning practices of the Veritas Water Company, a water production enterprise affiliated with Veritas University in Abuja. The study specifically investigates the operational framework of the factory, workforce size, production procedures, demand levels for water products, managerial perspectives on production activities, and the major constraints affecting productivity. The study employed a qualitative case study design. Information was gathered through observation of factory production activities and the examination of secondary materials such as academic publications, institutional documents, and literature on manufacturing and production management. Findings indicate that the Veritas Water Factory operates as a university-based enterprise aimed at providing safe and reliable drinking water to students, staff, and nearby communities in Abuja. The factory employs a moderate workforce responsible for various operational roles including production, packaging, quality assurance, distribution, and administrative coordination. Despite its operational structure, the study identifies several challenges affecting the factory's efficiency and capacity utilization. These challenges include unstable electricity supply, rising costs of production inputs, competition from other packaged water brands, distribution limitations, and equipment maintenance issues. Nevertheless, the growing demand for packaged drinking water in Abuja creates opportunities for business expansion. The study concludes that strengthening production planning mechanisms, upgrading production equipment, improving staff capacity, and expanding distribution networks are crucial for enhancing the efficiency and sustainability of the Veritas Water Factory.

**Keywords:** Capacity Planning, Production Planning, Manufacturing Operations, Institutional Enterprise, Workforce Structure, Operational Efficiency; Water Production Industry.

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## Introduction

Access to clean and safe drinking water remains an essential requirement for human survival and an important factor in maintaining public health. In many developing countries, including Nigeria, the inability of public water supply systems to meet the needs of the population has led to heavy reliance on privately produced bottled and sachet water. The rapid expansion of the packaged water industry reflects both the growing demand from consumers and the inability of public water infrastructure to adequately supply expanding urban populations (World Health Organization & UNICEF, 2021).

Over the last thirty years, Nigeria's bottled and sachet water sector has experienced remarkable growth. Today, the industry represents one of the most dynamic segments of the country's small and medium-scale manufacturing sector. According to Francis & Isioma (2022), several factors have contributed to the expansion of the water production industry, including increasing urbanization, heightened awareness of waterborne diseases, and the declining reliability of municipal water supply systems.

Manufacturing organizations require effective production planning systems in order to achieve optimal performance and productivity. Production planning refers to the process of deciding what goods should be produced, the quantities required, and the timeframe within which production should occur in order to meet market demand. Capacity planning complements this process by determining the maximum level of output that an organization can produce with its available resources (Heizer et al., 2001). In the water production industry, capacity planning involves coordinating multiple operational processes such as water extraction, filtration, purification, sterilization, packaging, and distribution. These processes require specialized equipment and skilled personnel in order to maintain product quality and comply with regulatory standards.

According to Slack, Brandon-Jones, and Burgess (2010), effective production planning enables manufacturing firms to maximize resource utilization, minimize operational costs, and improve overall efficiency. Conversely, poor planning may result in delays in production, inefficient use of resources, and reduced

organizational performance. Manufacturing enterprises in Nigeria face numerous structural challenges that hinder productivity. These challenges include inadequate infrastructure, unreliable electricity supply, limited access to financing, and inefficient industrial logistics systems (Akinwale, 2021). Such difficulties are particularly severe for small-scale manufacturing enterprises that lack the financial capacity to invest in advanced production technologies.

In recent years, universities in Nigeria have increasingly embraced entrepreneurial initiatives as part of strategies to generate internally generated revenue and create practical learning opportunities for students. These initiatives include the establishment of agricultural farms, printing presses, consultancy services, and water production plants.

Veritas University Abuja established the Veritas Water Factory as part of its institutional enterprise development strategy. The factory produces packaged drinking water intended to serve the needs of students, staff members, and nearby communities within the Federal Capital Territory. In addition to generating revenue for the university, the enterprise also contributes to improving access to safe drinking water within the campus environment.

The creation of university-owned enterprises reflects a broader trend in higher education administration where institutions diversify their revenue sources through commercial activities (Oyinola, et al 2024). However, the sustainability and success of such enterprises largely depend on their ability to operate efficiently and remain competitive within their respective industries.

Ayogu and Shimawua (2025) argue that the efficiency of an organization is strongly influenced by leadership coordination, administrative systems, and effective resource management. Similarly, T. P. Pillah et al. (2025) argues that many institutional enterprises within Nigerian universities experience inefficiencies due to inadequate monitoring of operational resources and insufficient evaluation of production systems. Such limitations can lead to underutilization of installed production capacity, delayed maintenance of equipment, and ineffective workforce deployment. Applying this perspective to the Veritas Water Factory, regular verification of production resources including filtration equipment, packaging machines, storage facilities, and staff competencies would significantly improve operational planning. Resource verification also supports accurate production forecasting because it allows management to determine the realistic production limits of the facility.

Considering the increasing demand for packaged drinking water in Nigeria and the strategic importance of institutional enterprises in universities, it is essential to examine the operational structure and production planning mechanisms of the Veritas Water Factory. This study therefore investigates the capacity and production planning practices of the Veritas Water Company located in Abuja. The research focuses on workforce structure, production capacity, operational processes, demand levels, managerial insights, and the key operational challenges influencing the performance of the enterprise.

## Statement of the Problem

Despite the rapid growth of the packaged water industry in Nigeria over the past two decades, many water production factories continue to face numerous operational challenges that limit their productivity, efficiency, and long-term sustainability. The demand for safe drinking water has increased significantly due to population growth, urbanization, and concerns over the safety of untreated water sources. As a result, the bottled and sachet water industry has expanded rapidly across many Nigerian cities, including Abuja. However, the expansion of the industry has not always translated into optimal operational performance for many water production facilities. Several structural, economic, and institutional constraints continue to affect their ability to operate at maximum capacity.

One of the most significant problems affecting water production enterprises is the mismatch between installed production capacity and actual production output. Installed capacity refers to the maximum level of production that a factory can achieve under normal operating conditions. In many cases, however, factories are unable to operate at this level due to technical or organizational limitations. According to William J. Stevenson (2014), manufacturing organizations often experience a gap between theoretical production capacity and actual production performance due to operational inefficiencies. In the context of water production factories in Nigeria, several factors contribute to this gap, including equipment breakdowns, limited maintenance culture, shortage of skilled technical staff, and disruptions in production schedules. When machines break down or when maintenance is delayed, production processes slow down, resulting in reduced output levels and decreased profitability.

Another major challenge confronting water production enterprises is the high cost of production inputs. The water production process requires several essential materials and equipment such as plastic bottles, sachet nylon packaging materials, purification chemicals, filtration systems, and automated packaging machines. Many of these inputs are imported from foreign countries due to limited domestic manufacturing capacity. As a result, the cost of acquiring these materials is highly sensitive to fluctuations in foreign exchange rates. When the value of the national currency declines, the cost of importing production materials increases significantly. This situation raises the overall cost of production for water factories and may force some companies to increase product prices or reduce production volumes in order to maintain financial stability.

Electricity supply instability represents another major constraint affecting manufacturing industries in Nigeria, including water production factories (Akinwale 2021). The water purification and packaging process relies heavily on electricity to power filtration machines, pumping systems, automated packaging equipment, and cooling facilities. However, Nigeria's electricity supply has historically been unreliable, with frequent power outages affecting both small and large manufacturing enterprises. According to reports by the World Bank, unreliable electricity supply significantly increases operational costs for manufacturing firms in developing economies. Many factories are therefore forced to rely on alternative power sources such as diesel or petrol generators in order to sustain their production activities. While generators help maintain operational continuity, they also increase

operational costs due to the high price of fuel and maintenance requirements.

Institutional enterprises such as university-based factories face additional administrative and structural challenges that may affect operational efficiency. Unlike privately owned manufacturing companies that operate primarily under profit-driven management structures, institutional factories are often embedded within broader administrative frameworks that involve multiple layers of decision-making. Ayogu and Shimawua (2025), suggests that bureaucratic organizational structures may sometimes reduce operational flexibility within institutions. In such settings, managerial decisions related to procurement, equipment replacement, staffing, and budgeting may require multiple approvals before implementation. These procedural requirements can slow down decision-making processes and delay operational improvements within the factory.

Increasing competition within the bottled and sachet water industry also represents a significant challenge for water production enterprises operating in Abuja. The packaged water market in the Federal Capital Territory has become highly competitive due to the presence of numerous private and corporate water brands. These companies compete for market share through pricing strategies, brand recognition, product quality, and distribution networks. As new entrants continue to emerge within the industry, existing water factories must constantly improve their production efficiency, marketing strategies, and distribution systems in order to remain competitive. Failure to adapt to market competition may result in declining sales and reduced profitability.

Furthermore, there is limited scholarly research focusing specifically on institutional manufacturing enterprises located within Nigerian universities. Although several academic studies have examined private water production companies and the broader bottled water industry, relatively few studies have focused on university-owned production facilities. Institutional factories often serve dual purposes: they operate as commercial ventures while also supporting teaching, training, and community service objectives. As a result, their operational structures and management practices may differ significantly from those of private manufacturing firms.

The absence of extensive academic research on university-based water production enterprises creates a gap in the existing literature on production management and institutional entrepreneurship. Understanding how such factories manage production capacity, workforce organization, and operational challenges is therefore important for both academic research and policy development.

This study therefore seeks to address this research gap by examining the capacity and production planning of the Veritas Water Factory in Abuja. By analyzing the operational structure, workforce organization, production capacity, demand levels, and managerial strategies of the factory, the study aims to provide insights into the challenges and opportunities facing institutional manufacturing enterprises in Nigerian universities. The findings of the study may also contribute to improving production planning practices and operational efficiency within similar institutional enterprises across the country.

## Clarification of Terms

### Capacity Planning:

Capacity planning refers to the managerial process of determining the maximum level of production that an organization can achieve using its available resources such as machinery, labour, technology, and raw materials within a specific period of time.

- **Production Planning:** Production planning is the systematic process of deciding what products should be produced, the quantity to be produced, the resources required, and the time frame for production in order to meet consumer demand efficiently.
- **Production Capacity:** Production capacity refers to the highest amount of output that a factory or production system can generate under normal working conditions within a given period.
- **Packaged Drinking Water:** Packaged drinking water refers to purified water processed, sealed, and distributed in containers such as sachets or plastic bottles for human consumption.
- **Water Production Factory:** A water production factory is a manufacturing facility where raw water is extracted, purified, treated, and packaged for commercial distribution and consumption.
- **Operational Efficiency:** Operational efficiency refers to the ability of an organization to utilize its resources effectively in order to produce goods or services with minimal waste, reduced costs, and maximum productivity.
- **Workforce Structure:** Workforce structure refers to the organization of employees within an enterprise based on their roles, responsibilities, and functional departments such as production, quality control, administration, and distribution.
- **Institutional Enterprise:** An institutional enterprise is a business venture established and managed by an institution, such as a university, primarily to generate revenue, support institutional activities, and provide practical training opportunities.
- **Distribution Network:** Distribution network refers to the system of transportation, logistics, and supply channels through which finished products are delivered from the factory to retailers, institutions, and final consumers.
- **Quality Control:** Quality control refers to the procedures and standards used to ensure that products meet required safety, health, and performance specifications before they are released to consumers.

## Methodology

### Research Design

This study adopts a qualitative case study approach to examine the capacity and production planning of the Veritas Water Factory located in Abuja. The case study method is particularly appropriate for research that seeks to explore complex organizational processes within a real-life institutional context. According to Robert K. Yin, (2014), case study methodology enables researchers to obtain an in-depth understanding of

institutional practices, decision-making processes, and operational systems within a specific organization. By focusing on the Veritas Water Factory as a single case, the study provides detailed insight into the operational dynamics, production planning strategies, and managerial practices of the enterprise.

The qualitative research design was considered suitable because the study aims to explore operational structures, human resource organization, and production processes rather than quantify numerical variables alone. Qualitative methods allow researchers to capture the perspectives, experiences, and insights of individuals directly involved in the production process. As noted by John W. Creswell and J. David Creswell (2005), qualitative research is particularly useful in understanding organizational systems and administrative processes within institutional environments.

### Sources of Data

The research relied on both primary and secondary sources of data. The combination of these sources ensured that the study obtained comprehensive information regarding the operational activities of the Veritas Water Factory.

Primary data were obtained through direct observation and informal interviews conducted within the factory environment. Observation allowed the researcher to examine the production processes, operational workflow, and coordination among staff members involved in the production of sachet and bottled water. Through this method, the researcher was able to observe the stages involved in water extraction, filtration, purification, packaging, and distribution.

In addition to observation, informal interviews were conducted with staff members who play important roles in the production system. These respondents included machine operators responsible for operating production equipment, packaging personnel involved in sealing and packaging water products, quality control officers tasked with maintaining product safety standards, distribution staff responsible for delivering finished products to consumers, and administrative managers who oversee the general operations of the factory. These interviews provided valuable insights into the daily operational challenges faced by the factory as well as the strategies used to manage production capacity and distribution.

Secondary data were also utilized to complement the information obtained from primary sources. These data were obtained from scholarly publications, academic journals, textbooks, institutional reports, and online databases related to manufacturing management, production planning, and the packaged water industry. The use of secondary sources helped provide a theoretical foundation for the study and allowed the researcher to compare the operational practices of the Veritas Water Factory with established production management principles.

### Research Sample

The study adopted purposive sampling in selecting respondents for the interviews. Purposive sampling involves selecting participants based on their knowledge, experience, and relevance to the research topic. According to Creswell and Creswell (2017), purposive sampling enables researchers to obtain rich and meaningful data from individuals who possess direct knowledge of the phenomenon being investigated. In this study,

the sampling technique ensured that only staff members with direct involvement in production and administrative processes were selected as respondents.

Data collected from both primary and secondary sources were analyzed using descriptive analytical techniques. The analysis focused on key variables relevant to production planning and capacity management within the factory. These variables included production capacity, workforce structure, operational processes, level of demand for water products, and the challenges affecting production efficiency. The descriptive analytical approach enabled the researcher to systematically interpret the information gathered and identify patterns within the production and management processes of the factory.

Furthermore, the research considered several ethical principles throughout the study. Ethical considerations are essential in research involving human participants because they ensure that respondents are treated with respect and dignity. Participants were informed about the purpose and objectives of the study before the interviews were conducted. They were also assured that the information provided would be used strictly for academic purposes. Confidentiality was maintained by ensuring that the identities of respondents were not disclosed in the research report. Participation in the interviews was voluntary, and respondents were given the opportunity to decline participation if they so desired.

## Issues of Determination

### Production Capacity of the Veritas Water Factory

Production capacity refers to the maximum quantity of goods that a manufacturing system can produce within a specified time frame under normal operating conditions. In industrial management and operations planning, production capacity is an essential determinant of operational efficiency and organizational profitability. It reflects the capability of production facilities, machinery, human resources, and production planning systems to meet market demand. According to William J. Stevenson (2014), production capacity is influenced by several factors including equipment capability, labor productivity, production technology, maintenance practices, and organizational management systems.

In water production factories, capacity is commonly measured in terms of the number of sachets or bottles produced within a specific period, usually per hour or per day. The packaging technology used in the factory largely determines the level of capacity that can be achieved. Automated machines with advanced sealing and packaging systems are capable of producing thousands of sachets of water per hour, while manual or semi-automated systems operate at significantly lower production levels. Young Olike (2023), notes in one of his updated business plans that medium-scale water factories in Nigeria typically operate with production capacities ranging between 4,000 and 10,000 sachets per hour depending on the sophistication of the machinery and the availability of operational resources.

The Veritas Water Factory in Abuja operates as a medium-scale institutional production facility designed to serve both the university community and the surrounding population. Its production capacity is structured to meet the daily demand for packaged drinking water within Veritas University as well as nearby residential areas and commercial outlets. Although the

factory is not among the largest commercial water production plants in Nigeria, it maintains a production capacity that allows it to remain competitive within the local market.

Production capacity within the factory is influenced by several operational variables. These include the number and efficiency of water purification machines, the speed and reliability of packaging equipment, and the availability of trained technical personnel capable of managing the production process. Regular maintenance of production equipment is also critical in ensuring that the installed capacity of the factory is effectively utilized. According to Krajewski, Malhotra, and Ritzman (2016), preventive maintenance strategies play a vital role in sustaining production capacity in manufacturing organizations.

Another important factor affecting production capacity is production scheduling. Effective scheduling ensures that machines and personnel are utilized efficiently throughout the production cycle. Poor scheduling practices may lead to idle production time, machine downtime, and reduced productivity. In water production factories where machines operate continuously during production cycles, any disruption in scheduling can significantly reduce output levels.

The availability of raw materials and packaging supplies also affects production capacity. Packaging materials such as nylon sachets, plastic bottles, and labeling materials must be readily available for continuous production. When supply chains are disrupted or materials become scarce, production output may decline even if the factory has sufficient machinery and labor.

Furthermore, demand fluctuations influence how production capacity is utilized. During periods of high demand such as academic sessions, events, or peak consumption periods, the factory may operate at near full capacity. Conversely, during periods of lower demand, production may be reduced to avoid excess inventory. Production planning therefore requires careful alignment between production capacity and market demand.

Overall, the production capacity of the Veritas Water Factory reflects the combined influence of machinery, workforce expertise, production planning strategies, and market demand. By maintaining an efficient production system, the factory is able to supply safe drinking water to the university community while also contributing to the broader packaged water market in Abuja.

### **Staff Strength and Workforce Structure**

Human resources represent one of the most critical components of organizational productivity and operational efficiency. In manufacturing enterprises, the effectiveness of production systems depends heavily on the skills, coordination, and commitment of the workforce responsible for operating machinery, maintaining quality standards, and managing distribution networks. According to Cross (2019), organizations achieve higher productivity when they effectively coordinate their human resources with technological and managerial systems.

Within water production factories, staff strength refers to the number of employees involved in various stages of the production and administrative processes. The workforce structure of such factories is usually organized into different functional categories based on specific responsibilities. These categories typically include production managers, machine operators, quality

control personnel, packaging staff, logistics and distribution staff, drivers, and administrative officers.

The production manager plays a central role in coordinating the entire manufacturing process. This individual is responsible for supervising production activities, ensuring that machines operate efficiently, monitoring staff performance, and implementing production schedules. The production manager also ensures that the factory complies with regulatory standards established by health and safety authorities.

Machine operators represent another essential component of the workforce structure. These employees are responsible for operating the automated equipment used in water filtration, purification, and packaging processes. Their technical competence is crucial because improper machine operation can lead to production delays, equipment damage, or compromised product quality.

Quality control officers are responsible for maintaining the safety and purity of the water produced in the factory. Packaged water products must meet strict health and safety standards established by regulatory agencies such as the National Agency for Food and Drug Administration and Control (NAFDAC). Quality control personnel conduct routine testing of water samples, monitor filtration processes, and ensure that hygiene standards are maintained throughout the production environment.

Packaging personnel perform the task of sealing sachets or bottles, arranging products into packs, and preparing them for distribution. This stage of the production process requires careful handling to ensure that products are not damaged during packaging and transportation. Efficient packaging operations contribute significantly to overall production efficiency.

The distribution unit of the factory consists of drivers and logistics staff responsible for transporting finished products to retail outlets, institutional consumers, and other distribution points. Effective distribution systems are essential for ensuring that products reach consumers in a timely manner.

Administrative staff members handle financial management, procurement activities, record keeping, and communication with suppliers and regulatory agencies. Their role ensures that the factory operates within established institutional and regulatory frameworks.

Studies on manufacturing organizations indicate that effective workforce coordination significantly improves operational efficiency and productivity (Robbins & Judge, 2025). When employees understand their roles and work collaboratively toward organizational goals, production systems operate more smoothly.

In the case of the Veritas Water Factory, the workforce structure reflects the operational requirements of a medium-scale manufacturing enterprise. Through effective coordination among production staff, quality control personnel, and administrative managers, the factory is able to maintain consistent production and distribution of its water products.

### **Mode of Operation**

The mode of operation in water production factories refers to the sequence of technical and managerial processes through which raw water is transformed into safe and consumable

packaged drinking water. These processes involve several stages including water extraction, filtration, purification, sterilization, packaging, and distribution. Each stage plays a critical role in ensuring that the final product meets the health and safety standards required for human consumption.

The first stage in the production process is water extraction. In many packaged water factories, groundwater is extracted through borehole systems installed within or near the factory premises. Boreholes are designed to access underground water sources that are generally less contaminated than surface water sources. According to Oyeboode, et al (2015), groundwater extraction through properly constructed boreholes provides a reliable source of raw water for industrial purification processes.

Once extracted, the water is pumped into large storage tanks where it undergoes preliminary sedimentation. This process allows heavier particles such as sand, soil, and other solid impurities to settle at the bottom of the tank before filtration begins.

The next stage involves multi-stage filtration. Filtration systems are designed to remove suspended particles and other contaminants from the water. Water typically passes through several filtration layers including sand filters, carbon filters, and micron filters. Sand filters remove larger particles while activated carbon filters eliminate odors, chlorine residues, and certain organic contaminants.

After filtration, the water undergoes purification through reverse osmosis systems. Reverse osmosis is a widely used water purification technology that removes dissolved salts, microorganisms, and chemical contaminants. According to Metcalf and Eddy (2014), reverse osmosis membranes are highly effective in producing potable water by eliminating impurities that cannot be removed through conventional filtration methods.

Following purification, the water is subjected to ultraviolet sterilization. Ultraviolet light treatment destroys bacteria, viruses, and other microorganisms that may remain in the water after filtration and purification. This stage ensures that the water meets microbiological safety standards required by health authorities.

Once sterilized, the purified water is transferred to automated packaging machines where it is sealed into sachets or bottles. Packaging machines measure and fill precise quantities of water into nylon sachets or plastic bottles before sealing them securely to prevent contamination.

The final stage involves distribution. Packaged water products are arranged into bundles or crates and transported to various distribution points including retail shops, restaurants, institutions, and households. Efficient distribution networks ensure that products reach consumers quickly and maintain freshness.

Overall, the mode of operation in the Veritas Water Factory reflects standard industrial practices in the packaged water industry. By following systematic production procedures and maintaining strict quality control standards, the factory ensures that its products are safe, hygienic, and suitable for public consumption.

### **Demand for Packaged Water**

The demand for packaged drinking water in Nigeria has grown significantly over the past two decades. Rapid urbanization, population growth, and increasing concerns about the safety of

public water supplies have contributed to the widespread consumption of sachet and bottled water products across the country. In major urban centers such as Abuja, packaged water has become a primary source of drinking water for many households and institutions.

One of the major factors driving demand for packaged water is the inadequacy of municipal water supply systems. Public water infrastructure in many Nigerian cities is unable to meet the needs of the growing population. According to the World Health Organization (2022), limited access to safe and reliable water sources in developing countries often leads consumers to rely on commercially packaged drinking water.

Institutions such as universities, hospitals, government offices, and commercial establishments represent significant consumers of packaged water products. In these environments, large numbers of people require convenient access to safe drinking water throughout the day. Sachet water, in particular, has become highly popular because it is affordable, portable, and widely available.

Within university environments, the demand for packaged water is especially high due to the presence of students, staff members, and visitors who require drinking water during academic and administrative activities. University-owned water factories therefore serve an important role in meeting this demand while also generating revenue for institutional development.

Population growth in Abuja has also contributed to the expansion of the packaged water market. As Nigeria's Federal Capital Territory continues to attract migrants from different parts of the country, the demand for consumer goods including drinking water continues to rise. Studies on consumer behavior indicate that urban residents increasingly prefer packaged water because it is perceived as safer than untreated tap water (Tilahun & Beshaw 2020).

Seasonal factors also influence demand patterns. During hot weather conditions, water consumption increases significantly due to higher hydration needs. Social events, conferences, and large gatherings also create temporary spikes in demand for packaged water products.

The Veritas Water Factory benefits from its strategic location within a university community and the broader Abuja metropolitan area. By supplying packaged drinking water to students, staff, nearby residents, and commercial outlets, the factory participates in a rapidly growing consumer market.

### **Operational Challenges**

Despite the growing demand for packaged drinking water, water production factories in Nigeria face several operational challenges that affect their productivity and long-term sustainability. The Veritas Water Factory is not exempt from these challenges, many of which reflect broader structural issues within Nigeria's manufacturing sector.

One of the most significant challenges is unstable electricity supply. Water production processes rely heavily on electricity to power pumping systems, filtration equipment, reverse osmosis machines, and automated packaging units. However, electricity supply in Nigeria is often unreliable, with frequent power outages disrupting industrial operations. According to the

Banjoko, et al (2012). unreliable electricity supply is one of the major obstacles to industrial development in many developing countries. As a result, many factories rely on diesel generators to maintain continuous production, which significantly increases operational costs.

Another challenge relates to equipment maintenance. Production machines require regular maintenance in order to operate efficiently. When maintenance is delayed or spare parts are unavailable, machines may break down and halt production activities. In developing economies where access to technical support services may be limited, equipment downtime can significantly reduce production output.

Competition within the bottled and sachet water industry also represents a major operational challenge. Abuja hosts numerous packaged water brands competing for market share. These companies use various marketing strategies such as price reductions, branding, promotional campaigns, and extensive distribution networks in order to attract customers.

Transportation and distribution challenges also affect water production enterprises. Poor road infrastructure, vehicle maintenance costs, and fuel price fluctuations increase the cost of transporting products to retail outlets and consumers. Efficient logistics management is therefore essential for maintaining profitability.

Limited capital investment is another important constraint. Expanding production capacity requires significant financial resources for acquiring new machinery, upgrading production facilities, and improving distribution networks. Small and medium-scale factories may struggle to obtain the capital required for such investments.

These operational challenges are consistent with broader constraints affecting manufacturing enterprises across Nigeria. Addressing these challenges requires strategic planning, improved infrastructure, and supportive economic policies.

## **Theoretical Framework**

The theoretical framework for this study is anchored on key management and production theories that explain how organizations plan, manage, and optimize their production capacity to meet market demand. Understanding these theoretical perspectives is important in analyzing the operational structure and production planning strategies of manufacturing organizations such as the Veritas Water Factory in Abuja.

### **Operations Management Theory**

Operations Management Theory is an important concept used to explain how organizations manage the processes involved in producing goods and services. The theory is largely associated with the work of Frederick Winslow Taylor (1911), whose ideas on scientific management laid the foundation for modern operations management. Taylor emphasized the importance of efficiency, proper planning, and the systematic organization of work in order to increase productivity in organizations.

Operations management focuses on the planning, organizing, and controlling of production activities that transform raw materials into finished products. According to William J. Stevenson (2014), operations management involves designing and managing production systems in a way that ensures efficiency,

productivity, and customer satisfaction. This means that organizations must carefully coordinate their resources such as machinery, labour, raw materials, and technology to achieve effective production outcomes.

In manufacturing industries, operations management plays a crucial role in ensuring that production activities run smoothly. Managers are responsible for making decisions related to production scheduling, equipment maintenance, quality control, and inventory management. Proper coordination of these activities helps organizations minimize waste, reduce production costs, and maintain high-quality standards.

The relevance of Operations Management Theory to this study lies in its ability to explain how production processes are organized within manufacturing organizations such as the Veritas Water Factory. The theory provides a framework for understanding how production capacity is determined, how resources are allocated, and how operational challenges such as machine breakdowns, labour shortages, or supply chain disruptions can affect productivity.

In addition, modern operations management emphasizes continuous improvement and process optimization. Many organizations now adopt advanced technologies and digital production systems to improve efficiency and increase output. These principles make the theory useful for analyzing production planning and operational performance in manufacturing industries.

### **Capacity Planning Theory**

Capacity Planning Theory explains how organizations determine the level of production resources required to meet present and future demand for their products. The concept is strongly linked to the development of operations management and was widely discussed by scholars such as Jay Heizer and Barry Render (2020), who emphasized that effective capacity planning is essential for maintaining efficiency in production systems.

Capacity planning involves determining the maximum level of output that an organization can produce within a given period of time using available resources. These resources include machinery, labour, production facilities, raw materials, and technology. According to Heizer and Render (2020), capacity planning is a critical managerial activity because it helps organizations balance production capability with market demand.

Organizations must carefully plan their production capacity to avoid two major problems. The first problem is underutilization of resources, which occurs when a company has more production capacity than the demand for its products. This situation leads to wastage of resources and increased operational costs. The second problem is insufficient capacity, which occurs when demand exceeds the organization's production capability, resulting in shortages, delayed deliveries, and customer dissatisfaction.

In industries such as packaged drinking water production, capacity planning is especially important because production processes depend heavily on specialized machinery and continuous operational cycles. Effective capacity planning ensures that the organization can meet consumer demand without interrupting production activities.

In the case of the Veritas Water Factory, capacity planning determines the number of sachets or bottles of water that can be

produced within a specific period. The factory must align its production capacity with the needs of the university community and surrounding markets. The theory therefore provides a useful framework for analyzing how production resources are allocated and managed to achieve efficient output.

Capacity planning also helps organizations prepare for future growth and expansion. As demand increases, management may need to invest in additional machinery, expand production facilities, or employ more workers to maintain efficiency.

### Systems Theory

Systems Theory provides a broad framework for understanding how organizations operate as interconnected units working together to achieve common objectives. The theory was propounded by Ludwig von Bertalanffy in 1968, who introduced the concept of General Systems Theory. Bertalanffy argued that organizations should be viewed as systems composed of different interrelated parts that interact with one another and with their external environment.

According to Systems Theory, an organization functions as an open system. This means that it continuously interacts with external factors such as customers, suppliers, government policies, and economic conditions. Within the organization itself, different departments operate as subsystems, each performing specific roles that contribute to the overall performance of the organization.

In manufacturing organizations, several units work together as part of the organizational system. These include the production department, procurement unit, management team, distribution network, and quality control unit. Each of these units depends on the others in order to function effectively. If one subsystem fails to perform its function properly, it can negatively affect the performance of the entire organization.

The application of Systems Theory is particularly useful in understanding the operations of the Veritas Water Factory. For example, the production unit depends on the procurement unit to supply packaging materials and purification chemicals required for water processing. Similarly, the distribution unit relies on the production department to provide finished water products that will be supplied to consumers.

Another important aspect of Systems Theory is the use of feedback mechanisms. Feedback allows managers to evaluate performance and make necessary adjustments. In manufacturing organizations, feedback may come from production reports, quality control inspections, sales data, or customer feedback.

Systems Theory also recognizes that organizations operate within a broader environment that influences their performance. Factors such as government regulations, electricity supply, economic conditions, and market competition can affect the operations of manufacturing companies. Understanding these environmental influences is therefore essential for analyzing the operational challenges faced by organizations.

### Recommendations

Based on the findings of this study on the capacity and production planning of the Veritas Water Factory in Abuja, several policy and managerial recommendations are proposed in order to enhance operational efficiency, improve production capacity, and strengthen the long-term sustainability of the enterprise. These

recommendations focus on technological improvements, energy management, market expansion, human resource development, and modern production planning systems.

First, the factory should invest in modern automated production equipment in order to increase production capacity and reduce operational inefficiencies. In manufacturing industries, the level of automation significantly influences productivity and operational performance. According to William J. Stevenson (2014), automation enhances production efficiency by reducing manual errors, increasing production speed, and ensuring consistent product quality. Modern water packaging machines are capable of producing significantly higher volumes of sachets or bottled water within shorter production cycles compared to older or semi-automated systems.

For the Veritas Water Factory, upgrading production machinery would allow the organization to increase its production output and meet the growing demand for packaged drinking water within Abuja. Automation can also improve product hygiene and reduce contamination risks by minimizing direct human contact during packaging processes. In addition, modern machines often include integrated monitoring systems that help detect technical faults early, thereby reducing machine downtime and maintenance costs. Investment in advanced production equipment therefore represents an important strategic step toward improving the factory's competitiveness within the increasingly crowded packaged water market.

Second, the installation of alternative energy sources such as solar power systems would reduce reliance on diesel generators and improve operational sustainability. One of the most significant challenges affecting manufacturing industries in Nigeria is the instability of electricity supply. Frequent power outages disrupt production activities and increase operational costs, especially when factories depend heavily on diesel-powered generators to maintain continuous operations. According to the World Bank (2022), unreliable electricity supply remains a major constraint on industrial productivity in many developing economies, including Nigeria.

Solar energy systems present a viable alternative energy source for manufacturing facilities. By installing solar panels and battery storage systems, the Veritas Water Factory could generate a significant portion of its electricity needs from renewable sources. Renewable energy solutions not only reduce fuel costs but also contribute to environmental sustainability by lowering carbon emissions. Research on industrial energy management indicates that renewable energy adoption can significantly reduce operational costs over time while improving organizational resilience to power supply disruptions (IEA, 2021). For an institutional factory located within a university environment, the adoption of solar energy would also align with broader sustainability goals and environmental responsibility initiatives.

Third, the factory should expand its distribution networks in order to reach larger markets within Abuja and neighboring communities. Effective distribution systems are essential for ensuring that manufactured products reach consumers efficiently. According to Philip Kotler and Kevin Lane Keller (2016), distribution networks play a critical role in marketing strategy because they determine the accessibility and availability of products within target markets.

Currently, the Veritas Water Factory primarily serves the university community and nearby residential areas. However, the rapidly growing population of Abuja presents significant opportunities for market expansion. By establishing partnerships with retailers, supermarkets, restaurants, and event centers across the city, the factory could increase its sales volume and strengthen its market presence. Expanding distribution channels may also involve investing in additional delivery vehicles and improving logistics management systems to ensure timely product delivery.

Fourth, continuous training programs should be implemented for staff members in order to improve technical competence in production management and equipment maintenance. Human resource development is widely recognized as a critical factor in organizational productivity. According to Gary Dessler (2020), employee training enhances technical skills, improves job performance, and increases overall organizational efficiency. In manufacturing environments, employees must possess adequate technical knowledge to operate machines safely, conduct routine maintenance procedures, and respond effectively to operational challenges.

For the Veritas Water Factory, training programs could focus on areas such as machine operation, equipment maintenance, quality control procedures, and occupational safety standards. Staff members may also benefit from training workshops organized by equipment manufacturers or industry professionals. By strengthening the technical capacity of its workforce, the factory would reduce the likelihood of machine breakdowns, improve production quality, and enhance operational reliability.

Finally, the adoption of modern production planning software systems could significantly improve inventory management, demand forecasting, and production scheduling within the factory. Production planning involves coordinating raw materials, machinery, labor, and distribution activities in order to meet consumer demand efficiently. According to Heizer, Render, and Munson (2020), digital production planning systems help organizations optimize resource utilization by providing real-time information on production processes and inventory levels.

For example, enterprise resource planning (ERP) software systems allow managers to monitor production schedules, track inventory levels, analyze demand patterns, and coordinate procurement activities. These systems reduce the likelihood of material shortages or excess inventory, both of which can negatively affect production efficiency. Demand forecasting tools embedded within such systems also help organizations anticipate market needs and adjust production output accordingly.

For the Veritas Water Factory, adopting digital production planning tools would enhance managerial decision-making and improve operational coordination across different departments. Such systems could also facilitate accurate record-keeping and performance monitoring, which are important for institutional accountability and long-term strategic planning.

## Conclusion

Capacity and production planning represent fundamental components of manufacturing management. The Veritas Water Factory represents an important institutional enterprise that contributes to the provision of safe drinking water within the university community and surrounding areas.

Although the factory operates with an organized production structure and dedicated workforce, several operational challenges limit its ability to fully utilize its production capacity. Improving technological infrastructure, strengthening workforce development, and expanding distribution networks will significantly enhance the productivity and sustainability of the enterprise.

Implementing these recommendations would significantly enhance the operational efficiency and sustainability of the Veritas Water Factory. Investments in modern production equipment, renewable energy systems, expanded distribution networks, workforce training programs, and digital production planning technologies would enable the factory to improve productivity, reduce operational costs, and strengthen its position within the competitive packaged water market in Abuja.

## References

1. Akinwale, Y. O. (2021). Energy consumption, trade openness, and economic growth: Empirical evidence from Nigeria. *International Journal of Energy Economics and Policy*, 11(6), 373–380.
2. Ayogu, G. I., & Shimawua, D. (2025). Politics of bureaucracy and public policy outcomes in Nigeria. *International Journal of Research and Review*, 12(10), 455–467.
3. Banjoko, S. A., Iwuji, I. I., & Bagshaw, K. (2012). The performance of the Nigerian manufacturing sector: A 52-year analysis of growth and retrogression (1960–2012). *Journal of Asian Business Strategy*, 2(8), 177–191.
4. Bertalanffy, L. von. (1968). *General system theory: Foundations, development, applications*. George Braziller.
5. Creswell, J. W., & Creswell, J. D. (2005). Mixed methods research: Developments, debates, and dilemmas. In R. Swanson & E. Holton (Eds.), *Research in organizations: Foundations and methods of inquiry* (pp. 315–326). Berrett-Koehler.
6. Creswell, J. W., & Creswell, J. D. (2017). *Research design: Qualitative, quantitative, and mixed methods approaches* (5th ed.). Sage Publications.
7. Cross, O. D. (2019). Impact of e-recruitment on organisational performance. *International Journal of Economics, Business and Management Research*, 3(3), 195–206.
8. Francis, I., & Isioma, I. E. (2022). Evaluation of production process and capacity utilization: A case study of UNIBEN Water Factory. *NIPES Journal of Science and Technology Research*, 4(1), 106–117.
9. Heizer, J., & Render, B. (2020). *Operations management* (13th ed.). Pearson.
10. Heizer, J. H., & Render, B. (2001). *Operations management* (7th ed.). Prentice Hall.
11. Hollweck, T. (2015). Robert K. Yin (2014). *Case study research design and methods*. *Canadian Journal of Program Evaluation*, 30(1), 108–110.

12. International Energy Agency. (2021). *Renewable energy and industrial sustainability report*. IEA Publications.
13. Kast, F. E., & Rosenzweig, J. E. (1972). General systems theory: Applications for organization and management. *Academy of Management Journal*, 15(4), 447–465.
14. Kotler, P., & Keller, K. L. (2016). *Marketing management* (15th ed.). Pearson.
15. Krajewski, L. J., Ritzman, L. P., & Malhotra, M. K. (2016). *Operations management: Processes and supply chains*. Pearson.
16. Metcalf & Eddy. (2014). *Wastewater engineering: Treatment and resource recovery* (5th ed.). McGraw-Hill Education.
17. Oliko, Y. (2023). *Business plan on complete modern premium quality bottled water production plant*.
18. Oyinlola, M., Kolade, O., Okoya, S. A., Ajala, O., Adefila, A., Adediji, A., & Akinlabi, E. T. (2024). Entrepreneurship and innovation in Nigerian universities: Trends, challenges, and opportunities. *Heliyon*, 10(9), 1–14.
19. Oyebode, O. J., Oyegoke, S. O., Olowe, K. O., & Adebayo, V. B. (2015). Borehole drilling, usage, maintenance, and sustainability in Ado-Ekiti, Nigeria. *American Journal of Engineering Research*, 4(9), 1–12.
20. Pillah, T. P., Grace, E. G., & Victoria, T. P. (2025). Assessment of resource verification in Nigerian universities: Goal setting, strategic planning, implementation, and monitoring. *IRASS Journal of Arts, Humanities and Social Sciences*, 2(3), 107–112.
21. Robbins, S. P., & Judge, T. A. (2025). *Essentials of organizational behavior*. BoD–Books on Demand.
22. Slack, N., Chambers, S., & Johnston, R. (2010). *Operations management*. Pearson Education.
23. Stevenson, W. J., & Sum, C. C. (2014). *Operations management* (8th ed.). McGraw-Hill/Irwin.
24. Taylor, F. W. (1911). *The principles of scientific management*. Harper & Brothers.
25. Tilahun, M., & Beshaw, M. (2020). Customer's perception and preference towards packaged drinking water. *The Scientific World Journal*, 2020, Article 6353928.
26. World Bank. (2022). *Nigeria power sector report*. World Bank Publications.
27. World Health Organization. (2022). *Guidelines for drinking-water quality*. WHO.
28. World Health Organization & United Nations Children's Fund. (2021). *Progress on drinking water, sanitation and hygiene*. WHO & UNICEF.
29. Deusdedit, B., Anitah, A. (2026). Electronic System of Record Keeping and Organizational Performance in Mitooma District in Western Uganda. *MRS Journal of Multidisciplinary Research and Studies*, 3(3), 17-20.
30. Okwudiri, M. O., Ihuoma, A. N., Chinelo, S.N., & Francisca, N.E. (2025). Empowering Youth Leadership to Tackle Insecurities in Ogwashi-Uku and Ibusa in Aniocha South and Oshimili North L.G.A, Delta State: Opportunities And Challenges. *IRASS Journal of Economics and Business Management*. 2(11), 30-37.