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TECHNOLOGY AND THE FUTURE OF FOOD INDUSTRY: BENEFITS AND CHALLENGES

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ABSTRACT

The study is a descriptive survey research designed to examine technology and the future of food industry: benefits and challenges. The area of the study is Port Harcourt, Rivers State, Nigeria. The population of the study is 29 food industries in Port Harcourt, Rivers State, Nigeria. The sample size is 20 managers of food industries in Port Harcourt, Rivers State, Nigeria was used for the study. Stratified sampling techniques was applied in the selection process. The instrument used for the study was a structured questionnaire titled technology and the future of food industry: benefits and challenges (TFFIBC) with 30 item questions. Reliability co-efficient of 0.72 was obtained. Mean and t test were the statistical tools used for the study. It was found that technology helps to make a wide range of food accessible to a wider audience while also removing bacteria and disease from the food. Based on the finding, the researcher recommended that women should be given more power by assuring their access to resources that can be used to generate revenue, providing information and extension services, securing loans, developing labor- and time-saving technologies, and promoting their participation in family and agricultural decisions.

Keywords: Food Industry, food technology, food systems, beverage sector, digital technology.

INTRODUCTION

Since it affects entire economies and even national security, food is no longer a private affair. The world's food system is being shaped by the decisions we make on what and how we eat. More than ever, technology has a significant impact on the food business. The way we produce food is being transformed by revolutionary breakthroughs, such as trends in vertical farming, aquaculture, biotech, blockchain, and robotics, and this transformation will continue Food and agriculture organization of the united nation [1] Food technology demonstrates how technology, such as artificial intelligence and automation, can enhance how the world grows, produces, distributes, and supplies food, Family doctor.org [2]. Food tech is revolutionizing the food sector by employing the newest technology to control production, distribution, and consumption as firms turn to technology to combat inflation and boost efficiency. According to the US Department of Agriculture, the food sector contributes more than $1 trillion to the US GDP. There are several difficulties in such a big industry, as food sustainability, World economic forum [3]. The worldwide food industry is being transformed by food technology. Food technology is any technology that enhances the sale, manufacture, and distribution of food, as well as the supply of food, Aynsley &

Lawrence [4]. The relationship between technology and food has existed since the Industrial Revolution in the late 1700s and early 1800s, despite the fact that the term may seem recent. The standards for farming were established during this time, which also saw the advent of industrialized agriculture. Industry leaders and inventors collaborated during this time to improve food production and quality. The use of artificial fertilizer, the invention of pesticides, the advancement of electricity, and the beginning of horse-powered and later steam-powered equipment were all significant breakthroughs, Tatiana & Hamid [5]. But with the emergence of big data, artificial intelligence, and the internet of things during the past few years, food technology has emerged as a separate industry (IoT). Food technology uses IoT at every stage to make the food sector more sustainable. There are many uses for the internet of things, including in agriculture and farming.

According to a study by Nature Food, food systems are accountable for close to one-third of the greenhouse gas emissions in the globe. Land use change, waste management, keeping animals, production, and packing all contribute to an increase in these emissions. According to a survey by the United Nations' Food and Agriculture Organization, the globe also throws away nearly a third of its food supply. The World Health Organization estimates

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that despite all this food waste, approximately 828 million people still lack access to enough food, World health organization [6].

Due to the energy required for food production and waste generation, farming, the food business, and people's diets have an impact on the environment. The land is impacted by farming and is depleted of its nutrients. The world is dealing with a decrease in arable land for food production in addition to water problems. Some of these problems are being tried to solve via food tech. Startups are using the most recent technology to address many aspects of the food chain in an effort to increase employment, decrease hunger, and encourage ethical production and consumption. According to Emergen Research, the global market for food technology was valued at $220.32 billion in 2019 and is anticipated to reach $342.52 billion by 2027. Joshua [7] claims that food technology is boosting food production in an effort to lower the rate of hunger and feed the world. Utilizing digital and cutting-edge technologies, agriculture is becoming more automated in order to generate food and raw resources. The following are some examples of how technology is used in food production:

• Genetically altered creatures. To make a plant resistant to disease and able to grow in unfavorable growing environments, GMOs are put into the genes of the plant. Large-scale crops including rice, wheat, and corn all use GMOs.

• Drones. Satellite imagery can be provided by drones to track crop growth and address problem areas.

• Technology in the meat sector. Artificial intelligence is useful in the production of poultry because it can identify health problems in birds by listening to their sounds. In chicken farms, AI robots can help with slaughtering or collect eggs.

• Crop surveillance. AI can identify pests and diseases in crops in addition to the use of drones. To prevent significant losses, digital tools like AgroPestAlert, Farm Scout Pro, and IPM Toolkit can help identify pest infestations and changing soil conditions.

• 3D printer for food. Faster food production is possible using food printers, including pizza, munchies, and candies. Using AI, one ingredient at a time, the layers and structure of the dish are designed. Due to the possibility of recycling leftover ingredients, this could reduce waste.

Consumers are now more health-conscious than ever thanks to the rising prevalence of food-related diseases, which have forced them to make fundamental adjustments to their diet and lifestyle. Automatically, the focus shifts to foods without additional preservatives that can be harmful to one's health, Jonathan, Koen, & Giner [8]. The demand for items without the "healthy" label will inevitably decline, and to maintain market dominance, one of the biggest problems facing food and beverage managers is to get rid of artificial ingredients from their products. Obesity, which is closely linked to a high intake of sugar from processed foods and cereals, is one of the main factors that has increased the prevalence of diabetes. Since making this discovery, consumers have avoided purchasing items with artificial sweeteners and other additional preservatives, Centers for disease control and prevention [9]. Therefore, one of the largest issues facing the food and beverage business is for producers to develop nutritious goods that offer plenty of nutrients while also maintaining the brand's aesthetic appeal. As a result, a variety of nutrient-rich foods marked "gluten-free," "dairy-free," "sugar-free," and similar have appeared in grocery aisles. An excellent illustration supporting the aforementioned is the market's vast proliferation for food supplement ingredients, Yach, Khan, & Bradley [10]

PROBLEM OF THE STUDY

The worst effects of the coronavirus have so far been felt by the food and beverage industry. The food and beverage industry has been groggily responding to the epidemic, including the supply chain, restaurant sector, manufacturing, and food service organizations. Employees were unable to work at factories due to nationwide lockdowns, which had a negative impact on the supply chain. The threat of a food shortage is very real as farming and agricultural activity suffer. Fearful of the prolonged lockdowns, it was seen that the population resorted to panic buying, further depleting the supply of food and widening the gap between those who can afford to stockpile and those who cannot.

Back in 2020, it was widely believed that this bleak scenario may continue until a cure or COVID-19 vaccine was developed. While vaccination campaigns have been effective in the majority of countries, the food and beverage industry has not yet made any ground-breaking strides. This is due to the fact that people have probably been practicing social withdrawal for a while now in place of the so-called "new normal" and the ongoing emergence of fresh COVID-19 varieties. As a result, it is anticipated that the restaurant industry will suffer, and the meat industry as well, given the shift in customer eating patterns. The difficulties confronted by food and beverage managers are unquestionably numerous because of the absurdly tough competition and the fact that even the smallest change has the potential

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to have a significant impact on the entire supply chain. In the coming years, this industry is expected to undergo significant change as a result of emerging markets, shifting consumer purchasing patterns, rising food prices, an increase in the world's population, and cutting-edge technology. The recent identification of the Omicron variety is evidence that the COVID-19 pandemic assault will likely last for some time. The food and beverage industry is expected to continue showing positive growth despite ongoing difficulties.

Aim and Objectives of the study

The aim of the study is to examine technology and the future of food industry: benefits and challenges. Specifically, the study intends to:

- Examine the benefits of food technology in Port Harcourt
- Describe how technology improves the way food is produced in Port Harcourt
- Determine the challenges of food technology in Port Harcourt

Research Questions

1. What are the benefits of food technology in industries in Port Harcourt?
2. How can technology improve the way food is produced through technology in industries in Port Harcourt?

3. What are the challenges of food technology in industries in Port Harcourt?

Hypothesis

1. There is no significant difference between male and female managers on how food is produced in Port, Harcourt industry, Rivers State, Nigeria.

METHODOLOGY

The study is a descriptive survey research designed to examine technology and the future of food industry: benefits and challenges. The area of the study is Port Harcourt, Rivers State, Nigeria. The population of the study is 29 food industries in Port Harcourt, Rivers State, Nigeria. The sample size is 20 managers of food industries in Port Harcourt, Rivers State, Nigeria was used for the study. Stratified sampling techniques was applied in the selection process. The instrument used for the study was a structured questionnaire titled technology and the future of food industry: benefits and challenges (TFFIBC) with 30 item questions. To ensure validity, the designed instrument by the researcher was given to experts in the field of Food and nutrition. To determine the reliability of the instrument, test-re-test was applied and the responses were correlated to attain the reliability co-efficient of 0.72. Mean and t test were the statistical tools used for the study

RESULTS

Research Question 1: What are the benefits of food technology in Port Harcourt?

Table 1: Benefits of food technology

S/N	Items Benefits of food technology	4	3	2	1	Mean X	Standard deviation	No of Respondents
1	Food technology educates people on how to grow and prepare food using technology so that the resulting goods will have a high utility value and an even higher market value.	18	1	1	-	3.85	0.47	20
2	Due to technology, food has a longer shelf life.	13	5	1	1	3.50	0.80	20
3	Technology maintains appropriately locked food nutrition	17	3	-	-	3.85	0.35	20
4	Technology rids the food of bacteria or sickness	19	1	-	-	3.95	0.22	20
5	Food technology keeps the food supply secure and provides customers with healthier options.	15	3	1	1	3.60	0.80	20
6	Technology enables a wide audience to access a variety of inexpensive and healthful foods.	18	2	-	-	3.90	0.30	20
7	After completing this major, students can choose from a wide range of careers in the field of food technology.	12	7	1	-	3.55	0.58	20
8	Food technology can open more options for travel.	14	4	1	1	3.60	0.81	20
9	Using food technology in a variety of environments	18	2	-	-	3.90	0.30	20
10	Modern machinery can manage farmers' efforts.	15	5	-	-	3.75	0.43	20
	Average Mean					**3.74**	**0.51**	

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Entries in table 1 showed that food technology managers in Port Harcourt, Rivers State, Nigeria, accepted every item as a benefit of food technology. This is due to the fact that every item's mean was higher than the 2.50 criteria mean. A global average of 3.74 implies that technology helps to make a wide range of food accessible to a wider audience while also removing bacteria and disease from the food.

Research Question 2: How can technology improve the way food is produced in Port Harcourt?
Table 2: How technology can improve the way food is produced

S/N	Items How technology can improve the way food is produced	4	3	2	1	Mean X	Standard deviation	No of Respondents
1	In order to provide food more effectively for an expanding global population	17	3	-	-	3.86	0.36	20
2	Enhancing processing and packaging with technology can extend the shelf life and increase food safety.	12	8	-	-	3.60	0.40	20
3	Additionally, the utilization of machinery in the food business guarantees price and quality.	16	3	1	-	3.80	0.54	20
4	Utilizing machinery lowers the cost of maintaining food freshness and boosts output.	11	9	-	-	3.55	0.50	20
5	We can now innovate and make many things that we previously couldn't, all while maintaining the sustainability of our food supply thanks to 3D printing.	10	7	3	-	3.35	0.72	20
6	To boost agricultural productivity, use a global positioning system monitoring system and satellite imagery to monitor crop yields, soil conditions, and weather patterns.	15	4	1	-	3.70	0.55	20
7	Drones can be used to find and recognize infected or damaged crops and provide them with timely care.	17	2	1	-	3.80	0.50	20
8	Companies in the food business are able to develop alternatives to plastics and other environmentally hazardous packaging by using robots and digitalization.	13	4	3	-	3.50	0.74	20
9	Copia connects businesses with excess food to nearby shelters, after-school programs, and other non-profit organizations using their comprehensive food waste reduction dashboard.	15	5	-	-	3.75	0.43	20
10	To save money and cut down on overall food waste, Copia analytic software manages and tracks their surplus.	19	1	-	-	3.95	0.21	20
	Average Mean					**3.68**	**0.49**	

Entries in table 2 showed that managers of food technology accepted every suggestion for how technology might enhance food processing in Port Harcourt, Rivers State, Nigeria. This is due to the fact that every item's mean was higher than the 2.50 criteria mean. The overall mean of 3.68 recommends that Copia analytical software managers and measure their excess to save money and reduce their overall food waste. Additionally, technology aids food manufacturers in producing food more effectively for a growing global population.

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Research Question 3: What are the challenges of food industry in Port Harcourt?
Table 3: Challenges of food industries in Port Harcourt

S/N	Items Challenges of food industries in Port Harcourt	4	3	2	1	Mean X	Standard deviation	No of Respondents
1	Growing health awareness amidst an increase in COVID-19 and its variations cases	18	2	-	-	3.90	0.30	20
2	One major obstacle in the food and beverage industry is traceability, which affects not only record-keeping but also revenue generation for all sectors.	14	5	1	-	3.65	0.57	20
3	One of the biggest issues in the food and beverage sector is the increase in consumers vying for vegetarian and vegan products, which has resulted in a large drop in demand for meat and other items.	17	3	-	-	3.85	0.35	20
4	The complexity of inventory management is rising	9	10	1	-	3.40	0.55	20
5	Given that consumers are more technologically adept and socially aware of the internet, having an online presence is one of the primary difficulties facing the food and beverage business.	7	10	3	-	3.20	0.67	20
6	Most people are known to stick to the rules frugally, despite the fact that occasionally changes in waste management, food quality, raw materials, surplus production, and paperwork have emerged as one of the biggest issues facing food and beverage managers.	12	6	1	1	3.45	0.80	20
7	Employees were unable to work at factories due to the widespread lockdowns, which had a significant impact on supply	6	11	3	-	3.15	0.65	20
8	Eco-friendliness has become the new catchphrase due to industrialization's devastating effects on the environment and the industry's focus on the food and beverage sector.	13	6	1	-	3.60	0.58	20
9	Another element of the environmental difficulties facing the food and beverage business today is waste management.	8	12	-	-	3.40	0.40	20
10	Radioactivity in the food system represents another another worldwide food risk.	19	1	-	-	3.95	0.22	20
	Average Mean					**3.56**	**0.50**	

Entries in table 3 showed that managers of food technology acknowledged each issue as a problem facing the food sector in Port Harcourt, Rivers State, Nigeria. This is due to the fact that every item's mean was higher than the 2.50 criteria mean. An overall mean of 3.56 indicates that radioactivity in the food system and rising health awareness in the wake of an increase in COVID-19 and its variant cases provide a further worldwide food concern.

Hypothesis

Group	Mean	Sum of squared deviation	n	Df	Standard Error	t-cal	t-tab	Decision
Male X1	6.1	25.30	10	20	0.68	0.88	2.10	Accepted
Female X₂	5.5	16.90	10					

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The hypothesis is accepted since the computed value of t is less than the tabular value (t-cal t-tab). This indicates that the opinions of male and female managers in Port Harcourt, Rivers State, Nigeria, on the use of technology to enhance food production, are identical. Their mean performance does not significantly differ. The small discrepancy between X1 (6.1) and X2 (5.5) is purely coincidental.

DISCUSSIONS

Research Question 1: What are the benefits of food technology in Port Harcourt?
The outcome demonstrates that technology removes germs or disease from food and assists in making a wide range of affordable, healthful foods available to a big audience.

The findings are in line with those of John, Newsome, Williams, and Gustavo [11], who discovered that the food system's use of science and technology has made it possible to produce enough food in sufficient numbers to fulfill society's changing requirements.

The findings of the study are in line with those of Augustin, Riley, Regine, Bennett, Andrea, Tevor, Osmond, Peerasak, Welma, Ian, and Cobiac [12], who discovered that people search for food that is accessible, secure, practical, fresh, natural, free of preservatives, and devoid of undesirable qualities.

Research Question 2: How can technology improve the way food is produced in Port Harcourt?
The findings demonstrated that copia analytic software managers and track their excess to save money and reduce their overall food waste, and that technology aids food manufacturers in producing goods more effectively in order to meet the needs of a growing global population.

The findings are in line with those of Conor [13], who discovered that farmers are making commendable efforts to reduce their own carbon footprint through the use of integrated pest management tools, nearly smokeless tractor engines, and less inputs like fertilizer and nitrogen. As these technologies become more widely adopted and evenly distributed among rich and poor countries alike, food production will start to increase significantly, even in the world's poorest countries.

The findings of the study concur with those of Muhammad, Muhammad, Amirah, and Nursyazwani [14], who discovered that food fortification, packaging, and storage are still employed to meet the needs of an expanding population that depends on food for survival despite the negative effects.

Research Question 3: What are the challenges of food industry in Port Harcourt?
The outcome demonstrates that expanding health awareness and radioactivity in the food system, along with an increase in COVID-19 and its variant instances, are additional worldwide food risks. The findings of the study are in accordance with those of Antonio, Diego, Dorado, and Lorenzo [15], who discovered that robotic claw optimization utilizing 3D printing not only lowers production costs but also improves line flexibility and shortens lead imes.

The study concurs with those of Adesoji, Rodolfo, Brian, and Karen [16] who found that areas of concern include, in descending order of importance, taxation and fiscal issues, economic barriers to development and expansion, high cost of doing business, concerns about education, training, and labor, communication and public relations, and transportation.

CONCLUSION
The researcher came at the following conclusions:
1. Technology allows a big audience access a range of food that is both economical and healthy by removing bacteria and disease from the food.
2. Copia analytic software managers and track their excess to save money and reduce their overall food waste. Technology also enables food producers to produce goods more effectively in order to meet the needs of a growing global population.
3. Radioactivity in the food system and growing health awareness in the wake of an increase in COVID-19 and its variant cases are two additional worldwide food risks.

RECOMMENDATIONS
According on the findings, the researcher recommended the following:
1. Food technology improves accessibility and practicality.
2. give women more power by assuring their access to resources that can be used to generate revenue, providing information and extension services, securing loans, developing labor- and time-saving technologies, and promoting their participation in family and agricultural decisions.
3. In order to lessen the risk of cardiovascular disease, food firms should reduce the amount of saturated fats in the oils they use.

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