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For International Hybrid Conference

THEME

**REVITALIZING GLOBAL
ECONOMY FOR
SUSTAINABLE NATIONAL
DEVELOPMENT**
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MAY, 2024

**PROCEEDINGS OF THE INTERNATIONAL HYBRID CONFERENCE
ORGANIZED BY EMPIRICAL STUDIES AND COMMUNICATION
DEVELOPMENT – A RESEARCH CENTER**

THEME

**REVITALIZING GLOBAL ECONOMY FOR SUSTAINABLE
NATIONAL DEVELOPMENT**

MAY, 2024

Held At

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RESEARCH CENTER**

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INTRODUCTION TO IHCRGESND

Welcome esteemed delegates, scholars, and practitioners to the International Hybrid Conference on Revitalizing Global Economy for Sustainable National Development. As we gather virtually and in person, we embark on a collective endeavor to address one of the most pressing challenges of our time: ensuring the sustainable development of nations amidst a rapidly changing global economy.

In an era marked by unprecedented interconnectedness, the dynamics of the global economy have profound implications for national development strategies. This conference serves as a platform for interdisciplinary dialogue, knowledge sharing, and collaboration aimed at navigating the complexities of economic revitalization while prioritizing sustainability at both the national and global levels.

With representatives from academia, government, industry, and civil society, our discussions will traverse the multifaceted dimensions of economic growth, environmental stewardship, social equity, and technological innovation. By fostering an inclusive and participatory discourse, we strive to generate actionable insights and policy recommendations that can inform decision-making processes and drive tangible progress towards sustainable development goals.

As we embark on this journey together, let us harness the power of collaboration and innovation to chart a course towards a more resilient, inclusive, and prosperous future for all nations.

CONFERENCE OBJECTIVES

Foster Collaborative Solutions: The conference aims to facilitate cross-border collaboration among policymakers, economists, and industry leaders to address the pressing challenges faced by the global economy.

Explore Sustainable Development Strategies: Explore the innovative strategies that promote economic growth while ensuring environmental sustainability and social equity, fostering a more resilient global economy.

Identify Key Economic Drivers: Analyze the fundamental drivers of economic growth and identify opportunities for leveraging technological advancements, fostering entrepreneurship, and promoting inclusive economic policies.

Enhance Policy Frameworks: Evaluate existing economic policies and propose actionable recommendations to governments and international organizations to foster an enabling environment for sustainable national development.

Promote Knowledge Exchange: Facilitate knowledge sharing and exchange of best practices to empower nations with the necessary tools and insights to navigate complex economic challenges and achieve sustainable development goals.

Empower Stakeholders: Empower stakeholders with actionable insights and practical tools to drive sustainable economic growth, ensuring prosperity for present and future generations.

CONFERENCE THEMES

Green Growth and Sustainability: Exploring strategies for economic growth that prioritize environmental sustainability, renewable energy, and resource efficiency.

Innovation and Technology for Development: Discussing how technological advancements and innovation can drive economic development, create jobs, and foster sustainable growth.

Resilience in Times of Crisis: Addressing how nations can build economic resilience to withstand and recover from global crises such as pandemics, natural disasters, and economic downturns.

Infrastructure Development and Connectivity: Examining the role of infrastructure investment in promoting economic development, improving connectivity, and reducing disparities between urban and rural areas.

Inclusive Economic Growth: Exploring policies and initiatives to ensure that economic growth benefits all segments of society, including marginalized communities, women, and youth.

Global Trade and Economic Integration: Assessing the opportunities and challenges of global trade agreements, regional economic integration, and international cooperation in driving economic development.

Financial Inclusion and Access to Capital: Discussing strategies to promote financial inclusion, improve access to capital for small and medium-sized enterprises (SMEs), and foster entrepreneurship.

Human Capital Development and Education: Highlighting the importance of investing in education, skills training, and healthcare to enhance human capital development and drive economic growth.

Sustainable Agriculture and Food Security: Addressing the role of sustainable agriculture practices, food security initiatives, and rural development in promoting economic growth and reducing poverty.

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COMPETITIVE ELECTRICITY GENERATION AND THE ALBANIAN INVESTMENT OPPORTUNITIES

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ABSTRACT

In recent years, the generation of electricity by the power plants has undergone considerable variations, both for socio-economic reasons, but also for simple meteorological reasons, given the 100% dependence of the system relies on hydro power plants. In this context, it is important to remember that this cumbersome relationship between water and hydropower energy must be changed in the future, to avoid putting the entire energy system in imbalance in the case of a simple dry season. Based on the historical data and considering the potential investments, the effects on the generation system are expected at a maximum rate of 1-1.5% annual increase in the available electricity for final consumption. Meanwhile using the annual load profile for the average consumption, the prediction of the total electricity demand is estimated to increase at the rate of 3-5% in the coming years. If the current investments do not follow the increase in the demand rate, the imports will increase further putting the government expenditure on an additional financial pressure. The electricity prices in Albania do not follow the market volatility but are fixed from the Energy Authority. Since family consumption constitutes about 49% of total consumption, a variation in electricity could create further socio-economic instability in the country, compromising the efforts to join the EU.

KEYWORDS: Electricity Demand, Project Finance, Household Consumption, Independent Power Plants

1. Introduction

Albania depends on the imports of electricity by an average of 30% of the total electricity consumption, except for those years with heavy rainfall (Fig.1). Furthermore, the surge in the price of oil, or the slowdown in investments in nuclear energy, creates uncertainty about the future of the availability of energy imports at reasonable prices.

In 2009, the Czech operator CEZ acquired 76% of the National Distribution Operator, becoming the first fully operational foreign investor in the electro-energy sector. In two years of CEZ work, it has encountered a series of problems, due in part to the legacy of the previous public monopoly, such as the debts accumulated in the past, and the credits from energy users, especially from institutional ones. The conflicts stored with various entities and users gradually pushed the CEZ's operation in a difficult condition that was impossible to resolve (Holzner & Schwarzhappel, 2018). The legal landscape in the region is not entirely encouraging, given the similarity of the problem in Bulgaria, again with CEZ, or in Macedonia with the Austrian EVN (Grieveson & Holzner, 2018).

The national energy company (KESH) currently imports electricity on annual or semi- annual contracts, encountering difficulties in entering into long-term contracts. Furthermore there is a persistent difficulty of suppliers to meet their commitments (Uvalic, 2014).

Several studies on the demand and supply of electricity in the countries of South Eastern Europe (Sredojević, 2017) (DJUKIĆ, REDŽEPAGIĆ, & VUKOVIĆ, 2014), showed that the energy deficit can increase in the region in the years to come, if substantial investments are not made for an additional generation. This indicates that energy imports will be even more difficult to procure. Already at the moment, neighboring countries such as Greece, Macedonia or Italy are net importers of electricity (Holzner & Schwarzhappel, 2018).

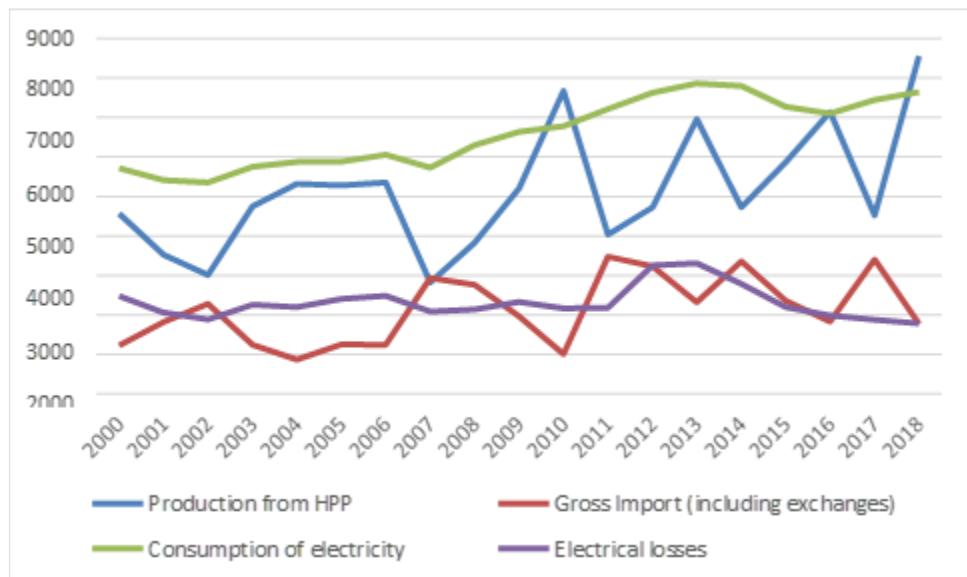


Figure 1: Production and Consumption of electric energy in GWh in the period 2000-2018
Source: <http://databaza.instat.gov.al>

In addition to the construction of new plants, KESH must also take care of the maintenance of existing ones, which are often in precarious situations. Big HPPs require particular protection due to the danger they can present to civilian populations (Celo & Bualoti, 2010).

In formulating development strategies in the division of generation, the characteristics of the Albanian system must be taken into account, such as the disproportionate ratio between the HPP production capacity, the concentration of generation sources in the North and consumers in the Central part of the country, the lack of significant investments in the sector in the past 30 years, the lack of investment attraction, as a result of the low price of electricity (Gjoka, 2016).

2. The existing generation system

As mentioned earlier, the electricity generation system is dominated by hydroelectric, with smaller spas, the majority of which have been suspended or dismantled permanently, given the obsolete technology, and the unsustainable operating costs.

The three main power plants of the Drin waterfall are:

Fierza HPP (500 MW);

Koman HPP (600 MW);

Vau Dejës (250 MW);

The waterfall of the river Mati, always located in the north of the country: Ulza HPP and Shkopeti HPP with a total of 52 MW.

The Bistrica 1 and 2 power plants on the Bistrica River, with a total capacity of 28.5 MW Independent power plants contribute with 31% of the total electricity or 2701 Gwh during 2018

The only thermal power plant is that of Vlora 1 with an installed capacity of 93 MW, but not yet operative.

Table 1 Quarterly balance of electric power in GWh year 2018

	2018-1	2018-2	2018-3	2018-4	Total
A Available electricity (A=1+2-3)	2123	1739	1812	1964	7639
1 Net domestic production (1=1.1+1.2+1.3)	3213	2707	1630	1003	8552
1.1 Thermo	0	0	0	0	0
1.2 Hydro (1.2=a+b)	3213	2707	1630	1003	8552
a Net public producers (a=a.1-a.2)	2087	1795	1304	665	5851
a.1 Gross public producers	2105	1810	1315	672	5902
a.2 Losses and own consumption	18	15	11	7	51
b Independent power producers	1126	912	326	337	2701
2 Gross import (including exchanges)	115	139	470	1049	1772
3 Gross export (including exchanges)	1205	1106	287	87	2685
	2123	1739	1812	1964	7639
B Consumption of electricity (B=1+2)					
1 Electrical losses (1=1.1+1.2)	599	390	356	438	1783
1.1 Losses in transmission	87	75	45	36	243
1.2 Losses in distribution (1.2=a+b)	513	315	312	402	1540
a Technical losses in distribution	343	234	234	259	1071
b Non technical losses in distribution	169	81	77	143	470
2 Consumption of electricity by domestic users (2=2.1+2.2)	1524	1349	1456	1527	5856
2.1 Households	790	591	607	693	2682
2.2 Non households	734	758	848	834	3174

Source: <http://databaza.instat.gov.al>

So far a number of operators have expressed interest in investments in the electro-energy field. Mainly these are direct investments to small and medium-sized power plants. Approximately today approx. 213 concessions for the construction of plants up to 50 MW. Some concessions are pending due to strong public concern about the environmental impact like Kalivaci. These arguments highlight the difficulty of foreign operators and capital to penetrate the energy market.

3. Methodology

This study is taking in consideration a series of thermal and hydro power plant generation projects, identified in the period 2020-2025. In order to have a clear view of the volume of energy needed to meet the demand of the country, the study took into consideration a scenario of increased demand by pursuing the current trend.

Table 1 Balance of electric power 2008 – 2018 in GWh

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
01 A. Available electricity	6296	6629	6773	7211	7619	7857	7794	7265	7094	7440	7639
02 A.1. Net domestic production	3831	5201	7674	4036	4725	6959	4726	5866	7136	4525	8552
03 A.1.1. Thermo	0	0	0	0	0	0	0	0	0	0	0
04 A.1.2. Hydro	3831	5201	7674	4036	4725	6959	4726	5866	7136	4525	8552
05 A.2. Gross Import (including exchanges)	2759	1964	1005	3475	3230	2323	3356	2355	1827	3403	1772
06 A.3. Gross (including exchanges)	293	536	1906	301	336	1425	288	956	1869	488	2685
07 B. Consumption of electricity	6296	6629	6773	7211	7619	7857	7794	7265	7094	7440	7639
08 B.1. Electrical losses	2140	2328	2167	2179	3251	3306	2783	2196	1986	1876	1783
09 B.2. Consumption of electricity by domestic users	4156	4301	4606	5032	4368	4551	5011	5069	5108	5563	5856

Source: <http://databaza.instat.gov.al>

In determining the strategy for the development of the generation sector, the recommendations of the study take approximate values on the potential to be installed in the various projects.

Regarding the priorities of these projects, at the present stage it is difficult to define each project separately, since none of them have independent assessments of feasibility and environmental impact. Starting from these data, an effort to understand the trend of the Electricity Consumption and Electricity Losses was performed through a simple trend regression.

Table 3. Trend equation for Consumption of electricity period (2000-2018)

Regression Statistics			Coefficients	Standard Error	t Stat	P-value
Multiple R	0.9144	Intercept	5184.09	173.05	29.95	0.00
R Square	0.836	time	141.38	15.17	9.31	0.00
Adjusted R Square	0.826					
Standard Error	362.363					
Observations	19					

Table 4. Trend equation for Electric losses period (2000-2018)

Regression Statistics			Coefficients	Standard Error	t Stat	P-value
Multiple R	0.0402	Intercept	2277.50	204.717	11.1	0.00
R Square	0.0016	time	2.980	17.954	0.16	0.8701
Adjusted R Square	-0.057					
Standard Error	428.66					
Observations	19					

Collecting the conclusions of the simulation, in correspondence to the characteristics of the system mentioned above, we can reach these results:

The electricity demand has a steady but continuous positive trend (Table 2). By 2025 an estimated volume of 8860 GWh will be needed. Meanwhile the Electric losses do not follow a regular trend (Table 3), this is due to the production of energy that is quite variable, but also to non-technical losses, that are illegal connections mainly in the distribution transmission system.

For the short term, until the commissioning of new thermal plants, which, given the trend of investments, will not happen before 2025, the coverage of the country's energy needs will continue to be fulfilled by imports, up to the maximum limits of 2500-3500 TWh per year, taking into account a GDP growth of approximately 3% per year, especially for the industrial and service sectors, which present the most dynamic trends.

An upper bound of the imports is connected to

- a) government expenditure constraints,
- b) electricity prices in the domestic and international market and finally
- c) the transmission and distribution system infrastructure that is not fully equipped to receive overload in the grid.

In addition to national production, elements of a broader context can also be introduced in the analysis of development scenarios. By analyzing the difference between the respective power generation structures, there is an option to reduce the cost of generation through close cooperation between the electricity systems of Albania and Kosovo. In Kosovo, production is mainly based on energy from the TECs, due to the convenience of the latter in a country that has large quantities of lignite. The generation coming from the TECs, unlike the water generation, is static over time, without fluctuations of an exogenous nature. In this sense, the systems can be complementary to each other, given the lack of HPPs in Kosovo, and thermal ones in Albania. This collaboration cannot present itself as a justification for not building new TECs in Albania, rather it must flow into the exchange of electricity between the two countries in particular moments of energy needs. This proposal was examined by the energy authorities of the two countries; for the moment there are already exchanges, which we hope to be implemented further in the future through long term agreements.

4. PPP options in Albania

The need for Project Financing through BOO / BOOT type schemes in the energy sector consists in the financing of a particular economic unit (Lock, 2003), or of an investment project economically separate from its promoters (Steffen, 2018), whose lenders evaluate its creditworthiness on the basis of cash flows generated. It consists in the constitution of an independent legal entity for the realization of an economic initiative financed with debt without recourse (and with risk capital), whose only source of remuneration is represented by the cash flows produced during management (Grimsey & Lewis, 2007).

The main feature of the tool consists in the separation between the project and its sponsors through the establishment of an ad hoc company, called SPV - special purpose vehicle - capable of isolating the initiative, its cash flows and its risks, from a legal, economic, patrimonial and technical point of view (through the so-called ring fence) from the business activities of the individual promoters. The success of the project is also based on a system of contractual guarantees, a security package, which makes it possible to allocate responsibility for the risks associated with the project to the numerous parties involved in the operation, through a complex system of contracts (Weber, Staub-Bisang, & Alfen, 2016).

In general, when financial conditions are inadequate to support new generation projects, IPPs can be invited to develop, build and operate new power plants with the necessary clauses to supply the available capacity to connected quantities of energy. Even if the investment has the financial resources necessary for the construction of new plants, it is important to continue an investigation of the price auction processes, among the various IPP choices. The government must thus encourage the construction of privately run power plants, to encourage competitiveness in the sector.

This scheme is used for the construction of public administration charging infrastructures and requires the administration to pay a fee for the availability of the infrastructure and related services. At this moment, the idea is spreading among many public administrations, also as a result of positions with poor technical validity, that leasing represents a more efficient solution for carrying out tariff-based operations on the PA, as an alternative to the PF, considered burdensome, complex and subject to frequent bankruptcies. The criticalities of the PF will certainly weaken leasing as well, considering that the two instruments can be assimilated and that the ineffectiveness of the first is not attributable to the nature of the instrument, but rather to the way in which it was used. In the United Kingdom, France and Spain, in fact, the PF for the construction of infrastructures with charges on the PA (such as healthcare investments or public lighting systems) is based on a leasing scheme (the so-called BLT - build lease and transfer), precisely because the infrastructure created is leased to the public company for the duration of the concession. The operation is then associated, in relation to the specific needs of the public administration, with the management of some or all of the non-core services. Therefore, in these three countries there is no formal distinction between two substantially identical instruments, which indeed merge to originate the so-called PF with pricing on the public administration.

The projects suitable for the development of PPPs are the central ones, which can be built in a relatively short period (less than 2 years), with a flexible operation in both maintenance and fuel. The best technologies available in the sector, aimed at meeting the above requirements are fuel oil or natural gas plants with combined combustion cycle (CCGT).

Cycle gas turbines (*Combined Cycle Gas Turbine*) can use both fuel oil and natural gas (when available) mixed fuel. They can have variable capacities, from 60 to 600 MW. The main advantage of CCGT plants is their net efficiency, which nowadays reaches up to 58% for large units, and up to 50% for smaller ones. In this direction they are considered among the best energy systems, which use fossil fuels. On the other hand, it is important to specify that CCGT plants have relatively low investment costs, even for small units.

As far as thermal energy is concerned, the most convenient technologies are:

TEC with combined turbine cycle (CCGT); distillate petroleum fuel or liquefied gas TEC with gas turbines (SCGT); distillate petroleum fuel or liquefied gas; Conventional TEC of steam turbines: coal or mazut fuel.

In the hydro-energy sector, in addition to the reconstruction of small power plants already underway, the most realistic projects to be implemented are the HECs of:

Bushati (84 MW) on the Drin River; Skavica (250 MW) on the Drini i Zi river.

The two projects that proved to be more convenient are that of Bratila and that of Skavica , also with respect to the construction of the TECs. Their marginal cost is lower only if petroleum distillate is used in the TECs, while if liquefied gas is used, the TECs are more advantageous.

In addition to this, all investments in the southern part of the country bring benefits on the side of energy transmission. As for the other HECs, these are more expensive than the petroleum distillate TECs.

5. Discussion and Conclusions

The project financing in Albania has mainly two possible directions, it can be non - recourse (the lenders finance the SPV and in the event of default there is no possibility of relying on the sponsors) and limited recourse (the sponsor can take on a further risk than that of simply subscribing a share of the capital of the SPV) and in addition we can distinguish the works into: warm (works that are able to generate revenue streams suitable for repaying the loan), cold (works that do not generate income but are socially useful: the state pays a quid to the sponsors) and lukewarm (works that partly generate revenues and are also subsidized by the PA).

The organization of the energy market, in order to operate in a medium-long term path, needs access by third parties as soon as possible, free to enter into bilateral contracts with local operators. This environment must guarantee energy producers the right to choose the counterpart, without binding the offer to the distribution monopoly. Furthermore, the public transmission operator (OST) must guarantee flows in the network without placing preference constraints on the local market. All these operations must be supervised by the public Authority for the Regularization of Electricity (ERE). Given the peculiarity of the energy asset and the very fragile balance of its marketing, only these guarantees can push foreign investors to venture into the Albanian market.

In previous years, many international consortia have expressed interest in the construction of hydroelectric plants, but also thermoelectric ones, setting up contractual formats of the IPP type. Potential investors later asked for long-term PPA contracts with KESH and OST. These agreements are essential in securing the financing of the investment scheme.

Given the importance of the energy sector in Albania, as the fulcrum of the country's much-suffered economic take-off, the promotion of private investments in the sector is a strategically important commitment. Analyzing the premises of the energy market, the liberalization of production operators, the conditions seem more than attractive. Domestic capital is generally insufficient to make the necessary investments in the medium-large generation. Foreign direct investments may unlock the situation, given the persisting contractual and regulatory obstacles. In order to foster a safe climate for investments in the energy sector, the country needs a transparent and coherent institutional framework, in order to favor independent investments in power plants (IPP). The liberalization process of the energy market has adopted the Bilateral Market model in the medium to long term. The institutional context must adapt to support projects of this type, drawing inspiration from the best international experience gained in the field.

In addition to this, during the transitional period of the opening of the electricity market, provision will be needed to be implemented in Public Private Partnership projects. In this direction, it is possible to take advantage of the experience gained in the USA, UK, Spain, etc., that the most efficient ways for an immediate start-up of the electricity markets are the medium-long term Agreements for the Purchase of Energy PPA (Power Purchase Agreements) (Churchill, 1996). These agreements smoothen the way to the new market, providing a necessary grace period for the profitable commercialization of electricity.

The institutional context must encourage these PPAs, especially during the initial and transitional phase of the liberalization of the energy market. In addition to this, the regulatory

environment must comply with the EU guidelines and directives, not only in anticipation of a forthcoming integration into the Union, but also to give signals of transparency to potential investors. In this way it is possible to guarantee financial sustainability for energy projects, and to guarantee the security of energy supplies in the years to come.

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NOVEL AFFORDABLE, RELIABLE AND EFFICIENT TECHNOLOGIES TO HELP ADDRESSING THE WATER-ENERGY-FOOD NEXUS

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ABSTRACT

Improving the food system sustainability and security has become an urgent global challenge. In this regard, one of the most effective routes is the shift of the human diet toward healthier and more sustainable consumption, involving in particular the prevalence of plant-based food. Controlled hydrodynamic cavitation (HC) technologies could help considerably in this transition. HC techniques are gaining increased scientific interest, and are quickly spreading across a wide range of technical fields, recently showing surprising performances with biological raw materials related to the food, agricultural and forestry sectors and resources. HC processes enjoy recognized advantages in the acceleration of the processing steps of plant-based food, the extraction of valuable bioactive compounds, the reduction and the valorization of waste streams, as well as the superior efficiency in resource use, energy consumption, process yield, and exergy balance than competing processes. Thus, HC is very promising candidate to help addressing the water-energy-food nexus, and, ultimately, sustainability. Findings obtained from direct experimental trials and recent literature concerning applications to food processing, provide a strong basis for novel investigation aimed at standardization, starting from the identification of the most suitable devices and the optimal processing parameters, eventually oriented to further spreading of HC applications.

KEYWORDS: affordability; food; health; hydrodynamic cavitation; process yields; sustainability; water

1. Introduction

Food production accounts for a large share of the anthropogenic environmental impacts. Almost half of the ice-free land area of the Earth is used as cropland or pastureland, with the global agriculture and food production systems releasing more than 25% of all greenhouse gases (GHGs) (Tilman & Clark, 2014), as well as being responsible for about one third of the soil degradation, and the main driver of losses of biodiversity (Bajželj et al., 2014).

The food production system is the largest user of freshwater and a key driver in pollution of aquatic and terrestrial ecosystems, due to agrochemicals and excessive use of nitrogen and phosphorus (Springmann et al., 2018). At the European level, the food sector is still one of the most water and energy demanding sectors (Rohmer, Gerdessen, & Claassen, 2019).

In a recent study, it was estimated that, worldwide, 5.2 billion ton of carbon dioxide were emitted in 2010 by the food system (Springmann et al., 2018). As well, it occupied 12.6 million km² of cropland, used 1,810 km³ of freshwater resources from surface and groundwater (bluewater), and spread 104 Tg of nitrogen, and 18 Tg of phosphorus in the form of fertilizers.

In the same study, the food production and consumption were projected to change between 2010 and 2050 because of the expected socioeconomic dynamics, such as the global population growth by about a third, and a tripling of the global income. As a result, the environmental

pressure of the food system was predicted increasing by 50–92% for each indicator, in the absence of technological change and other mitigation measures, with GHG emissions growing by an average of 87%, cropland use by 67%, and bluewater use by 65% (Springmann et al., 2018).

The urgency for securing food supply chains was also pointed out by several authors. It was based on rising population and income in emerging countries, leading to predict a doubling of food demand from 2000 to 2050, as well as on the impending shortage of both the needed energy inputs and the availability of further agriculturally usable land (Motesharrei et al., 2017; Taylor & Tainter, 2016).

The sustainability of food production and supply chains is driven by energy efficiency, functionality, and waste reduction, as well as healthy diets are generally more sustainable. Indeed, it was estimated that the economic benefits of a shift to plant-based diets, due to reduced health care costs, would surpass the value of the environmental benefits, overall benefits totaling up to 13% of global gross domestic product in 2050 (Springmann, Godfray, Rayner, & Scarborough, 2016).

On the environmental side, as pointed out by a recent study, the reason underlying the benefits brought by a shift to plant-based diets lies in the very limited conversion rate, around 15%, of proteins derived from vegetable raw materials, used to feed livestock, which become eventually available to human consumption (Di Paola, Rulli, & Santini, 2017). Therefore, the food production model based on animal-based proteins is much more expensive in terms of land area (2.4 to 33 times), and GHG emissions (2.4 to 240 times).

New or emerging technologies, aiming to improve or even replace existing ones in specific segments of the food production chain, should comply with the need for higher water and energy efficiency standards, as well as help to facilitate the transition to plant-based food. Among such technologies, those based on controlled hydrodynamic cavitation (HC) stand out for their relative cheapness and straightforward scalability, as well as the capability to enhance the extraction of bioactive compounds from plant materials, as extensively documented in a recent review for the fields of vegetable beverages and the wider food production and supply chain (Albanese & Meneguzzo, 2019a).

HC is defined as the phenomenon of generation, growth and collapse of microbubbles due to pressure variations in a liquid flow, triggered and sustained by several different methods. The most practical and scalable methods foresee pumping the flow through one or more constrictions of suitable geometry, such as Venturi tubes and orifice plates, in comparison to which, devices based on rotating parts are much more expensive, and impose higher operating and maintenance costs (Sarvothaman, Simpson, & Ranade, 2018).

The increase in kinetic energy at the constriction occurs at the expense of pressure, leading to microbubbles and nanobubbles generation, which subsequently collapse under pressure recovery downstream of the constriction (Gogate & Pandit, 2001). The violent collapses of the cavitation bubbles result in the generation of localized hot spots endowed with extremely high-energy density (Pawar, Mahulkar, Pandit, Roy, & Moholkar, 2017; Yasui, Tuziuti, Sivakumar, & Iida, 2004), highly reactive free radicals and turbulence, which can result in the intensification of various physical/chemical phenomena.

Recently, cavitation-based technologies got remarkable attention as efficient and affordable routes to the intensification of different physical and chemical processing applications, from wastewater remediation (Ciriminna, Albanese, Meneguzzo, & Pagliaro, 2017; Dindar, 2016;

Doltade et al., 2019), to preparation of nanoemulsions, biodiesel synthesis, water disinfection, and nanoparticle synthesis (Carpenter, Badve, et al., 2017), and many others. As well, in the recent past, cavitation gained a great reputation as a greener extraction method, and for its usefulness in the intensification of food and pharmaceuticals processes (Carpenter, Badve, et al., 2017; Panda & Manickam, 2019a), mainly due to its capability to remove or degrade toxic solvents, reduce process time and energy consumption, and achieve higher extraction yield.

This review discusses the current state of HC applications to the food production chain, whose potential for large-scale, advantageous implementation has been largely recognized as not only feasible, but also relatively fast and straightforward. However, their full exploitation at the market level has been so far hindered by a persisting lack of standardization (Sarvothaman et al., 2018).

2. Fundamentals of Controlled Hydrodynamic Cavitation

This short presentation of fundamentals of HC processes is limited to non-moving setups, such as Venturi tubes and orifice plates, i.e., the most practical and convenient ones, as mentioned in Section 1. Fig. 1(A) represents a circular-shaped Venturi tube with a convergence section, a nozzle, and a divergence section, whose respective geometries, in particular convergence and divergence angles, are dictated by a fairly long history of experiments, theory, and numerical modeling (Albanese, Ciriminna, Meneguzzo, & Pagliaro, 2015). Fig. 1(B) represents a slit Venturi, generally endowed with higher performances in comparison with the circular setup (Carpenter, Badve, et al., 2017).

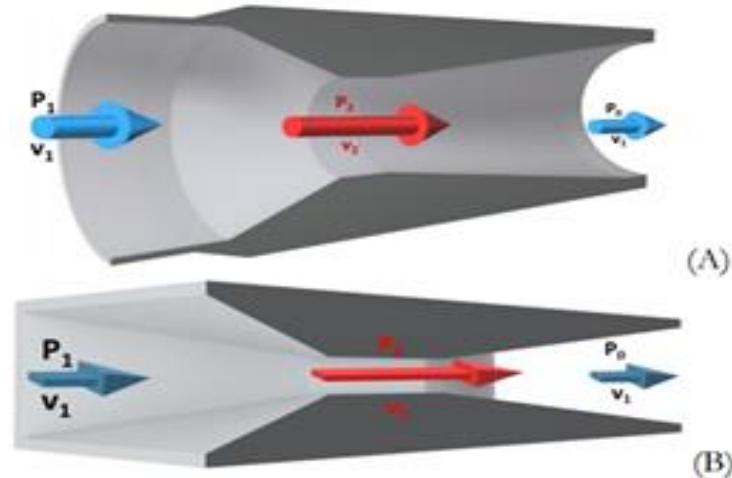


Figure 1. Schematic representations of HC reactor in the form of a circular (A) and slit (B) Venturi tube. P_1 , P_2 , and P_0 , are the upstream bulk pressure, the pressure at the nozzle, and the downstream bulk pressure, respectively, whereas v_1 represents the fluid speed, upstream and downstream of the HC reactor, and v_2 represents the fluid speed at the nozzle of the HC reactor.

The liquid acceleration, and the respective pressure drop, are regulated by the Bernoulli's equation (Pawar et al., 2017), i.e., the conservation of the mechanical energy for a moving fluid, represented in Eq. (1):

$$P_1 + \frac{1}{2} \rho v_1^2 + \rho g h_1 = P_2 + \frac{1}{2} \rho v_2^2 + \rho g h_2 \quad (1)$$

where P_1 and P_2 (Nm-2) are the upstream bulk pressure, and the pressure at the nozzle, respectively, ρ (kgm-3) is the fluid density, v_1 and v_2 (ms-1) are the fluid speed upstream and through the nozzle, respectively, h_1 and h_2 (m) are the heights of the fluid, and g (ms-2) is gravity. The third term at each side of Eq. (1) represents the specific potential energy, while the second term represents the specific kinetic energy. Assuming equal heights, the pressure drop ($P_2 < P_1$) at the reactor's nozzle arises because of the fluid acceleration due to mass conservation ($v_2 > v_1$). Whenever P_2 drops below the vapor pressure, at a certain temperature level, local evaporation occurs, and vapor bubbles are generated.

The dynamics of cavitation bubbles is quite complex. In a recent comprehensive article on HC dynamics, the Rayleigh-Plesset equation of bubble dynamics, representing the radial motion of the cavitation bubble, is only one in a set of four basic equations, the others representing the diffusive flux of water vapor molecules, the heat conduction across bubble wall, and the overall energy balance (Pawar et al., 2017). However, a widely used dimensionless quantity, named cavitation number (σ) and derived from the Bernoulli's equation, can be used to characterize the cavitation intensity in a flow system, in terms of easily measurable physical quantities. Its representativeness holds in most of relatively simple HC reactors, such as Venturi tubes and orifice plates (Pawar et al., 2017), and relate it with the cavitational intensity, with cavitation generally arising for $\sigma < 1$. The cavitation number is represented in Eq. (2):

$$\sigma = (P_0 - P_v) / (0.5 \cdot \rho \cdot v_2^2) \quad (2)$$

where P_v (Nm-2) is the liquid vapor pressure (a function of the average temperature for any given liquid), and the other symbols have the same meaning as in Eq. (1). Apparently, σ represents the ratio between the pressure drop needed to achieve vaporization, and the specific kinetic energy at the cavitation inception section. Despite some recent, motivated criticism (Šarc, Stepišnik-Perdih, Petkovšek, & Dular, 2017), σ allows representing the features of HC processes with confidence for most of practical purposes (Soyama & Hoshino, 2016), provided that the relevant quantities are measured properly.

Briefly, three intervals in the range of values assumed by the cavitation number were identified, corresponding to distinct HC regimes (Bagal & Gogate, 2014; Gogate, 2002):

- $0 < \sigma < 0.1$ – cavitation can be chocked, with an almost stationary bubble cloud arising from the merging of individual bubbles, and no, or very weak and rare, collapsing events, in a regime called supercavitation.
- $0.1 < \sigma < 1$ – cavitation is developed, with fairly strong and frequent collapses.
- $\sigma > 1$ – cavitation becomes residual, depending on the nature and concentration of impurities and dissolved gases, and virtually absent for $\sigma > 4$, with rare but very strong collapses.

However, cavitation regimes are subtly modulated by several details, such as the reactor's geometry (Carpenter, Badve, et al., 2017; Šarc et al., 2017), the flow rate and the inlet pressure, the geometry and the mechanical power of the impellers (Carpenter, Badve, et al., 2017; Pawar et al., 2017), as well as the content in dissolved gases and solid particles (Patil & Pandit, 2007). The medium temperature also plays an important role, with a peak in cavitation aggressiveness around 60°C (Dular, 2016; Li, Yang, Shi, Zhao, & Li, 2018). Cavitation processes concentrate the energy of the bulk liquid medium, up to extremely high local density, into a myriad of microscopic hot spots, located at the collapse of the bubbles (Pawar et al., 2017; Yasui et al., 2004). As a result, extreme physical phenomena arise, such as temperature and pressure

transients up to 5,000-10,000 K and >300 atm, respectively, very strong shear forces, micro-jets and pressure shockwaves. Powerful oxidants form, such as hydroxyl radicals ($\cdot\text{OH}$, oxidation potential 2.80 eV), as a result of water splitting (Yasui et al., 2004), whose generation was explained by a set of reactions based on theoretical and experimental arguments (Carpenter, Badve, et al., 2017; Ciriminna et al., 2017; Sarvothaman et al., 2018).

While oxidation processes are needed for the degradation of organic contaminants, they are harmful for the quality of processed food liquids (Ngadi, Latheef, & Kassama, 2012). However, within the range of HC regimes used in food applications, and absent any specific oxidizing additives, such processes are too mild to represent a real threat (Yusaf & Al-Juboori, 2014). Actually, no oxidation whatsoever was observed either in wort or in final beer produced by means of HC-assisted brewing processes (Albanese, Ciriminna, Meneguzzo, & Pagliaro, 2017).

As extensively discussed in a recent review study (Albanese & Meneguzzo, 2019a), among fixed HC reactors, Venturi tubes were preferred over orifice plates in the treatment of viscous food liquids. This superiority holds especially with liquids containing solid particles, as well as for the inactivation of spoilage microorganisms (Albanese et al., 2015), and for the creation of oil-in-water stable nanoemulsions (Carpenter, George, & Saharan, 2017).

However, a virtually endless variety of Venturi reactors exists, leading to different results in terms of process yields. At the respective optimized geometries, as a rule, slit Venturi reactors outperform circular Venturi in terms of process yields. This holds, for example, for the removal of total organic content from recalcitrant pollutants in wastewater, and for the creation of stable oil-in-water nanoemulsions; as well, wide margins exist for further improving the performances, including the effect of the slit length as a function of its height (Barik & Gogate, 2017; Carpenter, Badve, et al., 2017; Ramisetty, Pandit, & Gogate, 2014).

3. Hydrodynamic Cavitation and the Water-Energy-Food Nexus

3.1 Water and energy in the food production chain

The food production chain revolves around water, with the main clean water fluxes involved in food growth (farming), cleaning and processing, and wastewater streams deriving from the water discharge after any of the above-mentioned uses, with wastewater, desirably, not simply discharged as sewage, but recovered for further use.

Energy supply, in turn, powers cleaning and remediating systems for input water and wastewater streams, as well as food-processing devices, the latter comprising essential steps, such as those aimed at grinding and homogenization, ensuring microbiological and physical stability, and food storage. Substantial amounts of energy, as well as other resources such as soil improvers and fertilizers, and pesticides, are also required to grow food.

The food itself supplies energy to humans, along with macronutrients and micronutrients. Vitamins and other micronutrients, such as certain phytochemicals available in plant-based food, modulate the effectiveness of the physiological use of food energy, and are essential for health and well-being (Bayram et al., 2018; Willett et al., 2019). Thus, food-manufacturing processes are desirable, which combine the capabilities of producing safe, health-effective, and durable products, while achieving high process yields (i.e., actual net production of desired products per unit energy supplied to the process) with regard to target properties of the products. Based on the desirable spreading of plant-based food in the human diet, as highlighted in Section 1, processes able to enhance the nutritional and nutraceutical value of products

derived from vegetable materials, including unconventional sources, such as waste and byproducts of the food and biomass processing chains, would be extremely desirable too.

3.2 Energy-saving HC applications in the food production chain

Basically, HC's outperformance over conventional techniques lies in the fact that physico-chemical and biological reactions and processes can be carried out faster and more efficiently at ambient conditions, and at a lower cost, due to the intense energy delivery at the molecular level in the course of bubbles collapse (Carpenter, Badve, et al., 2017). Consequently, HC processing times were found generally shorter than in conventional extraction techniques, due to the maximization of the mass transfer coefficient generated by cavitation, translating into lower energy consumption (Cravotto et al., 2018).

In applications requiring working temperatures above the room level, such as in water disinfection and food pasteurization and sterilization, the heating efficiency can affect remarkably the process yields. HC processes showed excellent heating efficiency with a rotor-stator setup of the reactor (Sun et al., 2018). As well, all else being equal, the thermal efficiency was surprisingly higher when a closed loop pumping system comprised a Venturi-shaped HC reactor (Bermejo, Escaler, & Dular, 2018). It should also be noted that electricity is the only power source for HC processes, and it is increasingly generated worldwide by means of renewable energy sources; thus, spreading the adoption of HC techniques would contribute to a substantial improvement of the exergetic sustainability of the food production chain (Zisopoulos, Rossier-Miranda, van der Goot, & Boom, 2017).

A recent, comprehensive and authoritative review explored the main fields where HC can be applied, as a process intensification technique, with distinct advantages over competing techniques (Holkar, Jadhav, Pinjari, & Pandit, 2019). Such processes include water disinfection, wastewater treatment, emulsification, crystallization, synthesis of nanomaterials, delignification, depolymerization, and extraction from biological materials, resulting in higher energy efficiency and process yield, higher efficacy, reduced resource use (solvents, surfactants, oxidizing reagents, etc.), lesser or no toxic byproducts, and, sometimes, higher quality products. Moreover, in the same study, HC's superiority over other cavitation techniques, such as the acoustic and optic ones, was firmly asserted, in terms of efficacy beyond the laboratory scale, energy efficiency, and scalability, although this topic was substantially decided long ago (Gogate & Pandit, 2005; Gogate et al., 2001; Save, Pandit, & Joshi, 1997).

In another recent review, the process yield metric was standardized, aimed at the objective comparison of the energy efficiency of different processes and competing technologies resulting in the same products (Albanese & Meneguzzo, 2019a). Yields resulting from HC-assisted processes always exceeded the corresponding figures associated to any other technology, either conventional or newer, with acoustic cavitation (AC) lagging behind by a factor greater than three. In particular, conventional heat treatment, typical of food pasteurization processes, while outperforming some of the newer techniques, such as high pressure or pulsed electric field, lagged behind HC by a factor of at least 1.2. However, in the case of complex processes, implemented in a single unit operation HC-based system, such as for beer-brewing (Albanese et al., 2017), with pasteurization being only one among many different process steps, the outperformance rose to a factor of around 2.5, or even higher under particular brewing conditions (Albanese, Ciriminna, Meneguzzo, & Pagliaro, 2018).

Lately, higher process yields achieved by means of HC processes were shown for different applications. In the enhancement of biochar properties, HC processes achieved process yields 7 to 30 times higher in comparison with conventional slow thermal pyrolysis (Albanese, Baronti, et al., 2019). In the food production field, the HC-driven lethality effect for yeasts, and heat-resistant molds, was shown to be higher by at least an order of magnitude in comparison with high-pressure homogenization, and two orders of magnitude in comparison with AC (Fan, Martynenko, Doucette, Hughes, & Fillmore, 2018).

3.3 Water-saving HC applications in the food production chain

HC processes can contribute to save and preserve freshwater resources in different stages of the food production chain. A recent study investigated the effects of irrigation with tap water enriched with air micro- and nano-bubbles, generated by means of a Venturi tube HC reactor provided with an air inlet valve, on some morphological and physiological properties of cucumbers grown in greenhouse (Dahrazma, Naghedinia, Ghasemian Gorji, & Saghravani, 2019). Stem length, leaves number, blossom number, chlorophyll a, chlorophyll b, and carotenoids, increased by 1.14, 2.86, 3.80, 1.34, 1.44 and 1.35 times, respectively, in the plants after 12 weeks. The higher crop yield, and the enhanced functional properties, could help saving farming cost, land consumption, and irrigation water.

Irrigation water can be saved for crops growing in soils showing higher water-retaining properties. Biochar manufactured with the assistance of HC processes showed enhanced physical properties, likely leading to increased water retention when deployed in the soil (Albanese, Baronti, et al., 2019).

HC processes were shown able to extract more phytochemicals, such as polyphenols and flavonoids, and achieve remarkably higher antioxidant activity, in comparison with conventional extraction techniques, without the use of any synthetic solvent, i.e., with water as the only solvent. Case studies included cereals and fruits (Lohani, Muthukumarappan, & Meletharayil, 2016), as well as other vegetable and plant materials, such as fir needles (Albanese, Bonetti, D'Acqui, Meneguzzo, & Zabini, 2019). Solvent- free extraction allowed not only the extraction of healthier and safer products, but also a reduction of waste byproducts and wastewater, thus, in principle, the reuse of processing water, or even the direct use of the resulting aqueous solutions for human consumption. Many studies demonstrated the higher comparative efficacy and efficiency of HC processes in the mineralization, degradation, and reduction, of the total organic content and the chemical oxygen demand of wastewaters containing organic pollutants. The respective performance increased with the use of suitable oxidizing additives, such as hydrogen peroxide, in remarkably lower doses in comparison with conventional techniques, as well avoiding the generation of hazardous byproducts (Ciriminna et al., 2017). The removal of persistent and recalcitrant pesticides was especially interesting for applications to farming-generated wastewater (Panda & Manickam, 2019b).

Finally, HC processes have shown unrivaled ability in the real-scale disinfection of water from spoilage and harmful microorganisms, with a curious double peak of efficacy, one in the developed cavitation regime at relatively high levels of the cavitation number (Albanese et al., 2015; Carpenter, Badve, et al., 2017), the other in the supercavitation regime (Šarc, Kosel, Stopar, Oder, & Dular, 2018). As well, laboratory-scale HC processes were shown able to inactivate even some viruses (Kosel et al., 2017). Combined capabilities to effectively and efficiently remediate and disinfect wastewater, in principle could allow their reuse for further irrigation, leading to the saving of freshwater resources.

3.4 HC-driven exploitation of plant-based food

As shortly discussed in Section 1, the shift to a plant-based diet is likely to be the single most important step to alleviate the burden of the food production chain on the terrestrial ecosystems and the climate. As well, it is likely to lead to comparable or even greater benefits to the general health, alleviating the related economic burden.

Evidence has accumulated about significant inverse correlations between plant antioxidants intake and the risk for cardiovascular diseases, type 2 diabetes, hypercholesterolemia, some cancers, and other globally spreading chronic diseases (Albanese et al., 2018; Tang et al., 2017), as well as no recommended upper limits apply to the intake of antioxidants, for the purpose of health benefits. Indeed, a monotonic increase of the ratio of the antioxidant activity (AA) to the oxidant status in the human blood serum (serum antioxidant/oxidant balance), with the long-term intake of antioxidant bioactive compounds, was recently found, and related to a sort of homeostatic equilibrium (Laus et al., 2017; Soccio, Laus, Alfarano, et al., 2018).

Lately, by means of a novel AA assay, more representative of the real human physiology, a very effective synergism was demonstrated among mixtures of food-grade extracts, as well as among hydrophilic, lipophilic and insoluble-bound phenolic extracts (Soccio, Laus, Flagella, et al., 2018). Such synergism was up to two orders of magnitude greater than revealed by means of classical *in vitro* assays. This result supported the long-known evidence about the higher effectiveness of mixtures of plant phytochemicals (including phenolics, carotenoids, vitamin E, lignans, β -glucan, inulin, resistant starch, sterols, and phytates), for the prevention of cancer, cardiovascular disease, type 2 diabetes, and all-cause mortality, in comparison to single phytochemicals (Rui Hai Liu, 2004, 2007). So much, that it was recommended long since to acquire antioxidants or bioactive compounds through whole-food consumption, rather than from expensive dietary supplements (R. H. Liu, 2013).

Therefore, processing of plant foods, including vegetable beverages, should at least avoid damaging the bioactive phytochemicals, for example due to thermal degradation (Domínguez Avila, Wall Medrano, Ruiz Pardo, Montalvo González, & González Aguilar, 2017), while preserving their variety and abundance, including bound phenolics. Whole beverages, possibly including multiple functional ingredients, have the potential to convey superior health benefits than extracts, supplements, and single-ingredient beverages, provided that bioactive compounds are effectively extracted in the liquid phase, as well as go mostly undamaged in the processing. Moreover, processing costs should be kept as low as possible, translating into affordability for end users, as well as the sensorial properties of the products should be as attractive to the general public as possible.

HC processes can lead to enhanced extraction of bioactive compounds in the aqueous phase (i.e., in the end product), by means of the increased release of the respective fraction bound in carbohydrates, lignin, pectin, and proteins, due to the increase of the mass transfer rate and the interphase area (Cravotto et al., 2018; Panda & Manickam, 2019a). Combined with the reduced degradation of the bioactive compounds, due to lower working temperatures (Martynenko & Chen, 2016), higher AA levels could be achieved (Albanese & Meneguzzo, 2019a).

In the case of blueberry (Fan et al., 2018; Martynenko, Astatkie, & Satanina, 2015; Martynenko & Chen, 2016), and cranberry (Chen & Martynenko, 2017), the HC-based enhanced extraction of bioactive compounds (especially anthocyanins) from the whole fruits, combined with superior shelf life achieved at moderate temperatures, allowed straightforward industrialization (“Healthy Berries Ltd – Superfruit Purée,” 2019). With sorghum flour and apple pomace, the HC treatment led to AA increasing by 38.6% and 97%, respectively (Lohani et al., 2016).

In the HC-assisted brewing process, increased extraction of polyphenols, and higher AA, was shown with raw unmalted grains (Albanese et al., 2018), as well as boosted extraction of prenylflavonoids from pelletized hops (Ciriminna et al., 2018), both leading to improved healthy properties and shelf life of the end product. Along with higher process yields (Albanese & Meneguzzo, 2019b), these distinctive advantages allowed the development of the HC-based brewing system up to the industrial level (CAVIBEER | CNR & Bysea S.r.l., 2018).

High content of polyphenols and flavonoids, and surprisingly high AA, were revealed in aqueous solutions obtained by means of real-scale, HC-driven solvent-free extraction of silver fir (*Abies Alba* Mill) needles in a concentration as low as 0.44% w/v (Albanese, Bonetti, et al., 2019). In particular, the in vitro AA at the level of 10 μ g/ml (IC50, DPPH assay) was higher than shown by most reference substances, as well as by vitamins C and E.

The transition to plant-based diets could be facilitated by the full exploitation of nutrients, mainly proteins, which are generally available in lower concentration than in animal-based food. Reduction of particle size and effective cell disruption were the basic steps allowing a HC-based high pressure homogenization treatment to increase the protein availability from soybean processing materials, especially slurry, with the protein extraction yield increased by 82% (Preece, Hooshyar, Krijgsman, Fryer, & Zuidam, 2017). The HC treatment was found to outperform the AC one, as well as showed straightforward scalability. HC-based manufacturing of soymilk is already an industrial reality (“Food industry - TECNIDOS Sistemas y Procesos,” 2019).

HC processes found convenient application also with unconventional, land-neutral plant materials, such as microalgae. High HC-driven extraction yield of lipids (25.9–99%) from microalgae (*Nannochloropsis salina*) was obtained, due to the effective cell disruption, showing decreased energy consumption and straightforward scalability (Lee & Han, 2015), as well as it emerged as the fastest process of lipid extraction in comparison to conventional methods (Setyawan, Mulyono, & Budiman, 2018). HC-based edible oil (including algae’s oil) extraction and refining technologies have already reached the industrial level (“Degumming | Arisdyne,” 2019; “Edible oil refining | Cavitation Technologies, Inc.,” 2019).

3.5 Advantageous HC applications in the food production chain

HC technologies, and the related methods, can help addressing any of the steps related to the food production chain, from farming to storage. A scheme highlighting the possible contributions of HC processes is shown in Fig. 2, with details provided in Table 1. It should be noted that biochar, which can be conveniently manufactured with the assistance of HC processes (Albanese, Baronti, et al., 2019), can in turn be applied to both soil amendment and water retention, and wastewater remediation. Moreover, the food processing step can be assisted by HC processes if the food material can be pumped along a hydraulic circuit, i.e., if it consists of a liquid or mixed solid-liquid matrix, such as, for example, beer wort containing water, grains, and hops (Albanese et al., 2017).

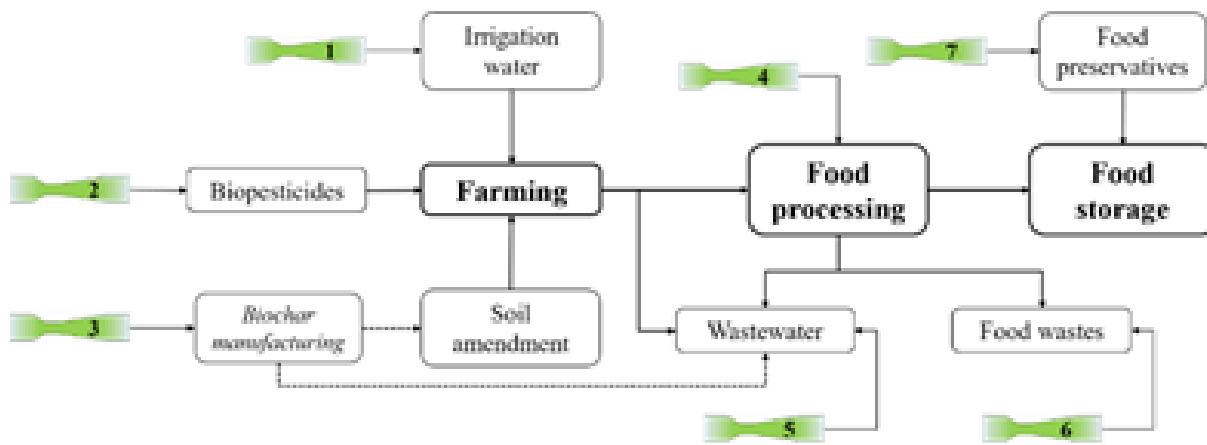


Figure 2. Partial scheme of the possible contributions of hydrodynamic cavitation processes to conventional food production chains. Numbers refer to HC processes applicable to different steps of the food production chains.

Table 1. Possible contributions of hydrodynamic cavitation processes to conventional food production chains: details.

Step ^a	Main applications	HC setup / regime ^b	Main relative advantages ^c	TRL ^d	References ^e
1	Desalination of sea and brackish water	Rotor-stator / supercavitation	Absence of scaling / fouling; higher energy and economical efficiency	3	(Zheng et al., 2019)
	Oxygen-enriched irrigation water	Venturi / developed cavitation	Increase in plant growth and enhancement of physiological indices	6	(Dahrazma et al., 2019)
2	Stable nanoemulsions of essential oils as biopesticides	Venturi / developed cavitation	Less use of emulsifiers/surfactants; more effective action; controlled and prolonged release	3	(Albanese, Bonetti, et al., 2019) ^f
3	Enhancement of biochar properties for soil amendment and water retention	Venturi / developed cavitation	Enhanced physico-chemical properties; higher energy efficiency and process yield	6	(Albanese, Baronti, et al., 2019)
4	Food liquids homogenization, pasteurization and sterilization, emulsification, extraction and reaction intensification, single-unit operation	Any setup / developed cavitation	Enhanced preservation of thermolabile compounds; enhanced physical and microbiological stability; higher energy efficiency and process yield	5-9	(Albanese & Meneguzzo, 2019b)
	Removal/degradation of organic and recalcitrant water pollutants	Any setup / developed cavitation	Less use of oxidizing additives; higher energy efficiency and process yield	5-9	(Ciriminna et al., 2017)
5	Water disinfection from bacteria and harmful microorganisms	Rotor-stator and Venturi / supercavitation	Enhanced microbiological stability; higher energy and economic efficiency	4	(Šarc et al., 2018)

6	Extraction of valuable bioactive compounds, solubilization	Any setup / developed cavitation	Economic valorization of food wastes; more efficient use of residues to feed livestock or biogas generation plants	9	(Grillo et al., 2019)
7	Extraction of antioxidant and antimicrobial compounds affecting shelf-life	Venturi / developed cavitation	Enhanced extraction rate; higher energy efficiency and process yield	8	(Ciriminna et al., 2018)

^a Numbers in this column refer to Fig. 2.

^b Relative to the cited reference.

^c In comparison with competing technologies.

^d Technology readiness level (Mankins, 2009).

^e Only the most representative or recent reference is supplied for each of the considered applications.

^f This reference recommends the relevant application for further research.

4. Discussion and Conclusions

At the current stage of development, hydrodynamic cavitation technologies are ready to favor a substantial efficiency leap in virtually any step of the food production chain, due to their applicability to many different processes, either stand-alone or in synergy with conventional techniques, the ability to intensify physico-chemical reactions and processes, the superior process yields, and the straightforward scalability. However, the lack of adequate standardization for any given application, affecting both the proper choice among different classes of HC reactors, and, within a specific class of reactors, the choice of the suitable process parameters, are still partially hindering the widespread adoption.

Nevertheless, industrial-level applications are emerging and fulfilling promises, while scholars are increasingly active in the search for new applications, and the definition of case-specific structural and process parameters. This review provided a short but hopefully representative view of the current trends.

About future perspectives, it should be noted that HC techniques can be applied to the processing of virtually any food material that has been the subject of experiments by means of AC techniques, provided that such material can be pumped along a piping system. Since AC has been experimented much more frequently, and with far more substances, than HC, including in food processing and extraction applications, although mostly at the laboratory scale, a virtually endless field of new applications for HC processes exists, with proven advantages, such as straightforward scalability and much higher process yields, likely to extend to any new case study.

As a representative example, AC-assisted extraction of polyphenols from maritime pine sawdust, a by-product from the industry of wood transformation, thus non-competitive with either food crops and land use, outperformed conventional maceration by 40% at the laboratory scale, such figure decreasing with scaling-up (Meullemiestre, Petitcolas, Maache-Rezzoug, Chemat, & Rezzoug, 2016). The opposite trend is expected for a possible HC application to the same process, which is thus recommended for further research.

Sometimes, industry seems to have taken advantage of research, to turn laboratory-scale AC applications into real-scale marketable HC systems. This is the case of the extraction of bioactive compounds from *Cannabis Sativa L.*, such as polyphenols, flavonoids, and cannabinoids, which was shown to increase at least by 100% under AC conditions, in comparison with the control extraction (Agarwal, Máté, Hofmann, & Csóka, 2018). In 2018,

a company introduced in the market an HC-based extraction system, claimed to treat the whole plant, converting cannabinoids into nanoemulsions, and, combined with moderate working temperatures, ensuring higher bioavailability, in addition to using much less solvents, and cutting production costs (“PhytoX | Hydrodynamic Extraction | Full Spectrum Extraction Cannabis,” 2018).

Both phytochemicals whose dietary intake is potentially beneficial to human health, and plants candidate for the respective extraction, are countless, with the *in vivo* effects still to be determined in most of the cases, let alone the possible synergisms and the methods of use, such as for the fortification of functional and medicinal beverages (Eksi, Kurbanoglu, & Ozkan, 2019). Either AC or HC have not yet been applied to the vast majority of plant materials and the extraction of the respective phytochemicals. This evidence, combined with quickly rising market trends for plant-based, healthy beverages, as well as for greener pesticides, offer research and applications concerning HC techniques and methods, with their proven competitive advantages, a bright future ahead.

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THE EFFECT OF BRANDING AND PACKAGING OF LOCALLY MADE COSMETIC PRODUCTS ON THE BUYING DECISION OF CUSTOMERS. A CASE STUDY OF COSMETIC PRODUCTS IN RIVERS STATE

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ABSTRACT

This paper is to examine the effect of branding and packaging of locally made cosmetic products on the buying decision of consumers. However, less has been done with respect to packaging from the point of view of the final consumer. The purpose of this study is to therefore focus on the consumer, and how the efforts put behind product packaging technology of locally made cosmetic products influence consumer purchase decision. This study was governed by three specific objectives; the assessment of graphics (colour and artwork), package dimension (shape and design) and information (labels), and how these key areas of packaging influence consumer buying decision of locally made cosmetic products. Ultimately, these aspects ought to reveal a general perspective of the impact of packaging on consumer buying decision of locally made cosmetic products. The research employed a descriptive design and sample size of 100 respondents were selected through a probability sampling design and was furnished with questionnaires to facilitate data collection. The information was then analysed and subjected to interpretation to further understand the association between product packaging and consumer buying decision of locally made cosmetic products. An analysis of the responses received by the sample population was subjected to various measures of description and inference to determine the said association, ultimately setting the direction in which the research inclined to. It was concluded that in support of the existing relationship between product packaging and consumer buying decision of locally made cosmetic products, firms in the cosmetic industry are justified in their efforts of designing attractive packaging in a bid to attract consumer interest and evoke purchase decision. The packaging variables have shown their importance both independently and cumulatively in communicating product quality and features in a manner that is competitive. A major recommendation emanating from this study is an academic inquisition into the role of package technology on consumer buying decision.

KEYWORDS: Branding, packaging, cosmetic products, consumers

Introduction

The department of environment (2010) defined packaging as “all products made of any material of nature to be used for the containment, protection, handling, delivery and preservation of goods from the producer to the user or consumer”. This definition holds a level of truth; that of the package being a product and as such ideally different from the product it contains. However, contrary to this, the view of a package as a product independent of the actual substance it bears is of little significance to consumers; theirs is a subconscious assumption of a synonymous nature between the package and the product contained within. As such it would therefore imply a linkage where a highly efficient and well-designed package would ultimately translate into a product of superior quality, yet researches have rarely isolated the cause of product satisfaction to the product’s package (Hess, Singh, Metcalf, & Danes, 2014). On the other hand, consumer

buying decision, derived from human behaviour has been viewed as a volatile concept, difficult to measure and predict. The burden of the success of a product has fallen into the hands of the marketer, who observes consumer behaviour to create an ‘appealing’ package, consequently manipulating packaging elements in order to turn the once ‘volatile concept’ into a predictable and economically measurable outcome (Levin & Milgrom, 2004). However, as the consumer changes in need, awareness and choice, and as competition grows to attempt to level the playing field, so must the marketer adapt their strategies accordingly.

The cosmetic market in Rivers State, over the past few years, has experienced an influx in the number of products available within the industry. From fragrances to skin care ranges, the consumer is spoilt for choice every time they walk into a retail store seeking for these items. Though top global brands such as Revlon, L’Oreal, Estée Lauder, Nivea, Avon and Oriflame (Rooney, 2011), have a presence in the country’s market, there is still cut throat competition from local players scrambling for a piece of the market (Situma, 2018). Gone are the days when a package was merely just a container that protected the product through various stages within the supply chain (Kotler & Armstrong, 2020), it is now also the last marketing communication tool that a company can use to advertise its product on the shelf of a retail store (Rundh, 2019).

Competition within this industry has forced local company stakeholders to invest in more attractive and innovative packaging to appeal to the consumer. A package is therefore highly instrumental in aiding a company’s positioning strategy as they target the consumer market. How the consumer places the value of the product within their mind, has quite a bit to do with the product quality in use (Ampuero & Vila, 2006). Since the consumer is faced with so many products every single time they visit a retail store, it is paramount that the package stands out from the rest of the array of similar products, and is attractive enough to evoke a choice. The package should be convincing, bringing together all its elements to appeal to the consumer’s need (Rundh, 2009, Kotler & Armstrong, 2010).

Cosmetic consumers in Rivers State enjoy a wide range of products that are attractively designed and packaged to appeal to their tastes and preferences. Local companies are bringing to the table various components of interest when it comes to the graphics, dimensions and information included in the package. Attempts are made at ensuring that the package meets the changing nature of preference of consumers, how they use the product, when they use it, and why they use it.

Statement of the Problem

The dynamic angle that comes into play is internationalization and the concept of the global village which have become widely embraced phenomena, sipping under the consumer’s aesthetics and consequently causing a product’s package to become somewhat of a volatile concept for every market player (Rundh, 2019). As cosmetic manufacturers reach a stalemate on consumer satisfaction where the parity among products is getting smaller and smaller, the package comes in as the final and most valued tool in determining consumer purchase decision (Rundh, 2009; Shah, Ahmad & Ahmad, 2019).

The cosmetic industry faces immense competition both from local manufacturers and global giants who have now found turf rather than lucrative to invest in and as such are bringing their products and services closer to the consumer (Situma, 2018). With the increase in competition, researchers have acknowledged the effect of product packaging on corporate investment with respect to capital and human labour. However, the issue arising, and that which has informed the undertaking of this study, is to determine whether the efforts put behind a cosmetic product’s package affects the consumer’s decision to actually purchase cosmetic products.

Objective of the Study

1. To assess the influence of graphics (colour and artwork) on consumer buying decision.
2. To analyse the role of package dimensions (shape and design) on consumer buying decision.
3. To measure the influence information on packaging bears on consumer buying decision.

Research Hypotheses

H01: There is no significant relationship between an attractive nature of a package colour, and its artwork on consumer buying decisions.

H02: There is no significant relationship between an attractive nature of a package dimension and consumer buying decisions.

H03: There is no significant relationship between product information provided on the package and consumers buying relationship

Significance of the Study

This study will test the relationship between a product's package and a consumer's decision to purchase based on the package. The information emanating from this research will be of benefit to the following;

- (a). Corporates: Cosmetic manufacturers and dealers with presence in the Rivers State market or future intention of the said, who are keen on market information with respect to product packaging and consumer buying decision, which may inform their strategies.
- (b). Researchers: Every study is of benefit to the realm of research in terms of knowledge addition and expansion. This study would be of benefit to researchers seeking information on marketing strategy of the cosmetic market in Rivers State and public with a focus on product packaging and consumers buying decision.

Scope of the Study

This research will look into the aspects of product packaging that may have an effect on consumer buying decision of the cosmetic products available in the Rivers State market. The study will be primarily carried out in Port Harcourt.

Limitations of the study

This study is undertaken to examine the effect of branding and packaging; however, the study is bordered on locally made products. This locally made products were restricted to cosmetics. The rationale behind this delimitation was to draw a concise and precise findings to specific products as regarding the effect of its branding and packaging. Also, due to the size of market, the Port Harcourt market was selected amongst several markets in Rivers State. This is because, the market holds the best prospect for this study and it is accessible to the student. Finally, this study concentrated on branding and packaging and not other forms of products promotion. It is also pertinent to state that the findings of this study may not be applied on non-cosmetics products across Rivers State.

Review of Literature

Conceptual framework

Packaging is an essential element of marketing strategy, serving as a crucial interface between the product and the consumer. It encompasses not only the physical container but also the design, graphics, and informational content aimed at attracting, informing, and persuading consumers (Kotler & Keller, 2016). In the context of the cosmetic industry in Ghana, where competition is fierce and consumer preferences continuously evolve, understanding the dynamics of packaging becomes paramount. Consumer behavior research has long emphasized the importance of packaging in shaping purchase decisions. Packaging serves multiple functions beyond mere protection and containment; it acts as a silent salesman, communicating brand identity, product attributes, and value propositions (Rettie, Burchell, & Riley, 2012). The visual and tactile cues provided by packaging influence perceptions of product quality, reliability, and desirability (Underwood, Klein, & Burke, 2001). The influence of packaging on consumer behavior extends to various dimensions, including aesthetics, functionality, and symbolism. Aesthetic attributes such as color, shape, and design play a critical role in capturing consumer attention and eliciting emotional responses (Labrecque, Patrick, & Milne, 2013). Studies have shown that consumers form initial impressions of products within milliseconds based on visual cues, highlighting the significance of packaging aesthetics in the purchase process (Orth & Malkewitz, 2008). Furthermore, packaging functionality, encompassing aspects such as ease of use, portability, and storage convenience, contributes to consumer satisfaction and repeat purchase intentions (Underwood et al., 2001). In the fast-paced consumer goods market, where convenience is highly valued, packaging that enhances usability and facilitates product consumption gains a competitive edge (Reimann et al., 2010). Beyond its practical and aesthetic functions, packaging serves as a symbolic medium through which brands communicate identity, values, and aspirations (Kapferer, 2012). The design elements, imagery, and messaging incorporated into packaging convey brand positioning, differentiation, and personality, enabling consumers to form associations and affiliations (Schroeder, Pennington-Gray, Donohoe, & Kiousis, 2011). For instance, premium packaging conveys notions of luxury, sophistication, and exclusivity, appealing to consumers seeking status and prestige (Han, Nunes, & Dreze, 2010). Theoretical frameworks such as stimulus-organism-response (SOR) theory and the elaboration likelihood model (ELM) offer insights into the cognitive processes underlying consumer responses to packaging stimuli (Keller & Lehmann, 2006). According to SOR theory, environmental stimuli, such as packaging cues, trigger internal psychological processes in consumers, leading to behavioral responses (Mehrabian & Russell, 2019). ELM posits that consumers engage in two distinct processing routes-central and peripheral-depending on their motivation and ability to process information (Petty & Cacioppo, 1986). Packaging elements may influence consumer attitudes and purchase intentions through either route, depending on factors such as involvement, expertise, and situational context. Empirical studies investigating the impact of packaging on consumer behavior have yielded mixed findings, underscoring the complexity of the relationship and the moderating influence of contextual factors (Dawar & Parker, 1994). While some studies have reported significant effects of packaging cues on product evaluations and choice behavior (Orth & Malkewitz, 2008), others have found limited or negligible effects, particularly when controlling for other marketing variables (Underwood et al., 2001) (Labrecque et al., 2013).

Theoretical Framework

In understanding the influence of packaging on consumer buying decisions, several theoretical frameworks provide valuable insights into the cognitive processes underlying consumer

responses to packaging stimuli. Two prominent theories that are particularly relevant to this context are the Stimulus-Organism-Response (SOR) theory and the Elaboration Likelihood Model (ELM).

Stimulus-Organism-Response (SOR) Theory:

The SOR theory posits that environmental stimuli (S) trigger internal psychological processes (O) in organisms, leading to behavioral responses (R) (Mehrabian & Russell, 2019). In the context of packaging, the stimuli refer to the various sensory cues presented by the packaging, including visual elements such as color, design, and imagery, as well as tactile sensations such as texture and shape.

When consumers encounter packaging stimuli, these cues activate cognitive processes such as attention, perception, and evaluation in the organism (consumer). For example, vibrant colors or attractive graphics may capture the consumer's attention, while informative product labels may facilitate the perception of product attributes and benefits.

The internal psychological processes activated by packaging stimuli influence the organism's affective and cognitive responses to the product. Positive affective responses, such as feelings of pleasure or excitement elicited by visually appealing packaging, can enhance consumer perceptions of product desirability and quality. Similarly, cognitive responses, such as the interpretation of product information and the formation of brand associations, play a crucial role in shaping consumer attitudes and purchase intentions.

Ultimately, the behavioral response of the organism, manifested as the decision to purchase or reject the product, is influenced by the cumulative impact of packaging stimuli on affective and cognitive processes. Brands can leverage the principles of SOR theory to design packaging that effectively captures consumer attention, elicits positive emotional responses, and communicates relevant product information, thereby influencing consumer buying decisions.

Elaboration Likelihood Model (ELM):

The Elaboration Likelihood Model (ELM) proposes that individuals engage in two distinct processing routes—central and peripheral—when evaluating persuasive messages (Petty & Cacioppo, 1986). The central route involves careful consideration and systematic processing of message content, while the peripheral route relies on heuristic cues and peripheral factors to make judgments.

In the context of packaging, consumers may employ either the central or peripheral route depending on their motivation and ability to process information. When consumers are highly involved or motivated to evaluate the product, they are more likely to engage in central processing, carefully scrutinizing packaging elements such as product information, brand reputation, and product attributes.

Conversely, when consumers have low involvement or limited cognitive resources, they may rely on peripheral cues such as packaging aesthetics, brand imagery, or social endorsements to make quick judgments about the product. In such cases, the visual appeal or symbolic associations conveyed by the packaging may exert a stronger influence on consumer perceptions and purchase decisions.

Empirical Review

Orth and Malkewitz (2008): In their study, Orth and Malkewitz examined the role of holistic package design in consumer brand impressions. They found that packaging attributes such as color, shape, and graphics significantly influenced consumer perceptions of brand personality, quality, and preference. Specifically, packages with cohesive and aesthetically pleasing designs were more likely to evoke positive brand impressions and enhance purchase intentions.

Underwood et al. (2021): Underwood and colleagues investigated the attentional effects of product imagery on packaging communication. They found that visually appealing packaging designs captured consumers' attention more effectively than plain or unattractive designs. Moreover, packaging elements such as images, logos, and product illustrations played a crucial role in conveying brand identity and product attributes, influencing consumer perceptions and purchase decisions.

Reimann et al. (2010): In their research on aesthetic package design, Reimann and colleagues explored the behavioral, neural, and psychological aspects of packaging aesthetics. They found that packaging aesthetics significantly impacted consumer preferences and choices, with visually appealing designs eliciting stronger positive emotions and purchase intentions. Additionally, neuroimaging data revealed distinct patterns of brain activation in response to different packaging stimuli, highlighting the neurocognitive mechanisms underlying consumer responses to packaging.

Labrecque et al. (2013): Labrecque and colleagues conducted a comprehensive review of color research in marketing, including its application to packaging design. They found that color plays a crucial role in shaping consumer perceptions, attitudes, and behaviors, with different colors evoking distinct emotional responses and associations. Moreover, color congruence between packaging and brand identity was found to enhance brand recognition and recall, facilitating consumer decision-making processes.

Research Methodology

Research Design

The research utilized a descriptive design to examine the relationship between packaging and consumer buying decisions. Descriptive research aims to describe and analyze the characteristics of a phenomenon without manipulating variables. This design was chosen to provide insights into consumer perceptions and behaviors regarding locally made cosmetic products in Port Harcourt.

Population and Sampling Design

The population for this study consisted of consumers of locally made cosmetic products in Port Harcourt. A sample size of 100 respondents was selected using a probability sampling design, employing stratified and systematic sampling techniques to ensure representation across different demographics.

Data Analysis Method

The data collected was analyzed using statistical methods, including descriptive statistics and inferential statistics. Descriptive statistics such as frequencies, percentages, means, and standard deviations were used to summarize the characteristics of the variables. Inferential

statistics such as correlation analysis and regression analysis were employed to examine the relationships between packaging variables and consumer buying decisions.

Data Analysis and Discussion of Results

Table 1: Demographic Profile of Respondents

Demographic Variable	Frequency	Percentage
Gender (Male)	30	30%
Gender (Female)	70	70%
Age (years)		
- 18-25	40	40%
- 26-35	30	30%
- 36-45	20	20%
- Above 45	10	10%
Income Level		
- Low	25	25%
- Moderate	50	50%
- High	25	25%

Source: Field Survey, 2024

Table 2: Influence of Graphics on Consumer Buying Decision

Aspect of Graphics	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Color	40	30	20	5	5
Artwork	35	25	15	10	15

Source: Field Survey, 2024

Table 3: Role of Dimensions on Consumer Choice

Aspect of Dimensions	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Shape	45	25	15	10	5
Design	40	30	15	10	5

Source: Field Survey, 2024

Table 4: Influence of Product Information on Consumer Buying Decision

Aspect of Product Information	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Ingredient Information	50	20	15	10	5
Usage Instructions	45	25	15	10	5
Warnings	30	30	20	10	10

Source: Field Survey, 2024

Table 5: Cumulative Analysis of Packaging Variables

Packaging Variable	Mean Score
Graphics	4.0
Dimensions	4.2
Product Information	4.3

Results for Hypothesis**Table 6: Results for Hypothesis H01 (Graphics on Consumer Buying Decision)**

Hypothesis	Pearson's Correlation Coefficient (r)	p-value	Result
H01: There is no significant relationship between an attractive nature of package color and artwork on consumer buying decisions.	0.65	< 0.05	Rejected

The findings of the study indicate a significant relationship between the attractiveness of package color and artwork and consumer buying decisions. This suggests that consumers in Port Harcourt place importance on visually appealing packaging when making purchasing choices. Marketers should prioritize the design elements of packaging, ensuring that colors and artwork resonate with the target audience's preferences and convey the desired brand image.

Table 7: Results for Hypothesis H02 (Dimensions on Consumer Buying Decision)

Hypothesis	Pearson's Correlation Coefficient (r)	p-value	Result
H02: There is no significant relationship between an attractive nature of package dimension and consumer buying decisions.	0.72	< 0.05	Rejected

Similarly, the study reveals a significant relationship between the attractiveness of package dimensions and consumer buying decisions. Packaging shape and design play a crucial role in capturing consumer attention and influencing purchase behavior. Marketers should consider innovative packaging designs that stand out on the shelves and differentiate their products from competitors.

Table 8: Results for Hypothesis H03 (Product Information on Consumer Buying Decision)

Hypothesis	Pearson's Correlation Coefficient (r)	p-value	Result
H03: There is no statistically significant relationship between product information provided on the package and consumer buying relationship.	0.60	< 0.05	Rejected

The results demonstrate a statistically significant relationship between the product information provided on the package and consumer buying decisions. Consumers value clear and comprehensive information about product ingredients, usage instructions, and warnings, which enhances trust and confidence in the brand. Marketers should ensure that packaging communicates relevant product information effectively to meet consumer expectations and regulatory requirements.

Summary, Conclusion and Recommendations

Summary of Findings

The study aimed to investigate the impact of packaging on consumer buying decisions of locally made cosmetic products in Port Harcourt Rivers State. Through a descriptive research design, data was collected from consumers in hair salons, focusing on packaging graphics, dimensions, and product information. The analysis revealed significant findings regarding the influence of these packaging variables on consumer perceptions and behaviors. Specifically, packaging graphics, dimensions, and product information were identified as crucial factors shaping consumer preferences and purchase intentions in the cosmetics market.

Conclusion

Based on the findings of the study, several conclusions can be drawn regarding the impact of packaging on consumer buying decisions of locally made cosmetic products in Rivers State. Firstly, packaging graphics, dimensions, and product information collectively exert a significant influence on consumer perceptions and behaviors. Secondly, investing in visually appealing graphics, innovative dimensions, and informative labeling is essential for enhancing brand visibility, differentiation, and consumer engagement. Lastly, a holistic approach to packaging design that integrates cohesive elements aligned with brand identity and consumer preferences is crucial for optimizing brand performance and competitiveness in the cosmetics market.

Recommendations

Drawing from the conclusions, the study offers the following recommendations for marketers, product designers, and researchers:

Invest in Visual Appeal: Marketers and product designers should prioritize the development of visually appealing packaging graphics that capture consumer attention and convey brand identity effectively. Employing vibrant colors, attractive artwork, and eye-catching designs can enhance product visibility and stimulate purchase intent.

Innovate Packaging Dimensions: Brands should explore innovative packaging dimensions and shapes to differentiate products and stand out amidst competitors on the retail shelf. Experimenting with unique packaging structures that align with brand aesthetics and consumer preferences can enhance product attractiveness and consumer engagement.

Enhance Product Information: Ensure transparent and informative product labeling that provides clear and relevant information to consumers. This includes ingredients, usage instructions, and benefits, which are crucial for building consumer trust, satisfaction, and loyalty.

Adopt a Holistic Approach: Take a holistic approach to packaging design by integrating cohesive elements of graphics, dimensions, and product information that align with brand

identity and consumer expectations. Consistency and coherence across all packaging elements can optimize consumer engagement and brand perception.

Continued Research: Further research is warranted to explore additional factors influencing consumer perceptions and behaviors in the cosmetics industry. Investigating the role of packaging sustainability, cultural influences, and emerging trends can provide valuable insights for enhancing consumer-brand interactions and driving brand success.

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Wertheimer, M. (2022). Untersuchungen zur Lehre von der Gestalt II. *Psychologische Forschung*, 4(1), 301-350.2.4 The Influence of Product Information on Consumer Buying Decision

PRACTICE, PRACTITIONERS AND REDIRECTION FOR ADAPTING AUSTRALIAN CITIES

Petra Perolini

ABSTRACT

Rapid growth and climate change will challenge some of the fundamental assumptions on which our cities have been built. Australian cities will have a huge task ahead of themselves: to accommodate significant climatic change while maintaining their liveability and functioning as an urban system. Governments are currently getting ready to transform our cities to make them ready for the future. Current attempts to only physically engage with this transformation process will not be adequate. What is needed is a project that can propose a new and different model of transforming and adapting our cities to prepare them for the changing climate and population growth. Metrofitting, a term used to describe the transformation many cities need to undertake to ensure long-term vitality could provide some urgent answers. This paper offers a critical perspective on the concepts of metrofitting and re-directive practice. It puts forward a contextually dynamic view of urban futures. Overall, the argument and ideas presented seek to reframe how we engage with city planning. Metrofitting requires a level of activism currently absent in design practice and culture.

KEYWORDS: Design practice, metrofitting, retrofitting, adaptation, urban, redirection

1. Introduction

Rapid urban growth is not unique to Australia, but in no other Western country are cities growing as fast as in Australia (Colebatch, 2016). Although not unique to our time, it poses unique challenges. Figures published by the 2011 Census (ABS, 2011) reveal that 88.9% of the population live in urban Australia. In some states, New South Wales and Victoria, over 90 per cent are urbanised. In the Australian Capital Territory, almost 100 per cent are urbanised due to almost the entire population living in Canberra and its suburban areas. In the past five years Australia's biggest cities, Melbourne and Sydney, have grown by 2 per cent and 1.6 per cent respectively, estimating that by 2050 they will have doubled in their size; both Melbourne and Sydney to nine million people (Colebatch, 2016). This sharp population increase is a combination of net overseas migration (more people staying than leaving) and a natural increase (birth minus death). However, as the population ages, the natural increase will shrink but migration will increase (Colebatch, 2016).

The rapid growth presents these cities with countless complex challenges. Urban designers are confronted with the task to redesign cities that are projected to double their size in the next 40 years. A study commissioned by the Victorian Department of Transport and the City of Melbourne (The City of Melbourne Project Team, 2010) to establish the potential to transform metropolitan Melbourne to meet the projected population of 8 million by 2050, talks of the enormity of the daunting challenge of building the equivalent city and infrastructure that has taken 185 years in under 30 years. Add to this the fact that these cities will increasingly be exposed to cyclones and other extreme weather events brought on by a changing climate. These events are predicted by scientists to worsen with global warming. Climate change will challenge some of the fundamental assumptions on which our cities have been built. According to Fuenfgeld (2011), Australian cities will have a huge task ahead of themselves: to accommodate significant climatic change while maintaining their liveability and functioning

as an urban system. Heat Islanding, inadequate structures not able to withstand unprecedented high winds, cyclones and prolonged rainfall and draughts are just some of the conditions they will have to overcome in the coming decades. Current attempts to only physically engage with this transformation process will not be adequate. What is needed is a project that can propose a new and different model of adapting our cities to prepare them for the changing climate and population growth. Metrofitting, a term used to describe the transformation many cities need to undertake to ensure long-term vitality could provide some urgent answers (Fry, 2011).

2. The Project of Metrofitting

Currently, Australian cities are literally exploding with road, rail, metro, business and leisure hubs and housing projects, springing up at record speed. The Federal Government has committed \$50 billion to infrastructure investment between 2013-14 and 2019-20, pushing Australia's top cities to compete on an international scale; offering thriving urban centres with fast transport links between home and work countless options for sport, culture, drinking and dining. As discussed, the challenge will be transforming cities to cater for a growing population is a doubling of the population by 2050, something that traditionally took over two centuries to develop, while at the same time preparing cities to become climate defensive.

Although our cities are highly adaptable systems, climate change will challenge the business-as-usual activities of urban centres in many ways (Fuenfgeld, 2011). Arguably, Australian cities are well prepared to respond to a range of climate-related hazards. A recent cyclone in March/April 2017 has brought devastation to many eastern costal cities, leaving a trail of destruction to lives, homes, infrastructure, business, livestock and the environment. The associated floods in Queensland and New South Wales have yet again highlighted the importance for residents to be prepared rather than react once a disaster unfolds. Undeniably, Australian cities have been at the forefront of driving these developments (Fuenfgeld, 2011). Fuenfgeld (2011) states that many local Council have begun to assess and plan for the impacts of climate change. Likewise, residents in affected cities are well prepared for extreme events like floods, bushfires, heatwaves, hail, cyclones etc. They know how to access vital information and have emergency plans in place. However, these weather events will intensify and become more frequent due to population growth and surging migration. The World Bank (2010) has issued a warning to all major cities globally that we are unprepared and currently unable to cope with what will confront us.

Ultimately with climate change, population growth and food shortages predicted, our cities will need to adapt to a difficult future. The practice of Metrofitting discusses a new and different model of adapting our cities. The concept of Metrofitting is taking the idea of retrofitting (which is a technological response) and making urban strategies by addressing all that is at risk in the city, structurally, socially economically and culturally and develops a transformative approach to give a city a viable future (Fry, 2011). The practice presents ideas and actions for the retrofitting on an urban scale, a new practise for planners, architects and urban designers. As such it is presented to overarch and redirect all that is urban and will modify or remodel existing structures, communities, neighbourhoods, cities, and urban cultures, to respond to the challenges and issues of unsustainability (Perolini, 2009). Importantly, Metrofitting acknowledges that a city is always circumscribed by a complex mix of relational determinates: its topography, climate, demographics, infrastructure, by-laws and ordinance and so on (Perolini, 2009). Metrofitting accepts that no matter how well designed a city may seem it will always be a mixture of the functional and dysfunctional.

Furthermore, the practice of Metrofitting acknowledges that the structures of cities are always formed in response to the physical, natural, economic, political, social and cultural. Dealing with all these elements relationally is what distinguishes Metrofitting from retrofitting. The relational approach understands that cities are a diverse and dense web of economic, political, social and cultural structures and need to be understood and challenged as one entity. Within this entity and according to the socio-economic circumstances of its population and environment, the city delivers positive or negative ways of life (Perolini, 2009). Almost everywhere, as urban populations grow, and problems of the unsustainable deepen, inherent problems of the city increase. Problems associated with transport infrastructure, disconnected suburbs, energy supply, homelessness, poverty, a lack of affordable housing, unemployment, crime and violence all fold into each other. The architectural landscape is often incoherent; a historical sense of place is erased and not replaced by the new. The amount of exposed thermal mass in so many CBD's make them feel unpleasantly hot in summer and icy cold in winter.

Fundamentally, the practice of Metrofitting recognises that we mostly don't need to add to the existing urban infrastructure by adding more material fabric. Rather, it asserts the priority of dealing with existing elements, especially by modifying their structure, operation and use so they are able to contribute to a city's long-term vitality. It is based on the proposition that to make the city a better place environmentally, economically, socially and culturally to live and work in, it is necessary to deal with what is already there, in every respect (Perolini, 2009).

3. Adapting to a New Approach

Currently architects, planners and urban designers are not educated to attempt the named transformative approach (Metrofitting) of adapting our existing cities and prepare them for the future. As professionals they are trained to function and to exist in a narrow disciplinary field. Often they only consult with other design professionals within limited and instrumental contexts — which is to say that they do not learn to view and engage with the cities relational complexity (Perolini, 2009). As such, they see the city and engage with it pragmatically and technically. In terms of affirmative change, the division of knowledge of their specific disciplines intellectually restricts them and in this aspect, Metrofitting requires a new kind of architecture, design and planning education liberated from past priorities and preoccupations (Perolini, 2009). In addition to a new educating approach for professionals in the fields of architecture, planning and design, what is required is a design agenda and practice beyond service provision — Metrofitting is a domain of designer leadership.

A position paper written as part of a Master course requirement at Griffith University in 2009 on *_Retrofitting Cities'* outlines a number of strategies necessary for implementing the concept of Metrofitting. Overarching, Metrofitting requires a level of activism currently absent in design practice and culture (Perolini, 2009). While able to be viewed as the politicisation of design it also needs to be seen as a domain of economic opportunity and as a context in which all the design practices can realise a greater potential. This means for design and designers to be less preoccupied with style but to engage on a heightened level in social and environmental responsibility. Together this has the potential of making design practices powerful drivers of sustainment, a term used to describe the role of design and the responsibility of designers to facilitating the ability to make and sustain viable futures (Fry, 1999). In contrast to environmental building rating systems and green building initiatives, what is being identified here is a comprehensive approach that engages absolutely every area of urban structure - form, socio-cultural fabric, economy and use (Perolini, 2009).

In contrast to existing ways of designing that only address symptoms of unsustainability, and thereby so often act to maintain the status quo, Metrofitting approaches change based on futuring the city in terms of what it will have to confront and deal with in coming decades. Futuring is a term used by Fry (1999) to explain a different design practice, an alternative method needed to negate the current ineffective, weak and fragmented approach taken by industry professionals and to expand and become a more ethical and professional practice able to respond to ethical, political, social and ecological concerns of today and tomorrow. However, the starting point is not with the city itself but with those practices that bring it into realization and animate it. Put simply, for cities to change and be able to become thriving urban centers offering sustainable, functioning and livable communities, the existing practice model has to transform.

4. Re-directive Practice

The concept of re-directive practice is not detached from established design practices but is a turning towards a focus of designing a way of engaging design and sustainability/unsustainability relationally. Fry (2007) defines re-directive practice as —adaptation in face of what has to change to counter the unsustainable; the elimination of what threatens sustainment by designing things away; and prefiguration, which is designing in order to re-detectively deal with what is coming.|| Metrofitting a city would name a re-directive project. So while changing a city through Metrofitting seems and is, an extremely complex and enormous task, the following questions thus arises: who are the practitioners willing to rise to the challenge. Who is going to get involved? Who will lead? Who will be the catalytic leaders of the change community? Realistically, most projects that would be of interest to re-directive practitioners need to be initiated by the practitioners themselves. Every project affords the means to gain new knowledge. Every project arrives as an experimental learning exercise. With more knowledge and more exposure, existing clients would be re-directed, new clients created and the environmental and economic benefits of a re-directive approach realised.

What is proposed would be totally unrealistic if it were not for two things: the problems of unsustainability already intrinsic to most cities and, more significantly, the inevitable crisis heading their way, climate change and the effect it will have on cities. As the history of the architecture of the modern movement affirms, urban dreams so quickly can (and have) become disasters. In the face of this situation, Metrofitting and re-directive practice make one clear and powerful statement: act now rather than waiting for the problems to arrive. Metrofitting provides a conceptual and organisational approach that invites engagement by the varied policy, planning and design elements of government, industry and community — this so they may take broader responsibility for the coming situation. The cost of doing so will be significant, but negligible in comparison to allowing an ad hoc response to occur (which would effectively mean giving way to breakdown and crisis management).

The mess in our urban centers that is unsustainability in large part, arrived by urban design, architecture and planning and the only way to overcome this situation is by design becoming a re-directive practice as the basis of leadership by design.

5. Re-educating Designers - Writing Metrofitting into the Curriculum

Metrofitting is actually situated in an essential major reform of the curriculum in higher education. While, over a broad range of disciplines, a concern with sustainability arrived mostly over the last decade the issue mainly appeared as an add-on to existing areas of knowledge and practice. Today, design professionals, planners, architects and educators generally recognise and acknowledge that securing viable futures requires something far more

substantial than what has been on offer thus far. The foundation of a process that can lead to sustainment becoming the directional stimulus of humankind actually requires a major reform of a great deal of what is taught, and its underlying assumptions and values (Fry, 2009). It requires the fact to be faced that structural unsustainability arrives because of what we have learnt — effective people are taught how to be unsustainable in the very process of learning to maintain, develop and function within the modern world. Even *sustainable development* is locked onto this trajectory. The direction that actually has to be followed is the *development of sustainment* (Fry, 2009).

Table 1: Example Content

<i>Architecture (building removal, adaptation, climate defensive structures, fire protection, water harvesting, energy architecture, designing for materials and component recovery and reuse)</i>
<i>Landscape architecture (shade, wind protection, fire risk reduction, food production)</i>
<i>Planning (flood risk elimination, solar orientation, fire risk reduction, vehicle kilometers travelled reduction, refugee influx accommodation)</i>
<i>Building construction (storm reinforcement and impact protection (indoor and outdoor including glazing), external heat insulation, fire protection, water harvesting, new storm protective structures and storm water management, renewable energy, damaged and 'at risk' building demolition, materials recovery, storage and reuse, emergency workforce training)</i>
<i>Interior design (emergency facilities design — power, food, water; internal weatherproofing, etc.)</i>
<i>Visual communications (the promotion of Metrofitting, building safety classification signage, storm protection shelter signage, evacuation route signage)</i>
<i>Civil engineering (structures reinforcement (bridges, towers etc.); storm water management, detention and retention; built environment damage removal, emergency structures construction, emergency water supply)</i>
<i>Services engineering (warning systems, emergency services supply (to and beyond vital services), emergency workforce)</i>
<i>Sociology/social work (public education and emergency shelter provision, food and clothing, counseling, community preparedness development and reformation, emergency workforce)</i>
<i>Medicine (emergency services including field hospitals)</i>
<i>Law (emergency measures review and development, Metrofitting key measures enforcement)</i>
<i>Management (overall Metrofitting action management and coordination) —all of above</i>
<i>Research — all of above and all related trades industry, education</i>
<i>Professional development</i>
<i>Campaigns (general and on specific issues) Exhibitions (general and on specific issues) To undertake all these measures would be a true educational revolution!</i>
<i>Public education</i>

Retrieved from Design Futures Working Paper No 1. 2009 by Queensland College of Art Griffith University.

6. Concluding Comments

Metrofitting is about putting the city in a position to adapt to climate change and population growth; it is about recognising and creating the mechanisms to enable the existing social ecology of the city (how decisions are made, who makes them, and how community is formed or revitalised) to change; it is about the transformation of the city's economy; it is about social justice, equity and cultural sustainment; and predicted problem management (for instance, the doubling of its residents). Above all Metrofitting is about how we live and work together to secure a viable future.

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MEGAPROJECT AND RISK MANAGEMENT: A CASE OF KUWAIT

Dr. Shaikha AlSanad

ABSTRACT

Mega construction projects are extremely large-scale investment projects that typically cost more than one billion dollars, demanding resources that run into millions of man hours, with numerous stakeholders with an extraordinary amount of interlink. Latterly, the notion of mega project evolving significance in the Kuwait industry, due to the innovative strategies development plan for the country. Evidence from research shows that identical poor performance for megaprojects in worldwide country. This research endeavor aims to identify, prioritize and categorize assess risks perceived for the construction of a mega project in in Kuwait. A total of 54 perceived risk factors which categories into six groups have been identified and prioritized on the basis of criticality in the construction mega project. A structured questionnaire survey was employed as a key tool for assessing the respondents' perception of the level of impact and the probability of occurrence for each of the identified risk factors. A total of 700 questionnaires were distributed and 536 completed questionnaires were received. A significant difference is observed in the perception of stakeholder's professionals from the type of organization and their experience on the criticality of these factors. This study will assist the construction stockholders practitioners to develop plans to achieve their goals and improve the megaproject process on the basis of these outlined concepts.

KEYWORDS: Mega construction projects, project management, risk identification, risk assessment, project life cycle, risk management

1. Introduction

Risk is an vital aspect to consider in any project as it can affect several key factors of any project, such as the cost-benefit analysis during the project lifecycle and the demand, production costs, execution time, and financial variables (De Palma, Picard, & Andrieu, 2012). The notion of risk analysis has been established as an imperative procedure in any project (Sanderson, 2012). However the crucial necessity of risk analysis is amplified further when it is put in to the realm of megaprojects where each risk has significantly more impact and ramifications for the stakeholders involved (Irimia- Diéguez, Sanchez-Cazorla, & Alfalla-Luque, 2014).

Any construction activity fundamentally carries with it certain level of risk. The level of the risk is directly correlated to size and complexity of the construction project (Flyvbjerg, Bruzelius, & Rothengatter, 2003; Irimia-Diéguez et al., 2014; Perry & Hayes, 1985; Smith, Merna, & Jobling, 2009). Consequently, understanding and managing the wide array of risks associated with construction projects has been recognized as an important management process in order to maximize the chances of achieving project objectives in terms of time, cost, quality, safety and environmental sustainability (Tipili & Ibrahim, 2015). The concept of risk analysis has been established as an imperative procedure in any project (Sanderson, 2012). The essential for identifying and managing risk is even more important when viewed from the

perspective of Mega Construction Projects (MCP). In a MCP the risks involved are amplified significantly due to the sheer size and complexities MCP's projects involve.

The construction of megaprojects requires resources that run into millions of man hours and have massive budgets with a vast array of stakeholders from the construction sector. These unique factors introduce complexities and other unclear risks into their execution. As megaprojects, are occasionally implemented when compared to general construction projects, the knowledge with regards to the risks associated with them is very limited. Kuwait is planning to implement huge infrastructure and development projects through its long-term strategies from 2007 until 2035 to elevate the country's position to the region's top commercial and financial hub (Helmy, 2011). Therefore, understanding the risks associated with megaproject is crucial for the successful implementation of the planned developments.

Historically, outputs of construction megaprojects have garnered a bad reputation largely due to regularly actual poor project management performances, cost and time escalations, and poor outcome quality. Previous studies have reported that despite their growing popularity and adoption, construction of megaprojects are associated with enormously poor performance and design consisting of poor outcome quality, benefits shortfall, time and cost escalation, and fail to deliver in the terms used to justify the need for the project (Flyvbjerg et al., 2003). Also, a number of researchers have reported that megaprojects poor performance are due their inherent characteristics such as uncertainty, high complexity, high risk, huge project size, large variety and number of people involved, political influence (van Marrewijk, Clegg, Pitsis, & Veenwijk, 2008). Moreover, decision maker operates within limited rationality and decisions are based on incomplete information or incorrect data. Consequently, it is important to establish a method and system to manage these risk factors effectively in advance. Additionally, it is essential to manage the probability of such risk factors causing failures in the project by implementing models or mitigation measures (Locatelli, Mancini, & Ishimwe, 2014). Although there is a wide body of general research on megaprojects, the current literature fails to provide a frameworks/guidelines for construction industry practitioners which advise on the risks of megaprojects and how best to mitigate them (Walker, 2015). This type of research is even more limited when put in to the context of addressing the risks associated with megaprojects in Kuwait and the wider region. Moreover, very little research has probed risks from the perspectives of project stakeholders groups (Tipili & Ibrahim, 2015).

This study demonstrates results of an ongoing research endeavour. Consequently, initial results of this on-going study reveal the challenges and risks associated to megaprojects perceived by Kuwait's construction industry stakeholders. Initial phase results analysis has revealed 54 perceived risks in total, which are grouped under six categories; namely political, economic, technical, environmental and social risks. The results show that there is a significant difference in the perception of the criticality of these factors based on the stakeholder's level of experience and sector of organization.

Kuwait finds itself in a unique position in the construction world as many megaproject's have been given the greenlight by the government with the aim of improving and enhancing the country's infrastructure and regional standing. Therefore it is crucial to better understand the risks involved in this sort of construction activity. Moreover, it is absolutely imperative to garner first-hand insight from local construction industry stakeholders who know the state of the construction sector in Kuwait in order to devise accurate and feasible roadmaps and action

plans to minimize and mitigate the reverberations of said risks. This research seeks to highlight the differences in stakeholder's perceptions towards the potential and significance of the risks involved with conducting mega project construction in Kuwait.

2. Methodology

Survey method is general for of data collection in field of construction management and logistics research and assists as a broad method for obtaining raw data (El-Sayegh, 2008; Prasitsom & Likhitruangsilp, 2015). In this study, structural questionnaire survey was used as a key tool for gauging the respondents' perception of probability of occurrence and the level of impact for each of the identified risk factors. The literature review and the semi structure interviews assisted as the basis and guidelines for designing the questionnaire survey. A pilot study was conducted in order to verify that the instructions, language, scale items, and understanding of the questions used in the questionnaire were clear (Pallant., 2010). The first draft of questionnaire was delivered to a list of 15 stakeholders involved in the construction industry to observe difficulty and problems during the response process. The group was asked to comment on the readability, accuracy, and comprehensiveness of the questionnaire. According to the replies made by all 15 members, minor comments were made, except that some slight mistakes were found, which were corrected as a result. Importantly, the final version of the questionnaire included all amends suggested by the respondents.

The questionnaire in its final version, including question based on the Likert scale questions. Risk assessment in terms of the perceived level of impact and probability of the occurrence of a list of 54 risk factors in relation to the construction a mega project within the Kuwait construction Industry using a five-point Likert scale (1 = very low; 2= low, 4 moderate; 4= high; 5 = very high probability and impact). The survey was distributed to local construction stakeholders with experience in Kuwait's building and construction industry. Nonprobability sampling techniques were used to maintain a high degree of legitimacy of the received data. To assist respondents and improve the response rate, a web based questionnaire was designed and the link was sent by email to all respondents. To maintain high degree of legitimacy of received data, out of 700 questionnaires were administered, 536 questionnaires were filled and returned. This represents 76.5% of the total questionnaires sent out which is considered sufficient for the study based on the perception of Oke and Ogunsemi (2009) that the result of a survey could be considered as biased and of little significance if the return rate was lower than 20-30 %. The data collected from the questionnaires was then collated and analysis. Data gathered from the survey was analyzed using the Relative Importance Index (RII). For this nature of data, the standard deviation and mean of each risk factor are not appropriate to determine the whole results because they do not reflect any relationship between the risk factors (Ghosh & Jintanapakanont, 2004). An RII value was calculated for the probability and impact of each risk factor. The same approach has been used by many researchers to analyses the probability and impact of risk factors (El-Sayegh, 2008; Ghosh & Jintanapakanont, 2004; Gündüz, Nielsen, & Özdemir, 2013). Relative Importance Index (RII) is calculated using the following equation (Karim, Rahman, Memmon, Jamil, & Azis, 2012):

$$\frac{\sum_{i=0}^s a_i n_i}{5N} \quad (1)$$

Where

a = the weight assigned to each response, N = total number of responses,
 n = frequency of each response,
 5 = the greatest weight

The probability and impact of each factor is multiplied to obtain the degree of risk. The prioritized risk factors can be assessed further in order to conduct a quantitative analysis of the degree of risks. "The specific combinations of probability and impact lead to a risk being rated as „high“, „moderate“, or „low“ significance" (Project Management Institute, 2008)

3. Results of Analysis

Expert judgment was elicited through the distribution of a survey questionnaire to government and private sector construction industry stakeholders in Kuwait. To maintain high degree of legitimacy of received data, a total of 700 questionnaires were distributed to the sample population and 536 questionnaires were collected from the respondents with a response rate of 76.5%. This represents 76.5% of the total questionnaires sent out which is considered sufficient for the study based on the perception of Oke and Ogunsemi (2009) that the result of a survey could be considered as biased and of little significance if the return rate was lower than 20-30 %. Table 1 below illustrates the respondents' profile. The survey question comprised of questions which were designed to ascertain the respondents' perceptions on the risks and risk significance of conducting mega projects construction in Kuwait. This research specifically collated information from the aforementioned stakeholder groups based on their academic qualification, years in service, the likely number of projects they have handled with the value of the project. Other data that was collected includes information about their perception of risk factors, likelihood of occurrence of risk factors and its impact on the performance of the projects.

Table 1: Respondents' Profile

Category	Number	%
Business category		
Developer/Client	24	5%
Contractor	63	14%
Supply chain	39	8%
Owner	37	8%
Research institute	55	12%
Facility Manager	14	3%
Subcontractor	39	8%
Consultant	107	23%
Other	83	18%
Types of Megaprojects involved in		
Oil Sector	54	12%
Industrial	43	9%
Electricity & water	66	14%
Educational	58	13%
Health	33	7%
Tourism	16	3%
Services	82	18%
Sport	20	4%
others	89	19%
Type of organization		
Government sector	214	46%
Private sector	247	54%

Table 1 illustrates the respondents' profile. The outcomes results reveal that the majority of participants (54%) belonged to the private sector, whereas 48% of the participants belonged to the government sector. The majority of survey participants, 23%, were consultants, while 14% were contractors, 12 % worked for research institute, 8 % were supply chain, 8% for owner, 8% subcontractor, 5 % were developers, and 3 % were facility managers. The richer the experience of participants in the construction sector results in getting better information about the perceptions of risk for the construction and implementing the practices of megaprojects in Kuwait. The results specified that the majority of the respondents had been complicated in different natures of megaprojects project.

3.1 Risk Identification & Analysis

A total 54 risk factors been identified from the Literature review and interview survey, which been categorized into six risk category such as : political risk , the supply chain risk social risk, Environmental Safety and Health risk, environmental risk, technical risk , and lastly economical risk. The survey participants were asked to rate probability of occurrence and the level of impact of each risk factors according to the following Likert scale: „1“ very low , „2“ denoting low, „3“ denoting medium , „4“ high, and „5“ very high.

3.2 Reliability Test

To certify the reliability of individually risk factor, Cronbach's coefficient alpha was performed to test the internal consistency amongst the items included in each factor (Pallant., 2010). The results show that the internal consistency is 0.968 for the probability of risk factors whereas 0.962 is for the impact of risk factors. According to Pallant. (2010), the internal consistency is considered to be confirmed at the Cronbach Alpha of 0.7 or above. Therefore, both the values are at an acceptable level for making all factors reliable.

3.3 Risk Identification & Analysis

The survey endorsed participants to delivered numerical scores that conveyed their perception on probability of occurrence and level of impact of each factor to deliver mega project. For this nature of data, the mean and standard deviation of each factor are not appropriate to determine the generally results because they do not reflect any association between the risk factors (Ghosh & Jintanapakanont, 2004). Instated, the risk factors collected from the survey were analyzed statistically using Relative Important Index (RII). According to the RII, the risks indicated by the stakeholders were then ranked as the results are shown in the Table 2. According to risk rating values, the most significant risk identified was, The length documentary cycle" (also known as Project Initiation Documentation) in the life cycle of the project (RII = 0.80) followed by, Variation order to project during the construction phase" (RII= 0.73). Other important risk factors were „Delay in paying subcontractors invoices" (RII= 0.71), „Technical difficulties in obtaining utility permits" (RII= 0.69), and „Lack of financial resources and Cash flow problem of partners,, (RII = 0.69).

Table 2: Overall Ten Most Significant Risks According To Interview Participants

Risk	RII	Ranking
T.1 The length of the documentary cycle during the project lifecycle	0.80	1
T.6 Variation order to project during the construction phase	0.73	2
T.19 Delay in paying subcontractors invoices	0.71	3
T.9 Technical difficulties in obtaining utility permits	0.69	4
E.1 Lack of financial resources and Cash flow problem of partners	0.69	5
T.7 Incorrect project cost & time estimation.	0.68	5
SC.1 Delay of materials & equipment supply.	0.67	7
P.1 Bureaucracy and corruption practices	0.67	8
SC.3 Shortage in manpower availability	0.67	9
E.3 Material price changes	0.66	10

3.3.1 Inferential Statistics

Inferential test performed to explore the differences and/or relationships if any in the data in order to test the hypotheses. The Mann-Whitney U test was used to test the following hypotheses:

H1: There is a difference in stakeholders' perception of the risk factors affecting the delivery of mega projects based on their organization type.

3.3.2 Results of Hypothesis 1

3.3.2.1 Mann-Whitney U test for Impact level for group of Risk.

Before presenting the results of Mann-Whitney U test, it is vital to oversee the purpose for the selection of this test from the non-parametric tests. The Mann-Whitney U test is used when the two independent groups are involved in the data collection, which can be seen in this situation. Two independent groups such as private and government sectors are involved in the data presented in the table below.

Table 3: Result of the Mann-Whitney U Test for the level of impact risk.

Mann-Whitney U Test Statistics a				
	Mann-Whitney U	Wilcoxon W	Z	Asymp. Sig. (2-tailed)
Technical	30534.500	69037.500	-3.162	.002
Economical	32966.000	66119.000	-1.599	.110
Social	30306.500	68809.500	-3.136	.002
Political	30877.500	69380.500	-2.786	.005
Supply Chain	31820.000	70323.000	-2.244	.025
Environmental, Safety and Health risk	31667.000	70170.000	-2.318	.020

The following Mann-Whitney Test was performed between impact level for risk group and organization type to find out any statistical significance. The results are suggested as significant if the p-value is less than 0.05. Evidently the p-value for all group expect, economic risk' are less than 0.05, which meant that there is a difference between the stakeholders' perception about the impact level for the group of risk expect „economical risk“ based on their organizational type and as the confidence level is greater than 95%. So for these factors H1 is accepted. Noticeably those respondents from „government sector“ discipline provide more importance to the impact level of risk factors associated with construction mega project in Kuwait. This is further elucidated with the help of mean rank values generated by the same test. Since the significance values in table 12 are less than 0.05 hence a significant difference can be seen in the mean rank values between working for all the risk category except economic risk and its group average. The mean rank values for „government sector“ discipline aerospace industries are more than those of „private sector“ which means that „government sector“ are facing more problems in the implementation of megaproject in Kuwait construction industry.

4. Conclusion

This study identified the risks associated with construction of a mega project. Following to a thorough mixed research method, literature review which was conducted to shortlist potential risks related to megaprojects, the identified risks were evaluated and ranked using a mixed method approach which entailed qualitative semi structured interviews and qualitative questionnaires involving Kuwait's construction industry stakeholders. The results of the study demonstrate that although there is some consensus, fundamentally there are stark differences in the risk perceived to be most significant by the two stakeholder groups. The results show that every risk listed in the survey was perceived by the respondents as a significant risk. However, the differences occur when the focusing on the risks that the different stakeholder groups deem to be the most significant. The results highlight that the private sector stakeholders perceive the risks related to the economic aspects of mega project to be more significant. Whereas the Government sector stakeholders give more precedence to the technical, political, social, environmental, safety and health risks associated with mega projects. Understandably, the private sector emphasizes on economic risk such as "Lack of financial resources and cash flow problem of partners" and "Global economic recession", since the private firms are profit orientated and look to make the most financial gain and the least financial loss. The vast majority of the private sector respondents indicated that their organizations focus on the financial risk involved in mega project construction more than other risk factors.

Respondents representing the government sector stated that the risk they perceived to be the most significant was the technical risk. Both groups reach a consensus with relation to the general lack of experts available in the field of mega construction project. This result coincides other research conducted by, who also conclude that the lack of experts available to manage mega construction project has a detrimental impact on the project itself leading to financial loss. A mega project due to its size and critical nature necessitates expert management in order to minimize risk occurrence for the private sector some the risks can be managed through internal resources and experts, other more complex risk require the need for external intervention in several alternative forms such as contractors and outsourcing.

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REVIEW OF EXISTING APPROACHES TO MANAGE SUSTAINABILITY AND MOVING TOWARDS A SUSTAINABILITY MANAGEMENT SYSTEM FRAMEWORK

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ABSTRACT

Sustainable development is the world's most ambitious goal at present and organizations have made many efforts in the last two decades to achieve this objective through appropriate management of sustainability. There are numerous studies which argue that the integration of environment, economics and social systems can be adequate to address the sustainability challenges of present era however, a holistic method for the management of sustainability is still lacking. On one hand, the integration of the multidisciplinary goals is essential for sustainable development of organizations but at the same time the integration of complex systems to manage sustainability may not be completely effective and such an effort may raise a number of presently unknown concerns. Some researchers have argued that since the shift towards sustainable development must not be trivial rather fundamental, we should focus on the sustainability issues as an independent matter, which cannot entirely be addressed by the integration of existing systems. In an effort to propose holistic sustainability management system we will discuss and combine the literature on the integration of existing management systems, ISO standardized guidelines for developing management systems (particularly sustainability management system), and the literature on sustainability assessment methods. Our contribution is different from other authors in two ways: (1) we have looked into the management of sustainability as a distinct concept rather than the integration of existing management systems, which many authors have done in the past, and (2) the proposed framework for sustainability management establishes clear connections between the processes required to systematically manage sustainability. The multi-dimensional focus of sustainability management framework (SMF) is one of its key strengths. Economic, quality, environmental, health and safety, and social challenges can all be managed through the application of this standalone framework. However, the large investment of time and resources is its weakness. In future, we aim to extend the proposed SMF to address the time and resource issues and further explore the implementation challenges.

KEYWORDS: Sustainability management system, integration of management systems, ISO guidelines for development of sustainability management system, sustainability assessment.

1. Introduction

Sustainable development (SD), being the most challenging goal of the current century, has been the focus of discussion of various authors and commentators. Several definitions, explanations, and frameworks of sustainability have been proposed in the last two decades. Some argue that the environmental management may be sufficient to manage sustainability (Vnoučková, Hyršlová, & Tomšík, 2014; Winn & Pogutz, 2013), as environment is the most compromised element, while others believe that the integration of existing management systems (MS) may be an effective way of managing organizational sustainability (Samy, Samy, & Ammasaiappan, 2015; M. Rebelo, Santos, & Silva, 2014). Some authors have noted that the individual management system standards (MSS) may be extended to incorporate the sustainability objectives which may avoid the need of a standalone sustainability management system (SMS).

However, these individual MSS may not be sufficient to effectively address the holistic sustainability needs of organizations¹, which will be explained in detail later in this paper.

We aim to review and understand the existing methods for sustainability management. Based on this review, we attempt to develop a sustainability management framework (SMF) at a general level, coherent with the existing approaches. Our work has its uniqueness in two ways; first, we aim to bring the isolated sustainability concepts in a single framework, and second, we highlight the processes which are required to be systematically undertaken to ensure effective application of any SMS. The standalone SMF is robust in its structure due to its three-fold methodological basis. First, the proposed SMF is consistent with the academic literature on sustainability management systems to ensure that it is fundamentally correct. Secondly, it is in line with the ISO standardized guidelines to assure its global acceptability. Third, the proposed SMF incorporates a systematic assessment mechanism which guides the overall system in the right direction.

2. Background Review

McKinsey and Company conducted a survey to explore why and how companies are undertaking sustainability (Bonini, Gorner, & Jones, 2010). The results of this study indicate that even though organizations recognize the critical importance of sustainability, most of them do not practically engage in the management of sustainability. This trend is primarily due to the uncertainties associated with the return on investment and is partly due to the inability of organizations to understand the holistic perspective of sustainability (P. J. T. Domingues, Sampaio, & Arezes, 2011; Naudé, 2011). In a similar study carried out by the UN Global Compact, similar conclusions were drawn (Hayward et al., 2013). The UN Global compact reported the opinion of more than 1000 CEOs on sustainability management, and surprisingly, only 33% of the CEOs were reported to believe that the businesses are doing enough to touch the core of sustainable development. On the other hand, 84% of the CEOs were reported to opine that businesses should set the example in addressing the global sustainability challenges. It implies that although organizations fully understand the significance of sustainability management, it tends to ignore sustainability at the operational level. From Spennar and Freeman's (2013) study, we can argue that the organizations tend to ignore sustainability in its operations mainly due to its lack of understanding of sustainable development. Also, the availability of a large number of isolated sustainability management options leave the organizations confused as ever about the „best choice“ specific to their case.

While the integration of multidisciplinary objectives is indispensable for creating a balance between the pillars of sustainability (Esquer-Peralta, Velazquez, & Munguia, 2008), the integration of existing standards to manage sustainability may not be a feasible solution. As the scope and construct of these standards are mostly different from each other (Karapetrovic 2002), the integration of these systems may not synchronize well, rather it may raise a number of presently unknown concerns. Another issue with integration of standards, largely argued in literature, is that it is the natural human tendency to resist change in status quo and therefore, humans tend to move backwards – towards the pre-integration zone (J. P. T. Domingues, Sampaio, & Arezes, 2014; Raišienė, 2011). Our sustainability aspirations demand more than integration. “No problem can be solved from the same level of consciousness that created it – Albert Einstein”.

A three-way literature search has been carried out to cover the depths of this topic and ultimately combine these ideas in a new sustainability management framework (SMF). The first part of literature review discuss the schemes for sustainability management that have been

presented in the academic literature. The second part explains the requirements of the ISO guidelines dealing with the management system structure and sustainability management in the standards (guide 72. Annex SL, guide 82) while the third part talks about the sustainability drive in the MS through sustainability assessment mechanism.

A keyword search for “sustainability management system”, “sustainability management framework”, “integrated sustainability management”, and “non-financial system management” has been carried out in Google, Google Scholar, Elsevier, Emerald, JSTOR, John Wiley Publications, Proquest, Sage Publications, Springer-Verlag, and Taylor and Francis. Journal and magazine articles, and organizational reports have been critically reviewed. The type of work, methodology and important learnings have been shown in Table 1.

Table 1: Literature review of managing sustainability through integrated or standalone systems

Reference	Type of Work	Methodology	Important Learning
Asif et al. (2011)	Integration of MSS	Integration based on Deming wheel process cycle, i.e., plan-do check-act (PDCA)	The requirements of an Integrated Management System (IMS) have to come from stakeholders, however, these should be scanned and prioritization based on their legitimacy
Jørgensen (2008)	Integration of MSS	Transverse connections between the standards	Instead of standardizing standalone MSSs for sustainability management, it is effective to integrate existing MSSs
Jørgensen et al. (2006)	Integration of MSS	Partial integration and total integration	Partial integration is usually effective at basic level but the integration of overall systems may require application of multiple approaches together, for example, strategic management approach, system based approach, and process based approach
MacDonald (2004)	Integration of sustainability goals within the minimum requirements of a single MSS (ISO14001)	Back casting method	There are five levels of planning which can incorporate sustainability goals within an established ISO14001 standard. These are constitutional, objective, strategic, action, and tool
Keysar (2005)	Procedural integration of sustainability tools	U.S. army case study	The integration of various tools, such as comprehensive system planning and Environmental Impact Assessment (EIA), can tremendously improve the overall sustainability performance compared to when these tools are applied independently
Jonker & Karapetrović (2004)	Integration of MSS	Systems based approach	The function of existing MSS is only to address the needs of the stakeholders and therefore, synchronizing the needs, rather than the MSS, can enhance the overall performance of the system.
Rebelo et al. (2016)	Integration of MSS	Process based integration	The formulation and implementation of coherent policy is the most crucial phase in the integration process since the shortcoming of these two system elements may have significant adverse consequences.

Mustapha et al. (2016)	Integration of MSS	Cross-linkages between the elements of MSSs	The proposed sustainable green management system provides guideline for the implementation of IMS according to the standard ISO criteria, however, the focus of the study has largely been „greening“ and environmental management, similar to (Keysar, 2005; MacDonald, 2004)
Grunda (2011)	Transformation of business model	Cyclic model	Systematic learning from the existing processes is a prerequisite for effective management of sustainability
Azapagic (2003)	Standalone Corporate Sustainability Management System (CSMS)	In collaboration with various industries	Involvement of stakeholders and adoption of risk based approach may effectively help to address the sustainability issues of corporations

The structure of any new system should also be aligned with already established standardized guidelines to ensure its wide acceptability. We have briefly discussed the requirements of ISO standardized guidelines with regards to the structuring of standards and systems in Table 2.

Table 2: Review of the requirements of ISO standardized guidelines for the development of MSSs

Guideline	Purpose	Important Learning
ISO Guide72 (ISO, 2001)	Guidelines for the justification and development of MSSs	<ul style="list-style-type: none"> The main components of new MSS include the identification of affected parties, the need for an MSS, sector-specific MSS proposals, value of an MSS, and risk of incompatibility, redundancy and proliferation. The standard common elements of ISO MSSs include policy, planning, implementation and operation, performance assessment, improvement and management review.
Annex SL (ISO/IEC Directive, 2012)	Consistency in high level structure, core text, common terms and core definitions of different MSSs	<ul style="list-style-type: none"> The 10 elements of high level structure are following: 1- Scope 2- Normative Reference 3- Terms and Definition 4- Context of Organization 5- Leadership 6- Planning 7- Support 8- Operation 9- Performance Evaluation 10- Improvement The 8 principles for justification of new MSSs include: 1- Market Relevance 2- Compatibility 3- Topic Coverage 4- Flexibility 5- Free Trade 6- Applicability of Conformity assessment 7- Exclusions 8- Ease of Use
Guide82 (ISO, 2014)	The guidelines for addressing sustainability in standards	<ul style="list-style-type: none"> Guide82 suggests various methods to approach sustainability right from the planning phase of the system. These methods include the systematic approach, life cycle approach, precautionary approach, risk-based approach, and stakeholder approach. Guide82 emphasize to include only those „sustainability principles“ and „sustainability issues“ which are relevant to the type of the business Guide82 suggest to establish trade-off rules

Similar to the „risk assessment“ of health and safety, and „environmental impact assessment (EIA)“ of environmental management, sustainability management also needs an assessment

mechanism that steers the direction of development in the right direction. The assessment methods for sustainability proposed in the literature include environmental impact assessment (EIA), Strategic Impact Assessment (SIA), Triple Bottom Line (TBL), Integrated Assessment (IA), and Sustainability Assessment (SA). Without going into the details of these individually, we will discuss the comparison between the advantages and disadvantages of these methods. Hacking & Guthrie (2008) have compared these assessment methods based on the strategic focus, comprehensiveness of coverage, and integration of themes. The results shown in Table 3 suggest that SA method cover all the essential features expected from sustainability assessment method.

Table 3: Comparision of the elements of various assessment processes for sustainability (Hacking & Guthrie, 2008)

Assessment method	Strategic focus	Comprehensiveness of coverage	Integration of the themes
EIA	No	No	No
SIA	Yes	May be	May be
TBL	May be	Yes	No
IA	May be	May be	Yes
SA	Yes	Yes	Yes

We have summarized the features of an expert SA framework as following:

- Ensure three-dimensional focus.
- Conceive sustainability principles.
- Establish trade-off rules.
- Use indicators to measure the performance of the system.
- Establish short and long-term goals.
- Involve stakeholders.
- Assess various options before selecting the sustainability strategy.
- Report the outcomes.

3. Sustainability Management Framework (SMF)

In this section we have combined the work presented in the literature review to formulate a holistic sustainability management framework (SMF), shown in Figure 1. The framework is based on the PDCA cycle and has six basic elements.

At first, the organization needs to understand the relevance of its business with sustainability, or in other words, organizations should be able to understand how sustainability can be incorporated into its systems. This understanding should then be reflected in the vision and scope of organization. The vision and scope outlines the roadmap of the sustainability journey and hence we suggest that these should be documented right at the beginning to always look back and gauge the extent of development. The organizations, based on its developed understanding of sustainability, should also establish clear sustainability principles which form the basis of sustainability goals and cannot be compromised.

The second element of SMF emphasize on defining the boundary criteria and objectives, or simply, what an organization wants and what it does not want. Doing so is not an easy task since the actions of the organization directly affect its stakeholders and hence their input is also compulsory in this process. Organizations should form a scheme to interact with its stakeholders in order to identify relevant and important sustainability issues (materiality matrix may be used for this purpose). The prioritized sustainability issues should then be translated to the boundary criteria which reflects the unwanted state of the system. Building on this criteria, a risk assessment should be carried out to cover the defined scope and the operations of the organization. The risk assessment will not only help the organization in setting up the objectives but also the quantitative indicators for measuring those objectives. More detail on the processes to be carried out at this stage has been provided in Figure 1.

The third element of SMF is to compliment the sustainability objectives of organization through appropriate sustainability initiative. At first, the organization should identify various sustainability initiatives that can attain a certain goal and later, these choices should be analysed relatively to assess their capacity to achieve the objectives. Once the suitable selection of sustainability initiative has been made, the management should start preparation and organization, which is the fourth element of SMF. A complete timeline should be defined for the execution of suitable sustainability initiative. Most importantly, the organization must build its capacity and extend its resources to assure effective implementation of the sustainability initiative. Furthermore, the data gathering procedures and guidelines, and the responsibilities and authorities must clearly be communicated at the relevant levels to make sure that everyone knows what is expected from them.

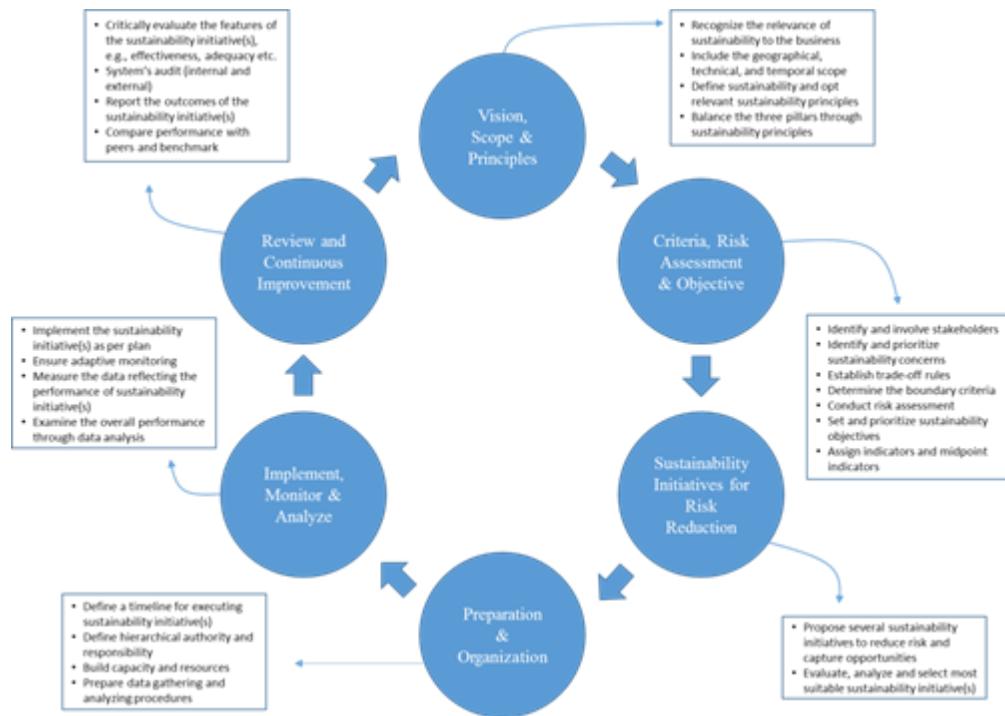


Figure 1: Proposed sustainability management system framework (SMSF)

The fifth element of SMF is the implementation, monitoring and analysis phase. The overall plan has to be implemented at this level, at the same time, the organization should continuously monitor all activities and analyse the obtained data. Adaptive monitoring is essential to ensure effective implementation. Monitoring the system's performance in the light of mid-point indicators and boundary criteria can be extremely helpful in steering the direction of

development. Once the results of the system are obtained at the end of the SMS cycle, the effectiveness of the sustainability initiative should be critically evaluated and reported, which is the final step of SMF. This will help the organization to identify improvement opportunities in the subsequent cycle of SMS that may even include the revision of sustainability vision, scope and principles. The reported parameters should be compared with the peers to set the benchmarks. Furthermore, all activities, evaluations, assessments, and analysis should be subjected to internal and external audits to ensure transparency and integrity of the system.

4. Conclusion and Future Work

This paper present an analysis on the sustainability management system for organizations. The discussion presented in this study highlight that although organizations and top-management recognize the importance of managing sustainability, the vague definition and lack of robust framework impede organizations from sustainability management at operational level. Efforts have been made to address the latter through the integration of environment, economics and social systems but a holistic method for sustainability management is still lacking. We have tried to fill this gap by proposing a holistic framework for sustainability management, named sustainability management framework (SMF), which combines the literature on the integration of MSs, MSS, and SMS, ISO standardized guidelines for developing management systems, and the literature on sustainability assessment methods. The advantages of this framework include improved transparency, adaptive management, and systematic approach to sustainable development. On the other side, the implementation of such a system demands extensive investment of time and resources. In future, we aim to improve the time and resource constraint along with the validation of this framework.

5. Acknowledgement

An expanded version of this paper, titled „Review of Existing Approaches to Manage Sustainability and Moving towards a Sustainability Management System Framework”, by W Nawaz and M Koç, has been in preparation for a journal publication. It details the individual aspects of SMF.

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DIALECTICS OF SUSTAINABILITY: CONTRASTING MAINSTREAM NEOLIBERAL AND CRITICAL ECOSOCIALIST PERSPECTIVES ON SUSTAINABLE DEVELOPMENT

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ABSTRACT

The current geological period of Anthropocene is defined by qualitatively new manifestations of negative planetary human impact and environmental crisis. Finally, it is increasingly acknowledged as crucial to contain the self-destructive tendencies of capitalism to preserve conditions for life on earth. Yet, there seems little agreement as to how the necessary transition towards sustainability can be realized. This narrative review explores the respective social science literature. Reflecting the meta-theoretical distinction between sociology of regulation and radical change, dialectic analysis contrasts mainstream functional-normative neoliberal and critical structuralist-antagonistic ecosocialist perspectives. The later deconstruct conventional approaches, such as the United Nations Agenda 2030, as ideological projects of capitalist expansion and legitimization, rejecting claims of green growth, environmental decoupling, and market-solutions of corporate social responsibility. Instead, paradigms of critical sustainability advocate for degrowth and redistribution, de-carbonization, decommodification, and democratization, challenging the exploitative growth logic of capitalism itself. On the organizational level, structural pathologies of corporate social responsibility are contrasted with propositions of democratic socialization. Further, attention is called to sustainability discourses in organizational scholarship, demanding paradigm shifts from managerialist to critical ontologies, realist to relational epistemologies, discipline-focused to interdisciplinary, and from value-neutrality to scholarly activism. Analyzing the sustainability discourse from a critical-theoretical perspective presents opportunities to reappropriate ecological ideas against degeneration into economicistic ideology, counterproductive to the objective of saving the planet from profitable destruction. With seriousness and urgency of the situation providing momentum for social transformation, sustainable development goals and related mainstream concepts need to be reconceived for more radical social and ecological critique, transcending system-justifying neoliberal ideology.

KEYWORDS: Anthropocene, Dialectics, Ecosocialism, Ideological Critique, Sustainability Transformation

1. INTRODUCTION

Widespread agreement across disciplines in the natural and social sciences suggests that the world has entered a new geological era of the Anthropocene—a distinct ecological and socio-cultural period, defined by destructive human domination and its devastating detrimental impact on the planet in its entirety [1], [2]. Hallmark symptoms of the associated ecological decline and deterioration include overburdening pollution of land, air, and sea, depletion of natural stocks and resources, deforestation, land degradation, and other forms of irreversible environmental destruction, accelerating extinction of species, loss of biodiversity, global

warming, extraordinary severe weather events, and related manifestations of progressive climate change [3], [4]. These ecological disasters, in turn, proliferate, perpetuate, and potentiate catastrophic social and humanitarian situations in large parts of the world, especially in (but not limited to) the most extremely affected areas of the so-called “Global South”, including escalating inequality, poverty, hunger, malnutrition, and starvation, hostilities, violence, wars and armed conflicts over dwindling resources, displacement and forced migration of affected populations, spreading of foodborne and infectious diseases, and other public health crises [5], [6]. Whereas, until a few years ago, such predictions were frequently dismissed as alarmist apocalyptic scenarios that could still somehow be denied or averted, their present- day reality and progressing manifestation has been scientifically documented in the most dramatic terms, for instance, in the latest report of the United Nations (UN) Intergovernmental Panel on Climate Change (IPCC) [7]. However, as evidenced by the same document, with most planetary ecosystems so obviously in decline and such catastrophic consequences on the horizon, there finally also seems to be a growing realization among both experts and political decision-makers that a fundamental reorientation of the global economic system is absolutely necessary to contain the self-destructive tendencies of unfettered capitalism in order to preserve the basis of human and non-human life on the planet [8], [9]. Nonetheless, despite this growing consensus, apparently, little agreement, whether in theory or in practice, can be reached as to how the required turnaround towards ecological and social sustainability can possibly (still) be achieved [10], [11]. Addressing this issue based on an exploratory review of selected key publications, this contribution identifies and contrasts two antagonistic approaches crystallizing within the social science literature. Specifically, this refers to the conventional mainstream or “neoliberal” approach versus an emerging radically critical or ecosocialist perspective [12], [13]. These two oppositional paradigms correspond with the division between technical-empirical and critical-emancipatory conceptions of science [14], underlying the meta-theoretical distinction between the sociologies of regulation and radical change [15]. Additionally, drawing on systems theory, society, organizations, and individuals can be differentiated as hierarchically nested levels of analysis incorporated in sustainability transitions. The present review predominantly focuses on selected concepts at the former two levels, specifically, comparing exemplary notions of conventional versus critical sustainability, green growth versus economic degrowth, and corporate social responsibility versus democratic socialization. A case in point, a common reference point on the societal level is the United Nation Agenda 2030 specifying 17 goals for sustainable development. This landmark in sustainability policy has variously been deconstructed as a neoliberal ideological project of capitalist expansion and legitimization through counterfactual claims of green growth, decoupling through innovation, market-solutions to environmental protection, and voluntary corporate social responsibility [16], [17]. Based on this critique, the alternative paradigm of critical sustainability is dialectically developed based on counter- concepts of degrowth, decommodification, radical democratization, and redistribution on all levels of political, economic, and social organizing. From the ecosocialist perspective, critical analysis of the root causes of unsustainability converges with social critique of the exploitative growth imperative inherent to the capitalist systems logic [14], [17]. On the organizational level, structural pathologies of corporate social responsibility are deconstructed and contrasted with radical propositions of socially responsible democratic socialization and social activism. To conclude, demasking the mainstream sustainability discourse from a critical-theoretical perspective presents an opportunity to re-appropriate underlying ecological ideas against degeneration into economicistic ideology counterproductive to the goal of saving the planet from profitable destruction. Evident seriousness and urgency of the situation are frequently emphasized as opportunities to raise consciousness and mobilize momentum for social transformation. Lastly, attention is called to how the sustainability debate shapes current discourse in organizational

science. Highlighting recent programmatic contributions, deemed necessary are paradigm shifts from managerialist to critical positions, from discipline-focused to interdisciplinary research, from realist to relational epistemologies, and from pretense of objectivity and value-neutrality to engaged scholarship and academic activism. Normative foundations supporting this reconceptualization of the academic self-image include occupational codes of ethical responsibility to prioritize people over profits, ecology over economy, and planetary survival over subservience to vested interests. Sustainable development goals of the Agenda 2030 and related concepts need to be reassessed as vehicles for real-world improvements and basis of more radical critiques of unsustainable social organization in the Anthropocene.

2. DIALECTIC EXPLORATION

An exploratory review of key publications in the interdisciplinary social science literature on environmental and social sustainability was conducted with the objective of delineating and contrasting two broader types of approaches, namely, the conventional mainstream (functionalist, normative) “neoliberal” perspective versus an emerging radically critical (antagonistic, structuralist) “ecosocialist” one. These oppositional paradigms, evidence for the existence of which has been suggested in the literature repeatedly [10], [11], [13], reflect the meta-theoretical distinction between sociological traditions of regulation and radical change [14]. The former proposes a view of society based on integration, progress, and consensus; the latter emphasizes domination, power struggles, and conflicting interests. The type of change advocated by the former is incremental, pragmatic, and follows a reformist agenda, whereas the latter stresses the need for fundamental, utopian, and revolutionary transformations [9], [17]. Background of said undertaking is growing interest in alternative approaches through which the necessary turnaround towards ecological and social sustainability can still be initiated, despite the progressing era of Anthropocene, suggesting irreversible environmental damage and accelerating planetary crises. The purpose of the sighted, compiled, and reviewed material was to serve as basis for speaking engagements at several scientific conferences as well as for curriculum development in university teaching. In these academic arenas, sustainability is increasingly becoming an important cross-cutting theme of particular interest. Following principles of narrative and problematizing literature reviews [18], exploratory searches were conducted covering major databases in the social sciences, using various combinations of terms, including “sustainability”, “sustainable development”, “radical environmentalism”, “critical theory”, “ecosocialism”, “corporate social responsibility” and “critique”. Based on the screening of titles and abstracts, relevant articles were identified and categorized according to various criteria, including article type, disciplinary focus, and level of analysis. Drawing on systems theory, society, organizations, and individuals were differentiated as hierarchically nested levels of analysis and articles allocated to these interdependent tiers. The present review predominantly focuses on the former two levels, specially, three core themes of the current sustainability debate are deliberated in a dialectic analysis. Sustainable development, green growth, and corporate social responsibility are three important concepts in the mandated turnaround of the capitalist economic system that have been portrayed as ideologically annexed and redefined by neoliberal discourse. To counteract this, conventional neoliberal understandings of these concepts are contrasted with radical ecocritical antipodes of a) critical sustainability, b) economic degrowth, and c) responsibility to socialize corporations. For each of these three themes, a limited number (typically three) of selected key publications will be reviewed. Explicit aim of this dialectic exploration of elements of Marxist ecology was to demonstrate the critical potential of ecosocialist perspectives in environmental science as antipodes to neoliberal, market-based conceptions [12], [13], [16], [17]. Core to all three concepts are structures and processes of direct democracy and participation as well as fundamental rejection of the capitalist profit and growth

imperatives. A final step explores, how critical conceptions of sustainability and degrowth shape current discourse in organizational science, highlighting some exemplary recent contributions to the debate.

3. CRITICAL SUSTAINABILITY

Although until recently critical conceptions of sustainability have received only limited attention, they are far from completely novel [19], [20]. For instance, almost two decades ago, different philosophies for environmental education have been differentiated and defined as rooted in the empirical, hermeneutic, and critical sciences, concluding that the latter, emphasizing emancipation, self-determination, and critique of ideology and domination, form the basis of radical ecocentric environmentalism [14]. Published about a decade later, the first identified seminal contribution comparing mainstream and critical perspectives on sustainable development [21] starts out by stating that the concept of sustainability, originally introduced to address environmental concerns, has been predominantly defined by the mainstream tradition of neoclassical (neoliberal) economic analysis, characterized by an inherent drive to prioritize economic issues and profits and marginalize or subjugate ecological concerns. This mainstream version of sustainable development, driven by perpetual accumulation requirements of capitalist economics, would aim at sustaining economic growth rather than developing ecological perspectives, supporting weak sustainability propositions at best, and remaining opposed even to the most basic steps towards necessary fundamental changes, which are seen as incompatible with the vested interests of short-term capital accumulation. Thus, the focal essay concludes that, for any meaningful aspect of sustainable development to be attained, fundamentally critical perspectives would be indispensable and need to be more fully developed [21]. Recommended for this purpose is an amalgamation of radical structuralist and poststructuralist approaches. Core to the former, the classic social critique of Marxism combines a shattering political-economic analysis of the exploitative, destructive, and crisis-prone tendencies of the capitalist system with a dedication to radical social transformation and emancipation through revolutionary action. To this end, Marx was interested in analyzing and actively supporting the social forces that could resist and rise up against, and, eventually, were expected to overcome capitalism, establishing a more democratic, just, and sustainable society characterized by socially and ecologically balanced relations of production and consumption—benefiting both the human species and the planet. Specifically, the Marxist concept of the “metabolic rift” provides an ecosocialist basis for analyzing the unsustainable exploitative growth regime of capitalism, underlying its inherent ecological crisis tendencies [19], [20]. This structuralist theoretical basis, according to the focal essay [21], should be enriched with additional traditions of critical analysis, such as the poststructuralist cultural critique of environmental degradation tendencies from other non-mainstream and grassroots perspectives.

A decade later, a second identified key publication [22] extends and elaborates the roles of class, capitalism, and domination in an outlined dialectic analysis of sustainable development from the perspective of critical theory. After providing a brief chronology of sustainability policy-making, starting from the 1987 United Nations (UN) Brundtland Report, the 1992 UN Conference on Environment and Development (Earth Summit) and associated Rio Declaration, to the 2002 (Johannesburg) and 2015 (Rio+20) Summits, the UN Agenda 2030 is reviewed and discussed. Providing the current paradigm for national and supra-national policies, the Agenda 2030 specifies 17 goals for sustainable development. Some of these are, in principle, uncontroversial (e.g., no poverty; zero hunger; gender equality), while others are more ambiguous (e.g., affordable and clean energy; climate action), yet, for some, it seems dubious whether they are compatible with genuine sustainability (e.g., decent work and economic growth; industry, innovation, and infrastructure). Indeed, in light of declining ecosystems,

accelerating climate change, widespread and rising poverty, food shortages, global health crisis, and continuing polarization of the living conditions of the rich and the poor, even moderate criticisms have pointed out that the Agenda 2030 has no realistic trajectory towards attainment of these goals. Moreover, more radical critiques have deconstructed the agenda as a neoliberal project of capitalist legitimization and expansion [9], [13], [17]. The focal contribution here [22] takes a balanced approach, acknowledging the progressive multidimensional understanding of sustainability as comprising social, environmental and economic objectives, but criticizing the neglect of the roles of communication and culture as well as of class and capitalism as factors negatively impacting or impeding sustainability. Subsequently, two perspectives are contrasted, debunking sustainability either as economicistic neoliberal ideology or reframing it as a fundamentally critical concept. Accordingly, economicistic ideologies seek to maintain and increase capitalist profits, while, at the same time, formulating desirable social and environmental values and goals, but without reflecting (or disclosing) how capitalist principles are negatively impacting society and counteracting these stated objectives [10], [11], [13]. The ideological character of the sustainability concept, specifically, is described as sounding positive and allowing diverse groups to project their opposing political goals into it, eventually blocking meaningful change.

In contrast, a suggested concept of sustainability based on critical theory addresses the root logic of instrumental reason, treating human beings and living nature as objects to be dominated and exploited by some groups at the expense of others [22]. Unsustainability, it is argued, is based on instrumental reason, striving to justify and rationalize structures of domination and exploitation. Mainstream conceptions of sustainability disregard these systemic aspects of class and capitalism, rendering them apologetic and ideological. In contrast, drawing on Marx as an early theorist of ecology [19], [20], sustainability is understood as the conscious organization of society in a way that allows future generations to satisfy their needs and improves society through participatory democracy and democratic socialism. Based on this utopian vision, critical theory exposes global capitalism's destructive, dominative, exploitative and exclusionary character, its inherent economic, political and cultural antagonisms, and their interaction with patriarchy, racism, nationalism, bureaucracy, and destructive industrialism, as manifestations of instrumental reason, compounding the aforementioned metabolic rift between a society's mode of production and the natural environment. Productive forces thus turn into destructive forces of the social metabolism between nature and society, depleting and destroying rather than conserving and protecting natural resources. Thus, unsustainability correlates with the degree to which economic class interests of elites become the governing principles of a society and its subsystems, particularly, as the poor tend to be most negatively impacted by environmental degradation and crises. However, sustainability would also be able to serve as a useful concept for the critique of capitalism, class and power inequalities. To demonstrate this, the article introduces a differentiated dialectical model of sustainability, consisting of the nested spheres of nature and society, as well as embedded economic, political, and cultural subsystems, reciprocally interacting via technology and human agents in ways that are either conducive or detrimental to various dimensions of sustainability.

Due to the complexity of this framework of analysis, the interested reader is referred to the original publication [22] for details. The last of the three selected key publications [23] is a relatively recent and comprehensive review and development of the concept of critical sustainability, summarizing and representing the current state of theorizing. Starting out with the assertion that repeated calls for greater sustainability in the past have been assimilated into capitalist processes and neoliberal narratives that have subdued, counteracted, and perverted their original intentions and environmental impacts, the authors advocate a critical re-conception of sustainability, rejecting prioritization of capital accumulation over ecological

integrity and social and environmental justice – focusing not only on socio-environmental relations, but challenging the dominant political economies shaping these relationships according to particular vested interests of wealthy and powerful elites. Echoing the last contribution reviewed above, critical sustainability is portrayed as a new understanding of sustainability, in which class, politics, and class politics truly matter, including recognition of the historical preconditions underlying respective class politics. While recognizing both the material and ecological necessities that sustain life on the planet, critical sustainability rejects the commodification of nature, instead striving for a biopolitical organization of social life that ensures human and nonhuman welfare, based on sociopolitical orientations that support dignity, equity, respect, and rights for all, within the boundaries of ecological systems [23]. This includes acknowledging tensions and conflicts among conventionally distinguished pillars of sustainability (economy, society, ecology), which typically are resolved by privileging profits over people and the planet, thus stifling necessary social change. Capitalist ideologies of exploitation and accumulation are regarded as so heavily intertwined that social justice and ecological sustainability are practically impossible to achieve under the current economic system. Following a central tenet of radical ecosocialism, critical sustainability thus is portrayed as converging with the Marxist critique of social and ecological unsustainability of the accumulation-based capitalist economic system [19], [20], [22], [23]. Emphasizing this point, the authors assert that, while their conception of critical sustainability supports allied versions of justice-oriented environmentalism and deep ecology, it would remain distinctively and essentially Marxist in its direct implication of capitalism as both an external (systemic) and a more subversively internal (ideological) threat to its core impact and ideas.

4. ECONOMIC DEGROWTH

The second thematic category concerns the more concrete and applied antagonism between neoliberal concepts of sustainable economic growth, typically in the form of “green growth” or “greening” capitalism, and antithetical ecosocialist concepts of “degrowth” and “decommodification”. Echoing several of the issues pointed out above, an exemplary critique of the sustainability discourse deconstructs the commodification of nature as a key feature of capital’s response to the ecological crisis [24]. Accordingly, the core problem with capitalisms response to the environmental crisis is that nature and social relations are transformed into economic resources, subordinated to the logic of the market and imperatives of profit, resulting in a progressive deterioration rather than improvement of social and environmental injustice. The concept of “green capitalism”, it is argued, reflects a renewed strategy for profiting from planetary destruction by leveraging the promise of technological innovation and expanding markets, while keeping the institutions of capitalism intact. Concluding that the expansionist logic of the capitalist system itself is not sustainable, strategies of degrowth and economies of subsistence are recommended. Continuing at this very juncture, the next included conceptual contribution sets out to assess the normative justifications for concepts of green growth and degrowth through the lens of critical social theory [25]. Whereas green growth means preserving the current capitalist economic system, and particularly its inherent growth paradigm, proponents of degrowth argue that perpetual economic growth cannot be environmentally sustainable and needs to be constrained and replaced by alternative approaches of a more radical transformation of society through strategies of degrowth. Degrowth is defined as the socially sustainable process of downscaling the social metabolism of society, that is, reducing the overall volume or throughput of material production and consumption, with the goals of preserving the natural environment and increasing human well-being and social equity [26]. In contrast to notions of green growth, degrowth requires a reduction in natural resource use, production and consumption, by decreasing the quantity of household goods, such as entertainment, information and communication technology, private

cars, transportation, and energy use. Although a decline in the gross domestic product is not a goal by itself, it is an inevitable consequence of the need of developed countries to radically downscale their economies.

Dialectically delineating the antagonistic approaches of green growth versus degrowth, the article concludes that, despite evidence that the claims of the former regarding growth without environmental impact through innovation and “decoupling” are largely counterfactual, it is the latter that still remains mostly marginalized in both academia and practice. The authors argue that the expected impact of degrowth's principle of prioritizing environmental preservation has a much stronger validity and normative justification and should be the preferred option. Thus, the reviewed article [25] seeks to contribute to the ongoing debate by establishing normative grounds for focusing efforts for environmental sustainability on the necessity for economic degrowth rather than the counterfactual fantasy of green growth. Addressing the actual implementation of mandated degrowth-strategies, the third identified key contribution [27] presents a systematic review of 128 previously published peer-reviewed articles on degrowth, analyzing a total of 54 proposals for action, based on both an *a priori* (theoretically constructed) and an emergent (empirically derived) conceptual framework. The former includes the categories of: a) Geographical focus (international, national, local); b) Type of approach (top-down/expert-led and bottom-up/community-led); and c) Ecological economics policy objectives (sustainable scale, fair distribution, and efficient allocation). Whereas sustainable scale strategies reduce the absolute throughput threatening to overload the carrying capacity of an ecosystem (e.g. resource use, pollutant emissions), fair distribution strategies seek to change the supply of goods among people, including the division of environmental costs and justice (e.g. transfer payments, broadening public participation). Efficient allocation strategies address resource flows between alternative uses to maximize generated welfare per unit of resource use (e.g. energy efficiency, investments in environmental conservation). Based on this classification, three more specific goals of degrowth proposals were extracted, based on the analysis of core topics and keywords: 1) Reducing the environmental impact of human activities (topics: consumption, production, and trade impacts; ecological conservation; infrastructure; pollutant emissions); 2) Redistributing income and wealth both within and between countries (topics: access to goods and services; equity; global governance; socioeconomic opportunities); and 3) Promoting the transition from a materialistic to a convivial and participatory society (topics: community building, education, and value change; democracy and participation; free time; voluntary simplicity and downshifting). These three goals correspond with related approaches of radical environmentalism, recommending decommodification, redistribution, and democratization as sustainability interventions into the interactions among nature and economic and cultural societal systems [22]. Based on their analysis, the authors conclude that the majority of degrowth proposals are national top-down approaches, focusing on government, rather than local bottom-up initiatives, emphasizing topics related to social equity and environmental sustainability [27]. However, largely neglected remain topics related to implications population growth and consequences for developing nations. Lastly, future research on how degrowth proposals would act in combination is called for. Overall, the review provides a most valuable starting point to explore the scope and range of approaches, topics, and goals of degrowth proposals and thus is highly recommended to the interested reader.

5. SOCIALIZING CORPORATIONS

The third category refers to the organizational level, contrasting the neoliberal mainstream with critical and radical propositions on the socialization and democratization of private corporations. Literature on corporate social responsibility (CSR) is vast and diverse and only

examples are referred to here [28], [29]. A common understanding of CSR refers to voluntary activities aimed at including social and environmental concerns in business operations and interactions with stakeholders [30]. Different ambition-levels of CSR are distinguished, ranging from compliance- driven (laws, regulations), profit-driven (markets, reputation), caring or green (values, principles), synergistic (integrated, embedded), and holistic (universal responsibility). However, apart from personal convictions, the basis for higher-level CSR ambitions remains as questionable as their economic viability. Similar limitations apply to the overlapping concept of corporate sustainability – a version of CSR focusing on environmental issues [31]. A recent seminal contribution offers an insightful analysis of systemic pathologies of CSR [32]. Accordingly, instead of proliferating responsible business practices, CSR predominantly serves market expansion, indoctrination, and legitimization. These pathologies are elaborated in terms of their functions of spreading the reach of capitalism to areas previously not under economic valorization and exploitation (material expansion; new markets for “green” products), contributing to the dissemination of capitalist rationality and neoliberal discourse by consolidating a “business ontology” (symbolic expansion; public faith in markets and managers), and meeting legitimization requirements of capitalism by diverting attention from corporate misconduct and negative externalities (obscuring destructive effects of industrial production). Pathologies are analyzed with regard to corresponding CSR activities (codes of conduct, stakeholder dialogue, CSR reporting), primary recipients (customers, society, employees, academics), dysfunctional effects, capitalist dynamics that underlie those (commodification, indoctrination, legitimization), and steps towards systemic change. Potential contributions of critical CSR research refer to efforts towards “de-commodification”, exploring ways of serving society beyond market transactions, and “de-naturalizing” and “de-legitimizing” capitalism, revealing its downsides and propagating alternatives beyond prevailing ideologies. Dysfunctional pathways and feedback loops between pathologies of CSR are developed in a multi-level model of individual, organizational, and systemic dynamics (e.g., negative side effects of material and symbolic expansion compounded by CSR; increased legitimization requirements addressed by CSR). The article [32] concludes that failure of CSR is inevitable, insisting on change on the systemic level of capitalism, and suggesting ways how critical CSR research can contribute to this political endeavor—transcending mainstream neoliberal discourse of CSR as a system- justifying ideology embodying rather than addressing the underlying pathologies of capitalism. The final article reviewed here [33] contributes to the debate by elaborating the structural incommensurability of profit goals with social and environmental concerns, and, subsequently, introducing a new concept, termed, not without humorous irony, as the “Responsibility to Socialize Corporations” (RSC). The author argues that the dominant discourse on CSR naturalizes capitalism, hiding irresponsible business practices, legitimizing corporations and neoliberal deregulation, and depoliticizing the search for a responsible economy, strengthening corporate power rather than containing it.

Distinguished are four perspectives within the CSR discourse regarding the relationships among economic and social (including ecological) objectives: a) Reductionism frames social and environmental issues as profit opportunities (green marketing); b) Projectionism pretends that responsible business practices and profit- orientation can be combined (business ethics); c) Dualism separates the two domains (corporate philanthropy); and d) Dialectics, which recognizes the structural incommensurably and antagonistic nature of profit goals and social responsibility. The first three approaches instrumentalize the social, idealize the economic imperative, or isolate the economic from the social, obscuring the real interrelations between the two domains and failing to draw necessary conclusions regarding the structural problems of CSR. The dialectical perspective problematizes structural antagonisms between profit motive and social responsibility, concluding that the concept of CSR needs to be turned “off

its head to its feet”, resulting in the notion of RSC, as a societal alternative based on democratic ownership of the means of production and socialist organization of politics, from private to common property, from elitist to participatory decision making, and from particularistic to universal interests in the common good. For this transformation towards socially responsible economic alternatives, a battery of measures is discussed [33], including efforts to restrict corporate power (economic regulations, control of capital flows, nationalization of banking systems, public institutions monitoring corporate crimes) and to democratize workplaces (strong worker rights and mandatory direct involvement in decision-making; strong labor unions and worker ownership). Activities on the organizational level would need to be embedded into changes at the societal level, aimed at strengthening democracy (public funding of civil society and social movements, direct participation in political processes), reducing poverty and socio-economic inequality within and across national states (redistribution of wealth, guaranteed income, public health care, pensions, and education, minimum wages, reduction of the working week, laws against child labor, cancellation of debts), and strengthening tendencies beyond capitalism based on the idea of the common good (abolition of intellectual property rights, support for the open source movement, alternative organizations). Overall, what is demanded here [33] amounts to radical reformism combining social movement activism, bottom-up alternative projects, and various structural reforms to create a socially responsible and ecologically sustainable society based on the radically democratic organization of the economy and politics as an alternative to the current system of corporate capitalism.

6. PRELIMINARY CONCLUSION

Aim of this exploration of Marxist ecology, unorthodox economics, and critical organizational theory was to demonstrate the potential of alternative ecosocialist perspectives as antipodes to neoliberal (market-based and corporation-focused) conceptions [19], [20]. The three exemplary mainstream concepts of sustainable development, green growth, and corporate social responsibility were contrasted with radical (eco-)critical antipodes of a) critical sustainability, b) economic degrowth, and c) responsibility to socialize corporations. Core to all three are structures and processes of direct democracy and bottom-up participation as well as a fundamental rejection of the dominant capitalist profit and growth imperatives, emphasizing the need for radical changes at the systems level [5], [14], [9], [10]. A common reference point on the societal level, the United Nations Agenda 2030, a landmark in policy-making, has been deconstructed as a neoliberal ideological project of capitalist expansion and legitimization, incorporating counterfactual claims of green growth, decoupling through innovation, market-solutions to environmental protection, and voluntary corporate social responsibility [16], [22]. The ideological nature of these system-stabilizing (rather than system-transcending) concepts is seen in the fact that they negate or obscure the fundamental contradiction between the inherent destructiveness of economic productivity and profitability, on the one hand, and the realization of social and environmental sustainability, on the other [13], [22], [34]. In the interdisciplinary literature, an alternative paradigm of critical sustainability is currently emerging, based on the development of antagonistic counter-concepts of degrowth, decommodification, radical democratization, and egalitarian redistribution of resources on all levels of political, economic, and social organizing [26], [27].

From the ecosocialist perspective, critical analysis of the root causes of unsustainability converges with the social critique of the exploitative profit and growth imperatives inherent to the capitalist systems logic [4], [5], [20]. On the organizational level, structural flaws of CSR were deconstructed as systemic pathologies and contrasted with the radical proposition of democratic socialization [32], [33]. Core to all dialectically contrasted concepts are structures and processes of direct democracy and participation and fundamental rejection of the capitalist

profit and growth mechanisms as drivers of unsustainability. In an additional step, it was explored, how critical conceptions of sustainability influence current discourse in organizational science. In this context, attention is called to how the sustainability debate shapes academic accounts of alternative forms of organizing and doing research in the era of Anthropocene. Highlighting an exemplary recent programmatic contribution [35] mandated are paradigm shifts from managerialist to critical ontological positions (e.g., from corporate interests to ecological welfare), from discipline-focused to collaborative interdisciplinary research (e.g., from specialization to systems-thinking), from realist to relational epistemologies (e.g., from simplistic causality to dynamic interdependence), and from pretense of objectivity and value-neutrality to a principled and committed stance of engaged scholarship and academic activism (from neutral observation and analysis to facilitating social change). Each of these paradigm shifts is detailed by the authors and integrated into a matrix for guiding organizational sustainability research in the Anthropocene, identifying challenges, topics of interests, and future steps for more responsible and engaged scholarship. A number of these recommendations are illustrated in a recent special issue on organizations and organizing in a post-growth era [36]. To conclude, deconstructing the sustainability discourse from a critical-theoretical perspective presents opportunities to re- appropriate ecological ideas against degeneration into economicistic ideology counterproductive to the goal of saving the planet from profitable destruction. Seriousness and urgency of the situation are emphasized as opportunities to raise consciousness and mobilize momentum for social transformation among the public as well as political decision-makers [9], [11], [17]. Normative foundations that need to be further developed to support this reconceptualization of the academic self-image, include occupational codes of ethical responsibility to prioritize people over profits, ecology over economy, and planetary survival over subservience to vested interests.

The literature reviewed above as well as described paradigm shifts for radical academic engagement in the field of organizational studies [35] offer promising venues for such an undertaking. Future research needs to redeploy the sustainable development goals of the Agenda 2030 as vehicles for actual real-world improvements and as basis of more radical critiques of unsustainable social organization in the Anthropocene. Referring again to the disturbing latest scientific evidence on climate change [7], the urgent need for a dramatic turnaround to preserve the conditions for life on the planet should be out of question. At present, the conventional interpretation of the Agenda 2030, along with notions of green growth and CSR, functions as ideologies to obscure the structural antagonism and negative dialectics between capitalist expansion and ecological sustainability, inhibiting real transformative change, thus, indirectly contributing to the destruction of the foundations of life on earth [11], [22], [34]. The fantasmatic vision of sustainable development within the logic of the current system is frequently portrayed as a “light at the end of the tunnel”. Referring to the catastrophic ecological and social consequences of the current planetary trajectory discussed at the outset of this essay, this false promise more accurately resembles the headlight of a train approaching from the opposite direction [5], [6]. Considering the truly alarming state of affairs, radical alternatives of critical sustainability beyond conventional neoliberal ideology, are more desperately needed than ever [9]. This contribution hopes to call attention to some underlying issues and the emerging body of literature, and to raise consciousness for the need to fundamentally alter the prevailing understanding of sustainability from incremental quantitative adjustments towards a qualitatively different utopian vision of radical social and economic as well as psychological and behavioral transformation.

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PEDAGOGICAL MONITORING AS A TOOL FOR FORMATING INNOVATIVE TECHNOLOGY OF TIME MANAGEMENT AT A UNIVERSITY

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Annotation: This article examines the role of pedagogical monitoring in the development of innovative time management technology in higher educational institutions (HEIs) using the example of Kyrgyz State University named after I. Arabaev (KSU named after I. Arabaev) and Jalal-Abad State University named after B. Osmakov (ZHASU). Time management is a modern approach to time management that is becoming increasingly relevant for students seeking to successfully combine study, work and personal life. The study used various methods of pedagogical monitoring, including student surveys, interviews with teachers and university administration, analysis of student performance, and standardized tests on time management. The conducted research revealed the advantages and limitations of existing approaches to time management, and also made it possible to determine optimal strategies for introducing innovative technology at KSU. I. Arabaev and Jalal-Abad State University named after B. Osmakov. The results of the study showed that the effectiveness of time management at a university is closely related to the use of pedagogical monitoring. Students who received training in innovative time management technology using monitoring demonstrated increased academic performance and more effective time management. In addition, teachers and university administration highly appreciated the introduction of innovative technology, noting the improvement in the organization of the educational process. This study provides practical recommendations for other universities that are seeking to implement innovative time management practices. It also emphasizes the importance of pedagogical monitoring in optimizing the educational process and increasing the efficiency of students' time management. The final results of the study can be used to develop innovative approaches to time management in educational institutions and help improve the quality of education.

KEYWORDS: student performance, educational indicators, quality of education, absolute academic performance, qualitative academic performance, excellent students, educational technologies, monitoring of the educational process

Introduction

The modern educational environment faces challenges that require constant development and implementation of innovative approaches. One of the key aspects of successful study is the effective management of students' time, which allows them to combine study with work and personal life. Time management is becoming increasingly relevant for students in higher education institutions (HEIs), and it is necessary to develop innovative methods for its implementation to improve the quality of education and train competitive specialists.

The purpose of this study is to study the role of pedagogical monitoring in the development of innovative time management technology at a university, using the example of the Kyrgyz State University named after I. Arabaev (KSU named after I. Arabaev) and Jalal-Abad State University named after B. Osmonov (ZHASU). The introduction of innovative approaches to managing students' time can significantly affect the efficiency of the educational process and the training of highly qualified specialists [1, 2].

Within the framework of this study, various methods of pedagogical monitoring used to analyze and evaluate the implementation of innovative time management technology at KSU named after I. Arabaev and ZHASU named after B. Osmonova. The advantages and limitations of these approaches are analyzed, and optimal strategies for the successful implementation of innovative technology in the educational practice of a university are determined.

The importance of this study for the educational environment of Kyrgyzstan lies in the fact that its results can help improve the quality of education and the efficiency of time management of students. The use of innovative time management technology based on pedagogical monitoring will allow us to develop advanced teaching methods and optimize educational processes in various universities of the country.

The study will provide practical recommendations for other educational institutions that are also seeking to improve student time management and improve the quality of education. The introduction of innovative time management technology into the educational sphere of Kyrgyzstan will contribute to the formation of competent specialists who can successfully adapt to the changing requirements of modern society and the labor market [3, p. 351].

The relevance of research:

The study is highly relevant for several reasons:

- *Optimization of the educational process:* in a rapidly changing world, it is important to constantly improve the quality of education and adapt to new challenges. The use of pedagogical monitoring and innovative time management technologies can help optimize curricula, improve the structure of training sessions and improve student academic performance.
- *Efficiency and effective use of resources:* the introduction of innovative time management technologies makes it possible to more effectively use the resources of educational institutions, optimize class schedules and take into account the needs of students, which contributes to a more productive educational process.
- *Student-centeredness:* the use of pedagogical monitoring allows us to identify the individual needs of students, and the use of time management technologies allows

us to adapt the educational process to different learning styles of students, which makes it more student-centered.

- *Competitiveness of universities:* the introduction of innovative methods and technologies into the educational process can increase the attractiveness of a university for potential students, as well as increase the rating and competitiveness of the educational institution as a center of higher education [4, p. 197].
- *Alignment with global trends:* Global trends in education indicate the importance of adopting new methods of learning and time management. Research in this area will help Kyrgyzstan follow global educational standards.
- *Need for research in Kyrgyzstan:* research on this topic can contribute to the development of science education in Kyrgyzstan, as well as help introduce new practices into the educational processes of universities in the country.

The general relevance of this topic is associated with constant changes in socio-economic conditions, the growth of technology and changes in student preferences. The use of pedagogical monitoring and innovative time management methods can improve the quality of education; make it more effective and adapted to the modern needs of students.

Significance of the study for the educational environment of Kyrgyzstan:

A study on the importance of pedagogical monitoring and implementation of innovative time management technology at KSU named after. I. Arabaev and ZHASU named after. B. Osmonova is of great importance for the educational environment of Kyrgyzstan for several reasons [5, p. 24]:

1. *Improving the quality of education:* the introduction of innovative time management technology and the use of pedagogical monitoring will help improve the organization of the educational process, optimize the use of students' time and increase academic performance. This will lead to an improvement in the educational process at the university and, ultimately, will improve the overall quality of education in Kyrgyzstan.
2. *Development of innovations in education:* research into the implementation of innovative time management technology stimulates the development and application of new methods of managing students' time in the educational process. This contributes to the development of innovations and best practices in the educational sector of Kyrgyzstan [6, p. 11].
3. *Effective use of resources:* managing students' time is a key factor in optimizing the use of university resources. The use of innovative time management methods will reduce the time spent on training, increase the productivity and efficiency of the educational process, which will have a positive impact on the use of financial and human resources.
4. *Training competitive specialists:* developing students' effective time management skills contributes to the formation of competencies that are important for a future successful career. Students with time management skills become more organized, self-disciplined and adaptable to the dynamic modern work environment.

5. *An example for other universities:* a study of the implementation of innovative time management technology at KSU named after. I. Arabaev and ZHASU named after. B. Osmonova can become an example for other universities and educational institutions in Kyrgyzstan. Following best practices and implementation experience will effectively improve the educational process and education in general in various universities of the country [7, p. 11].

Thus, the research is important for the educational environment of Kyrgyzstan, contributing to improving the quality of education, developing innovation and efficient use of resources, as well as the formation of competitive specialists ready for modern challenges and labor market requirements.

Literature Review

Definition of pedagogical monitoring and time management

Pedagogical monitoring: Pedagogical monitoring is a systematic process of collecting, analyzing and evaluating data from educational activities in order to improve its effectiveness and quality. This process monitors and evaluates progress in student learning and development, as well as the effectiveness of educational programs and teaching methods. Pedagogical monitoring involves measuring the achievement of educational goals, analyzing problem areas and identifying potential improvements. The monitoring results are used to develop recommendations and make decisions in educational institutions in order to optimize the educational process.

Time Management: Time management is a system of skills, techniques and strategies for effectively managing time in order to achieve maximum productivity and efficiency in completing tasks and achieving goals. The basic idea of time management is to skillfully distribute available time among various activities, giving priority to those tasks that are of greatest importance and urgency.

Time management in the context of education is the ability of students to effectively manage their time to more effectively study course materials, complete assignments, prepare for exams and combine study with other responsibilities. Applying time management helps students reduce stress, increase self-discipline, and achieve more sustainable results in their academic and personal lives. Time management is also important for teachers who can plan their teaching sessions, assignments and research time more effectively.

Modern innovative approaches to time management in universities

Modern universities are increasingly aware of the importance of effective time management of students, teachers and administrative staff to increase productivity and quality of the educational process. Here are several innovative approaches to time management that are used in modern universities [8, p. 96]:

1. *Use of technology and applications:* Universities are actively introducing various technologies and applications that help students and teachers manage their time effectively. This may include online platforms for scheduling classes and assignments, notifications of important events and due dates, and the use of electronic calendars and planners.
2. *Flexible learning and distance education:* universities offer students the opportunity to choose a flexible learning schedule and distance courses. This

allows students to independently plan their time and study from anywhere in the world, which is especially important for students with other responsibilities, such as working or having a family.

3. *Personalized Study Plans*: Universities offer students the opportunity to create personalized study plans based on their interests, goals and academic needs. This allows students to choose courses and programs that suit their individual needs, which increases motivation and interest in learning.
4. *Mentoring and Coaching*: Colleges provide students with mentors and coaches who can help students develop study plans, set goals, and manage their time. This contributes to the development of self-organization and self-discipline skills in students.
5. *Work-study integration*: Universities are developing programs that allow students to combine study with work and professional activities. This can be especially helpful for students who work part-time or have internships.
6. *Stress management and student well-being*: Institutions provide students with support and resources to manage stress and maintain psychological well-being. This includes stress management training, psychological support and counseling [9, p. 242].

All of these innovative approaches to time management in higher education help students and faculty use their time more effectively, achieve academic and professional goals, and create a more flexible and supportive learning environment.

Methodology

The research methodology is goal-oriented. This methodology describes the steps and methods used to collect, analyze and interpret data.

1. Formulation of the purpose and objectives of the study:
 - The purpose of the study is formulated - to study the role of pedagogical monitoring in the development of innovative time management technology at a university.
 - Research objectives that will help achieve the goal have been identified.
2. Literature review:
 - Studied scientific articles, publications and research related to the topics of pedagogical monitoring, time management and innovation in education.
 - Relevant data and facts were collected to provide a theoretical basis for the study.
3. Selection of research methods:
 - Qualitative and/or quantitative data collection methods have been identified, such as surveys, interviews, questionnaires, observation, document analysis, etc.

- A reasoned selection of methods most suitable for the study was carried out.

4. Development of research tools:

- Created questionnaires, interview scripts, document analysis questionnaires and other data collection tools.
- Pre-testing of the instruments was carried out to check their reliability and validity.

5. Data collection:

- A study was conducted, collecting data using the selected methods [10, p. 45].
- The anonymity and confidentiality of study participants was ensured, if applicable.

6. Data analysis:

- Processed collected data using statistical and/or qualitative analysis methods.
- The results were analyzed taking into account the objectives and the research hypothesis.

7. Conclusions and interpretations:

- Conclusions are drawn based on the results of the analysis of the research data.
- Interpreted the results of the study.

8. Recommendations and suggestions:

- Recommendations for the practical application of the research results are formulated.
- Possible ways of development and implementation of innovative time management technology at the university are proposed.

Description of selected universities for research

Two educational institutions were selected for the study:

Kyrgyz State University named after I. Arabaev (KSU named after I. Arabaev): KSU named after I. Arabaeva is one of the largest universities in Kyrgyzstan, offering a wide range of educational programs and faculties. The university has rich experience in the field of higher education and is considered one of the leading educational institutions in the country. Choice of KSU named after I. Arabaev for the study is due to its reputation, scale and significance in the educational environment of Kyrgyzstan.

Jalal-Abad State University named after B. Osmonov (JHASU) is one of the largest educational institutions in Kyrgyzstan, located in the city of Jalal-Abad. The university has diverse faculties and offers a wide range of educational programs at both undergraduate and graduate levels.

The choice of these two universities was determined by accessibility for the researcher, as well as the consent of their administration and students to participate in the study.

Combination of KSU named after. I. Arabaev and ZHASU named after. B. Osmonova allows us to consider various aspects and features of the role of pedagogical monitoring and time management in universities and assess their impact on students and the educational process in the general context of the educational environment of Kyrgyzstan.

Analysis of collected data on pedagogical monitoring and time management

Qualitative and absolute academic performance of students over the last three academic years Jalal-Abad State University named after B. Osmonov				
Academic year	Number of students	Excellent students	Absolute academic performance %	Quality academic performance, %
2020-2021	8875	208	93,65	55,71
2021-2022	6810	139	90,68	60,83
2022-2023	7184	171	93,79	56,75

Qualitative and absolute academic performance of students over the last three academic years Kyrgyz State University named after I. Arabaev				
Academic year	Number of students	Excellent students	Absolute academic performance %	Quality academic performance, %
2020-2021	10567	985	91,2	45,5
2021-2022	9112	879	87,5	53,5
2022-2023	8868	666	89,4	57,5

Introduction of innovative time management technologies using pedagogical monitoring

The introduction of innovative time management technologies with the help of pedagogical monitoring is the process of introducing new and effective approaches to managing the time of students at a university using systematic analysis and evaluation of the educational process. This process is implemented as follows:

1. *Defining goals and expectations:* Goals for implementing innovative time management technologies are established, such as increasing student achievement levels, reducing stress levels, improving time management and increasing the overall efficiency of the educational process. Expected results and success indicators are also defined.
2. *Selection of methods of pedagogical monitoring:* methods and tools are determined that will be used to collect data on students' time resources, their organization of time and activity. This may include surveys, interviews, focus groups and observation [11, p. 352].
3. *Data collection:* Data is collected on students' time management, their allocation of time to various activities and assessment of their performance. This data will help you understand the current situation and identify areas for improvement.

4. *Data analysis:* The collected data is analyzed using qualitative and quantitative analysis methods to identify patterns, trends and features in the organization of students' time.
5. *Development of recommendations:* based on the results of the analysis, recommendations and strategies for introducing innovative time management technologies are formulated. These recommendations may concern changes in curricula, organization of the educational process, the use of technologies and tools to optimize students' time, etc.
6. *Implementation and evaluation of effectiveness:* innovative time management technologies are introduced into the educational process, and their effectiveness is assessed using pedagogical monitoring. Regular checks and feedback are carried out with students and teachers to adjust approaches and improve results [12, p. 42].
7. *Participation of students and teachers:* It is important to actively include students and teachers in the process of innovation. Their participation and feedback can significantly improve the success of implementation and adoption of new technologies.

Pedagogical monitoring plays a key role in this process, allowing you to obtain information about the effectiveness of implementing innovative time management technologies and make the necessary adjustments to achieve the desired results in the educational process.

Research results

Analysis of academic performance data of ZHASU named after. B. Osmonova:

Absolute Performance Trend: During these three years, absolute performance shows consistently high results, starting from 90.68% and reaching 93.79% in the last academic year. This indicates that the students' overall progress in the curriculum and examinations is good.

Dynamics of qualitative performance: Qualitative performance also shows relatively high indicators, remaining in the range from 55.71% to 60.83%. Although there is some variation in this indicator, overall results remain at a high level.

Analysis of pedagogical monitoring and time management:

Positive points: High absolute pass rates indicate that the majority of students successfully pass university exams. Qualitative performance, although fluctuating, remains at a level that may indicate satisfactory mastery of the material and subjects.

Potential Areas of Improvement: Fluctuations in quality performance may indicate a possible need for improvement in teaching methods, assessment approaches, or student support. It is important to study the factors that influence these fluctuations in order to develop strategies to improve academic performance.

Need for in-depth analysis: Additional data analysis, including review of programs, teaching methods, student engagement, and assessment procedures, can help better identify areas where improvements need to be made.

The overall trend shows good results for absolute performance, but fluctuations in qualitative performance indicate a need for more detailed analysis and perhaps adjustments to teaching methods and assessment systems to ensure more consistent student success.

Analysis of academic performance data from KSU named after. I. Arabaeva:

Qualitative performance: Qualitative performance reflects the percentage of students who successfully passed exams with “excellent” or “good”. From the data provided, it is clear that qualitative performance over the last three academic years shows a different trend:

- In the academic year 2020-2021, quality performance was 45.5%.
- In the 2021-2022 school year, it increased to 53.5%.
- In the academic year 2022-2023, quality performance increased to 57.5%.

This decline in quality performance in the last academic year can be caused by various factors, such as changes in the curriculum, the complexity of subjects or the educational system. Low quality performance may indicate problems with students' knowledge or the quality of teaching.

Absolute performance: Absolute performance reflects the percentage of students who passed the exams overall, regardless of the grade received. Absolute performance results also show significant fluctuations:

- In the academic year 2020-2021, the absolute academic performance was 91.2%.
- In the 2021-2022 school year, it dropped to 87.5%.
- In the academic year 2022-2023, absolute academic performance did not increase significantly and reached 89.4%.

Increases in absolute performance may result from improvements in students' grades overall, regardless of grade, indicating an overall improvement in academic performance.

Dynamics of the total number of students: According to the data, the total number of students also changed over time:

- In the academic year 2020-2021, the total number of students was 10,567.
- That number dropped to 9,112 for the 2021-2022 school year.
- In the 2022-2023 academic year, the total number of students continued to decline and amounted to 8,868.

The decline in student numbers may be due to various factors, such as student attrition, changes in admissions policies, or demographic changes.

The discussion of the results

From the analysis of data from two universities - Jalal-Abad State University named after B. Osmonov and Kyrgyz State University named after I. Arabaev - the following conclusions can be drawn:

Jalal-Abad State University named after B. Osmonov:

Absolute academic performance: At the University of ZHASU named after B. Osmonov for three years it ranges from 90.68% to 93.79%.

Quality performance: The indicator of quality performance (excellent students) decreased from 60.83% to 55.71%.

Number of students: There is a decrease in the number of students from academic year to academic year.

Dynamics of grades: Consistently high values of absolute academic performance, but there is a decrease in the percentage of excellent students.

Kyrgyz State University named after I. Arabaev:

Absolute academic performance: Over three years, indicators decreased from 91.2% to 89.4%.

Quality performance: There was a significant increase in the percentage of excellent students, from 45.5% to 57.5%.

Dynamics of grades: Decrease in the total number of students, but an increase in the percentage of excellent students and high-quality academic performance.

Possible factors influencing changes:

Changes in Educational Policy: There may be changes in assessment requirements, curriculum, or assessment methods that affect student performance.

Quality of Education: Differences in the quality of teaching, curricula and assessment methods can affect student outcomes.

Student Composition: Changes in student composition, background, or motivation may affect overall academic performance.

General observations:

Jalal-Abad State University named after B. Osmonov: Although absolute achievement remains high, the decline in the percentage of excellent students requires attention.

Kyrgyz State University named after I. Arabaev: The increase in the percentage of excellent students and high-quality academic performance is a positive factor, even if the overall number of students decreases.

The general trend shows both positive and negative aspects. An increase in quality performance, however, a decrease in absolute performance and a decrease in the total number of students require further study and understanding of the possible reasons for these changes.

Such data allows us to highlight key areas that require additional attention and analysis, such as the quality of education, support for students with difficulties and possible changes within the educational system. They also provide a basis for developing strategies and interventions to improve the educational process and overall student achievement.

Assessing the effectiveness of innovative time management technologies in universities

Assessing the effectiveness of innovative time management technologies in universities can be a complex and multifaceted task, as it depends on various factors, including the context of application, the goals of implementation and the expected results.

To evaluate the effectiveness of innovative time management technologies, the following approaches can be used:

1. *Comparison with previous methods:* Comparing new technologies with traditional time management methods allows you to determine how effective the new approaches are. This may include comparing student performance, reducing stress levels, increasing productivity, and improving study-life balance [13, p. 25].
2. *Evaluating User Feedback:* Obtaining feedback from students and teachers using innovative time management technologies will help identify their experiences and opinions on how effective these tools are in improving time management and achieving better results.
3. *Measuring Improvements in Academic Performance:* Analyzing data on student performance before and after implementing innovative time management technologies can show whether there is a significant improvement in educational outcomes after applying new approaches.
4. *Studying the level of student participation:* Measuring the level of student participation in the use of innovative time management technologies can also serve as an indicator of their effectiveness. If students are actively using and benefiting from these tools, this may indicate the success of their implementation.
5. *Assessing the overall level of satisfaction:* Conducting surveys or questionnaires among students and teachers using innovative time management technologies will reveal their overall level of satisfaction and assess the effectiveness of these tools [14, p. 413].
6. *Studying changes in student activity and engagement:* Innovative time management technologies can contribute to more efficient organization of the educational process, which in turn can increase the level of student activity and engagement.
7. *Comparison with Other Universities:* Conducting comparisons with other universities that also use innovative time management technologies can help determine what advantage or difference they bring to the educational process.

It is important to understand that assessing the effectiveness of innovative time management technologies can be contextual and depend on the specific conditions and needs of the university, as well as on the level of involvement of students and teachers. It is also worth considering that the success of implementing these technologies can be a long-term process that requires constant analysis and improvement.

Identification of factors contributing to the successful implementation of innovations

Identifying factors that contribute to the successful implementation of innovations in educational contexts is an important step for effective implementation and improvement of educational practice. Below are key factors that can contribute to the successful implementation of innovation in universities [15, p. 255]:

1. *Leadership and support of the administration:* Active leadership and support from the university administration are among the most significant factors for success. The administration must show interest in innovation, promote its implementation and provide resources for successful implementation.

2. *Faculty support:* Successful implementation of innovations depends on the involvement and support of teachers. It is important to provide training and support for teachers in the process of introducing new approaches and technologies.

3. *Student Involvement:* Student involvement in the innovation process can improve its effectiveness. Students can provide feedback, make suggestions, and be active participants in projects.

4. *Clear Communication:* Proper communication between all stakeholders (administration, faculty, students) is critical. Clearly explaining the goals and benefits of innovation will help reduce resistance and increase motivation to implement it successfully.

5. *Training and support:* Training and support for all participants in the process are key aspects of successful innovation. Teachers and students need to be provided with access to training materials and support tools to effectively use new approaches and tools [16, p. 177].

6. *Evaluation and analysis of results:* Continuous evaluation and analysis of the results of innovations helps determine their effectiveness and potential areas for improvement. Based on the analysis, adjustments and additions can be made to improve the success of innovation.

7. *Flexibility and adaptability:* The educational environment is constantly changing, so flexibility and adaptability to new conditions play a key role in the successful implementation of innovations. The ability to adapt to change and make adjustments helps keep innovation relevant and meaningful.

8. *Support from the university structure:* Integrating innovations into curricula, programs and activities of the university helps ensure their sustainability and long-term successful implementation.

9. *Policies and rules:* University policies and rules should support and facilitate innovation, and not create obstacles to its implementation.

10. *Use of research:* Being based on research and best practices when introducing innovations allows you to use scientific evidence and the experience of other successful projects [17, p. 102].

The successful implementation of innovations in education requires an integrated and systematic approach that takes into account all aspects of the organization and functioning of the university.

Identification of possible obstacles and limitations to the implementation of time management technologies in universities allows us to anticipate possible difficulties and develop strategies to overcome them. Below are some of the main obstacles and limitations [18, p. 166]:

1. *Resistance to change:* The introduction of new time management technologies may encounter resistance from teachers and students, especially if they are accustomed to traditional time management methods.

2. *Insufficient support from the administration:* If the university administration does not provide adequate support and does not provide sufficient resources for the implementation of time management technologies, this can become a serious obstacle.

3. *Limited Resources*: Lack of financial and technical resources may limit the ability to implement and support new technologies.

4. *Insufficient training and support for users*: If teachers and students do not receive sufficient training and support in the use of new time management technologies, this may lead to insufficient effectiveness of their use [19, p. 36].

5. *Technical problems*: The introduction of new technologies may encounter technical problems such as software problems, limited internet availability, etc.

6. *Cultural Differences*: Different cultures and countries may have different approaches to time management, and new technologies may not always be culturally appropriate.

7. *Lack of motivation*: If students and teachers do not see the benefits of using new time management technologies, they may not show enough interest in implementing them.

8. *Non-compliance with existing procedures*: The introduction of new technologies may face difficulties if they do not comply with the existing procedures and rules of the university.

9. *Limited adaptability of curricula*: The implementation of time management technologies may be limited by the fact that curricula do not provide sufficient space for their use.

10. *Technology Access Barriers*: Some students may have difficulty accessing necessary technology such as smartphones or laptops.

To successfully implement time management techniques, it is important to consider these obstacles and develop appropriate plans to overcome them. Training, communication, support and good planning can help eliminate or mitigate these limitations and enable more successful implementation of educational innovations [20, p. 207].

Conclusion

Summarizing the results of the study, we can draw the following conclusions:

As a result of the analysis of the academic performance of students at two leading universities in Kyrgyzstan - Jalal-Abad State University named after B. Osmonov and Kyrgyz State University named after I. Arabaev - it is clear that both educational institutions demonstrate certain changes in student performance indicators for the period under review [21, p. 13].

Absolute pass rate: Both universities have high absolute pass rates, exceeding 89% for all academic years reviewed.

Qualitative academic performance: KSU named after I. Arabaev showed a significant increase in the percentage of excellent students (from 45.5% to 57.5%), while ZHASU named after B. Osmonov showed a decrease in this indicator (from 60.83% to 55.71%).

Dynamics in the number of students: In both universities there is a noticeable decrease in the number of students over the period under review.

Achievement Trends: Both universities have high overall academic performance, however, it is important to note that changes in qualitative academic performance are important for further analysis and improvement of educational processes.

Need for deeper analysis: Studying the reasons for these changes, including factors such as educational programs, quality of teaching, organization of the educational process and the structure of the student body, can provide a more detailed understanding of the situation.

The importance of the quality of education: The increase in the percentage of excellent students at KSU named after I. Arabaev is a positive indicator and may indicate an increase in the quality of education at this university [22, p. 20].

Importance of further research: To improve educational practices and ensure high quality teaching, further research is needed to identify the reasons for changes in student performance in both universities.

The introduction of innovative time management technologies in universities can lead to increased efficiency in student time management, but the successful implementation of these technologies depends on the leadership of the administration, the support of teachers and the active participation of students. Implementation of innovation may face various obstacles, such as resistance to change, limited resources, and insufficient training and user support. However, these obstacles can be overcome through clear communication, training, and adaptability. For the successful implementation of innovations in the educational process, it is necessary to take into account cultural characteristics, the level of motivation and support from the university structure. It is important to constantly evaluate the results of innovation, analyze data and take measures to improve and optimize the educational process [23, p. 11].

So, based on the presented data, we can conclude that there is a need for further study of the factors influencing the quality of education at both universities in order to improve educational practices and ensure quality training for students.

Recommendations

Based on the analysis and the results of the study of two universities in Kyrgyzstan, several recommendations can be made to improve the quality of education and improve student performance:

1. Improving the quality of teaching:

Teacher training: Conduct regular professional development programs for teachers with an emphasis on the use of modern teaching methods and the latest pedagogical technologies.

Mentoring and support for teachers: Creating a system of mentoring and support for new teachers, providing opportunities for the exchange of experience between teachers with different work experience.

2. Improvement of training programs:

Curriculum updating: Periodic review and updating of curricula in accordance with the requirements of the labor market and modern trends in science and technology.

Integration of practical classes: Incorporating more practical classes, internships and project work into the educational process for deeper learning and real-world experience.

3. Technological innovation:

Use of modern educational technologies: Integration of online platforms, interactive educational materials, as well as the creation of virtual laboratories to enrich the educational process.

Digital Literacy Training: Provide training programs on digital learning tools and platforms for both teachers and students.

4. Student support:

Creating a student support system: Implementation of student support programs, including consultations on academic issues, assistance in developing study skills and time management.

Development of student activity: Supporting student clubs, organizing events and forums to develop leadership and social skills.

5. Monitoring and evaluation:

Regular pedagogical monitoring: Organization of a system of constant monitoring of student progress with subsequent data analysis for prompt adjustment of the educational process.

Assessing the effectiveness of changes: Conducting regular assessments of the results of implementing changes in the educational process to measure their effectiveness.

The implementation of these recommendations can help improve the quality of education, increase student achievement and create a more favorable educational environment at universities in Kyrgyzstan [24, p. 48].

The discussion of the results

Contribution of the study to the development of the educational system of Kyrgyzstan

A study conducted on the example of Jalal-Abad State University named after B. Osmonov and KSU named after I. Arabaeva, can make a significant contribution to the development of the educational system of Kyrgyzstan. Its results and recommendations can be used to improve the quality of education, the efficiency of student time management and the introduction of innovative approaches in the country's universities. Here's how research can make a positive difference [25, p. 16]:

1. *Improving student performance:* Analyzing student performance data can help identify weaknesses in the learning process and take action to address them. Recommendations proposed based on the study can help university teachers and administration develop more effective teaching methods and organization of the educational process.

2. *Introduction of innovations into the educational process:* research into the effectiveness of innovative time management technologies allows us to understand what approaches can be useful for students and teachers. This can encourage the adoption of new methods of organizing study time, leading to more productive and effective learning.

3. *Improving the level of teacher training:* analysis of data on support and training of teachers in the implementation of new technologies will allow us to determine the necessary

educational programs and trainings to improve the qualifications of teaching staff. This helps to improve the level of teaching and the effectiveness of the educational process.

4. *Increasing students' learning motivation:* Research can help identify factors influencing students' motivation for learning activities. Knowledge of these factors allows us to develop measures to increase motivation, such as improving teaching methods, diversifying educational materials and actively involving students in the educational process.

5. *Improving the quality of education:* the results of the study can be used to reform the educational system of Kyrgyzstan as a whole. Improving the quality of education in universities will lead to the training of more qualified specialists, which contributes to the development of the country.

6. *Awareness of the need for innovation:* The study can highlight the importance and need for innovation in the educational system. Awareness of the benefits and effectiveness of new approaches can facilitate changes in approaches to learning and management of educational processes.

7. *Increasing transparency and openness:* the results of the research, as well as the methods used to conduct it, should be available to the general public. This promotes transparency and openness in the educational system and promotes trust in educational institutions.

A study conducted on the example of Jalal-Abad State University named after B. Osmonov and KSU named after. I. Arabaev, can become a starting point for the further development of the educational system of Kyrgyzstan and improving the quality of education in the country. The results and recommendations of the study can become the basis for the development of strategies and programs to modernize the educational process and increase its effectiveness.

Prospects for further research

Further research in the field of pedagogical monitoring and time management in educational institutions of Kyrgyzstan can be aimed at the following prospects [26, p. 29]:

1. Study of the influence of innovative time management technologies on the academic performance and learning ability of students. This could be done by analyzing the data in more detail, comparing groups of students who use new technologies with those who do not, and examining the reasons for differences in achievement.

2. Analysis of the effectiveness of educational programs and methods related to time management and organization of the educational process. Research can evaluate which approaches and practices are most effective and how they can be applied in different educational settings.

3. Study of factors influencing students' learning motivation. Research could focus on identifying the key factors that motivate students to engage in active and productive learning and developing strategies to stimulate learning motivation.

4. Assessing the impact of changes in the curriculum and program on student performance and interest. Conducting longitudinal research can help understand which curriculum changes lead to better outcomes and improved educational quality.

5. Research on the impact of modern technologies such as online learning and the use of mobile applications on students' time management and academic performance. This can help determine how effective new approaches are in organizing the educational process.

6. Study of the influence of factors outside the academic sphere (social, economic, cultural) on time management and student performance. Studying external factors will help to understand the broader context in which educational institutions operate.

7. Comparative analysis of the practices and results of educational institutions in different regions of Kyrgyzstan. This will identify differences and similarities in education systems and identify best practices that can be transferred to other regions.

8. Research on the influence of parental support and family environment on students' time management and academic performance. This can help to understand how families influence students' academic performance and what resources can be provided to improve their success.

9. Conducting additional research in these areas will provide a more complete picture of the state of the educational system of Kyrgyzstan and develop more effective strategies to improve the quality of education and student performance.

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Effect of Tree Locations in a Square during Hot Summer Period

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ABSTRACT

Location of trees in urban areas has large influence to mitigate overheating of horizontal surfaces. Most used urban areas for rest and enjoyment in the city during the summer period are squares, and it is necessary to create comfortable conditions for their usage. The aim of this paper is changing location of trees by using parametric approach to determine optimal position of the trees in order to decrease insolation in a square horizontal surface. The research is conducted on Liberty square design in the City of Novi Sad (Serbia). A temporal analysis is performed for the summer period using appropriate climate data in the Ladybug software. The results of the analysis showed number of hours of direct sunlight. Also, the results indicate that different trees locations can mitigate overheating of the horizontal surface up to several percent. The parametric approach used in this paper can contribute to developing urban guidelines for comfortable squares during summer period.

KEYWORDS: insolation, Ladybug, square, trees, urban areas

1. INTRODUCTION

In the previous decades, urbanization process has large influence to increase temperature of urban surfaces. As a consequence of this effect are uncomfortable outdoor conditions to stay on urban spaces, such as squares, parks, parking lots, courtyards etc. The high growth vegetation, especially trees, can be used to provide effectively shade which contributes to mitigate overheating in the urban areas [1]-[4].

Squares surfaces in urban spaces represent potential overheating areas, because they occupy large surface covered by concrete, bricks or any other material which contribute to increase surface temperature [5]. The insolation in an urban surface can be changed by placed trees in different locations [6], [7]. In previous research, in order to decrease surface temperature, the design guidelines are proposed, which implies various orientation of the buildings or its position on the square. Some research do not have any urban modification, but analyzing the insolation and thermal comfort condition in the squares and comparing various arrangement of trees in various squares [8], [9]. By taking into account the lack of the researches which conducted by using various trees locations, this research implies the possible tree locations and measure insolation in an urban square. The rapid development of digital technologies in the field of architecture and urbanism allows large opportunities to measure insolation level of any urban area, with appropriate conditions. In contemporary practice, software for parametric modeling enables the interaction between 3D computer graphics and software tool suitable for solar insolation level [10], [11].

The aim of this paper is to create and propose an algorithm for changing trees location on the predetermined rectangle surface in order to mitigate overheating of square urban area. The algorithm uses input data such as 3D models of built environment of the Liberty square in Novi Sad and climate data for mentioned city. Thanks to appropriate software packages and parametric modeling, which allows fast processing, this is the way to optimize greenery in the square and enable cooling of the space.

2. METHODOLOGY

The algorithm created in this paper proposes locations of any given number and geometry of trees on a square surface in order to mitigate insolation level. The algorithm methodology is elaborated upon.

The proposed method takes into account next phases:

- 3D modeling of the built environment of the Liberty square
- Climate data for Novi Sad
- Number, shape and size of trees to be placed in square surface.

Built environment of the Liberty square is represented by 3D model of the square flat surface terrain, spatial orientation, rectangle of square paved surface, surrounding buildings that influence the solar insolation level. Climate data for Novi Sad considers characteristics about air temperature, wind speed, relative humidity, and diffuse, direct and normal solar radiation. Number of trees are arbitrary, shape of the tree consider shape and size of crown and height of the trunk.

By using all mentioned data as input data in appropriate software package, the algorithm can solve insolation level for given location. 3D models of surrounding buildings and square surface was created in Rhinoceros, CAD modeling software. In the Grasshopper, software for parametrization of 3D model and add-on of the Rhinoceros, shape and size of trees was parametrized and connected with square surface in which trees have to be placed. Parametrized shape and size of trees are representing as 3D model in Rhinoceros on the square surface rectangle. The trees 3D models are simplified, as sphere. In the Ladybug, software for solar analysis, add-on of the Grasshopper, the weather data are inputted in order to solve solar simulation analysis, by using geometrical input data for the square.

2.1. Algorithm

Algorithm presented in this paper is divided into three phases.

The first phase includes geometry input which cast shade, such as surrounding buildings and existing trees near the buildings. The rectangular shape of the square is area which is exposed to sun (Figure 1). The geometry characteristics are consists of buildings heights, base geometry and width of buildings. Trees geometry is created by using size of tree crown, spherical shape of the crown and height from the base to center of the sphere. Rectangular shape of the square is approximately placed in the center of the square that is the most used space for resting.

All mentioned above geometrical elements are created in Rhinoceros and referenced in Grasshopper in order to use it in the further process of algorithm.

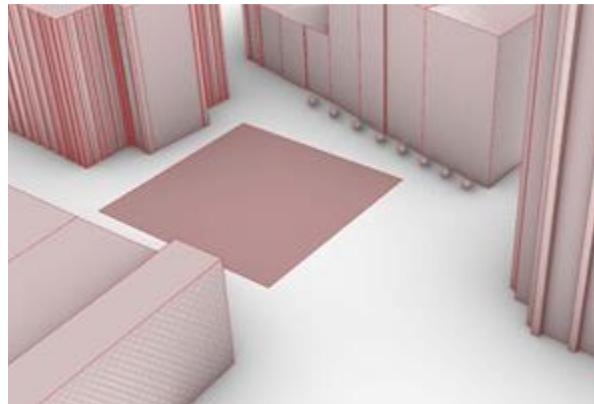


Figure 3. Geometry of surrounding buildings and existing trees in the Liberty square

The second phase of the algorithm is a part with trees in the rectangular shape and possibility to random change its positions. Several parameters are created to determine sphere locations. Firstly, the rectangular shape are populated with random points. The user can choose the number and height of points. These points are presented as centers of the spherical shape which presented trees (Figure 2). Also, in algorithm is enabled to user to change the size of sphere radius. Taking into account all these parameters, the random component is connected and allows random shuffle of the spheres. By changing number on the number slider, the spheres random change its locations.

Spheres will be used as solid forms that casts full shadow in the rectangular plane.

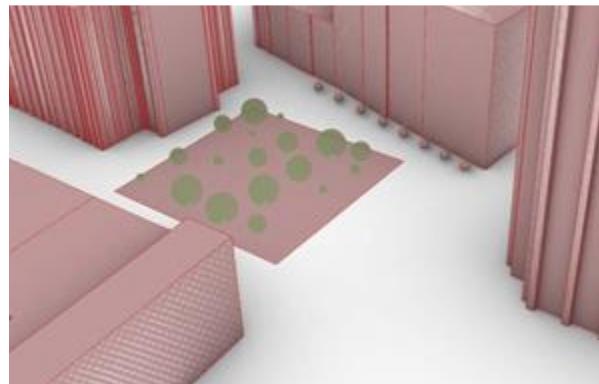


Figure 4. Trees disposition by using algorithm in the Liberty square

Third and the last phase of the algorithm is solar simulation analysis. For this analysis the Ladybug software is used, suitable to calculate hourly solar simulation. Geometry from the first and the second phase is input parameter that cast shadow, while the rectangular plane of the square is exposed to sun. Also, the climate data are taking into account, for specific period of the year and day. Final results are presented in hours (Figure 3).

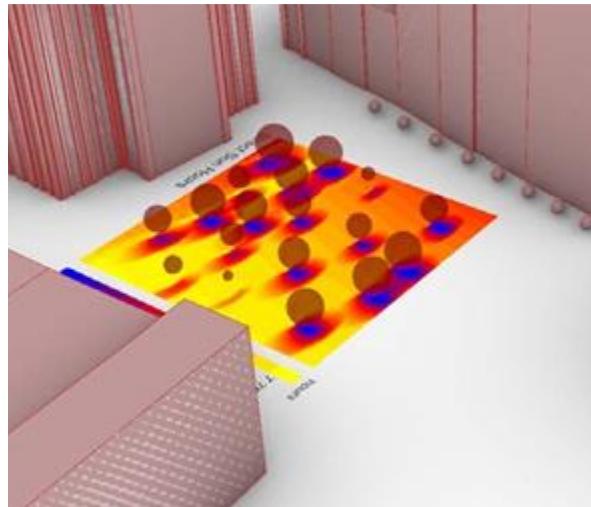


Figure 5. Color scheme of direct sun hours for rectangular plane with trees

2.2. Climate data

Solar insolation analyses are performed in Ladybug, by using appropriate geometrical data, which are the input data for solar simulations.

Climate data which are used consider weather data for Novi Sad measured in 27 different locations by meteorological sensors within Urban-Path European international project [12]. Data which are necessary for solar insolation, used in this paper, are air temperature, wind speed, relative humidity, and diffuse, direct and normal solar radiation for summer period. Stations measure the values every minute and every 10 min send the readings about climate and other technical information to the main server. The stations times are in Universal Time Coordinated (UTC) and are regularly synchronized by the main server (located at the University of Novi Sad, Faculty of Science – UNSPMF).

The algorithm enables user to select and input specific period of the year, months (1-12), days of the months (1-31) and period of the day (0-24). In this paper, the most problematic period during the hot summer period is June 21st, from 9 pm to 7 am. Also, this is most commonly used period when people spent time on the square during the summer.

3. RESULTS

Results suggest that method presented in this paper can be used for mitigation of insolation in square space based on trees locations. The result of the current situation shows that square space is sunny 6.41 hours per day. By planting trees and randomly disposition by using algorithm this value is lower substantially. The small difference is when the trees have lower radius and amounts 5.6 sun hours per day (Figure 4) and larger difference of 5.24 sun hours per day is when the trees have higher radius (Figure 4) compared to current situation.

The improvement of the sun hours in rectangular square space is noticed when the trees disposition are changed. Depends on the trees position, the results are different and it is in a range from 5.19 to 5.48 sun hours per day. By using all random seeds in Grasshopper, the final best result is obtained and its value is about 5 sun hours per day (Figure 6). Also, the same results can be obtained for different trees disposition.

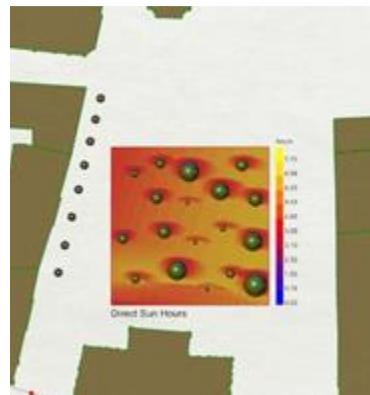


Figure 6. The small difference in sun hours compared to current situation

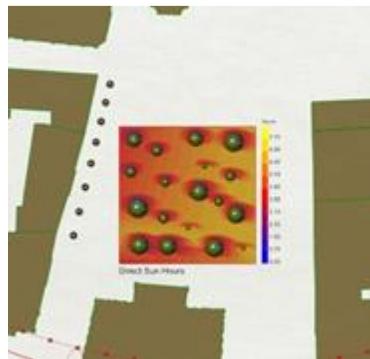


Figure 7. The larger difference in sun hours compared to current situation

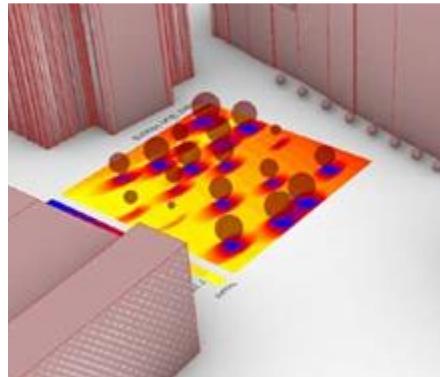


Figure 8. Trees disposition with the best sun hour result

4. CONCLUSION

This paper has shown that insolation level on square surface can be mitigated by changing trees disposition in various ways. Taking into account built environment, climate data and trees geometrical characteristics, simulations of insolation are performed. Method proposed in this paper is applicable on any world location, with appropriate weather data for precise location. Also, by using any paved surface and any tree geometrical characteristics the insolation mitigation can be noticed. This algorithm can contribute to better outdoor thermal comfort and allows optimal conditions for staying at the square space.

Integration of different software packages, Rhinoceros, Grasshopper and Ladybug enables very fast processing of solar simulation results. The results of this research are significance because provide the importance to understanding trees planting during summer period in the open urban spaces. This paper can improve the understanding of the management of tree shade, that provide to urban planners to predict comfortable urban places.

The limitation of this research is that there is no possibility to take into account real trees characteristics such as leaf density and transparency. There is only possible take trees as a solid form, that casts a full shadow at the ground. This algorithm and this method can be applied at any urban surface with any geometry with problem of overheating in the city.

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DETERMINANTS OF SUCCESS IN THE MULTI-LEVEL IMPLEMENTATION OF THE MULTI-ACTOR APPROACH TO INNOVATION IN AGRICULTURE, FORESTRY AND RURAL DEVELOPMENT: AN ANALYTICAL FRAMEWORK

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ABSTRACT

The Multi-Actor Approach (MAA) is a normative standard the European Commission (EC) formally applies to many of its (co-)funded innovative projects in agriculture, forestry and rural development. The MAA requires projects 1. to build on the activities of partners with complementary types of knowledge, including in particular (representatives of) the targeted users of the project results; and 2. to ensure the joint engagement of these diverse partners in all phases of the innovation process. Projects that are required to comply with the MAA are officially called 'Multi-Actor projects'. They include some international research and innovation projects funded under the EC's Framework Programme for Research and Technological Development Horizon Europe (or its predecessor Horizon 2020), as well as local EIP Agri Operational Groups (OGs), which are co-funded by the EC and the Member States (MS). As with all public policies, several groups of actors – including the EC itself – have a legitimate interest in learning how well the MAA is being implemented by its intended target actors. A general answer to this question is complicated by the fact that Multi-Actor projects differ in many respects, such as the innovative objectives they pursue, the size and composition of their consortia, the duration of their activity, and their geographic scope. One aspect that makes it particularly difficult to identify general implementation determinants is their embeddedness in distinct multi-level governance settings. For example, while Horizon Europe-funded research project consortia operate under the direct management of the EC's agencies, OGs are funded under a measure which is formulated by the EC but implemented at the national, or in some MS, regional level. These differences inevitably have an impact on how success in the implementation of the MAA can be achieved. In this paper, we propose a framework for analysing the factors that determine success in the implementation of the MAA, as well as their interrelations. This framework builds on a review and integration of insights from various fields of social scientific research, notably research on public policy implementation, multi-level governance, and participatory approaches in agricultural policy. To test the framework, we apply it to data from four case studies of OGs that we conducted in 2020 in the frame of the H2020-funded research project LIAISON.

1. Introduction

The Multi-Actor Approach (MAA) is a normative standard the European Commission (EC) formally applies to many of its (co-)funded innovative projects in agriculture, forestry and rural development. These projects are officially called 'Multi-Actor projects' (MA projects) (cf. EIP Agri 2017). They notably include all projects that form part of the European Innovation Partnership for Agricultural Productivity and Sustainability (EIP Agri) such as some international research and innovation projects funded under the EC's Framework Programme for Research and Technological Development Horizon Europe (or its predecessor Horizon 2020), as well as local EIP Agri Operational Groups (OGs), which are co-funded by the EC and the Member States (MS). However, other EU funding programmes such as LIFE, Interreg or LEADER/CLLD apply similar approaches.

A review of relevant policy documents reveals that the EC does not currently offer a consistent definition of what the MAA actually requires of the project consortia to which it applies. Requirements vary for different types of MA projects and typically also individual projects. However, the MAA – in any of its specifications – entails at least the following normative elements:

1. It requires innovation projects to build on the activities of “partners with complementary types of knowledge – scientific, practical and other” (EIP Agri 2017), including in particular (representatives of) the targeted users of the project results (multi-actor requirement); and
2. to ensure the joint engagement of these diverse partners in all phases of the innovation process, “from participation in the planning of the project and experiments, to implementation, the dissemination of results and a possible demonstration phase.” (EC 2020) (interactive innovation requirement).

As with all public policies, several groups of actors – including the EC itself – have a legitimate interest in learning how well the MAA is being implemented by its target actors. Presupposing that ‘success’ in the implementation of the MAA means compliance with the above requirements – how well are MA consortia faring, and which factors determine implementation success? In this paper, we will leave aside the first of these questions – that of assessing actual MAA implementation performance – and focus on the second: that of performance determinants.

A general answer to this question is complicated by the fact that MA projects differ in many respects, such as the innovative objectives they pursue, the size and composition of their consortia, the duration of their activity, and their geographic scope (cf. Fieldsend et al. 2020). One aspect that makes it particularly difficult to identify general implementation determinants is their embeddedness in distinct multi-level governance settings (cf. Hooghe/Marks 2003). For example, while Horizon Europe-funded research project consortia operate under the direct management of the EC’s agencies, OGs are funded under a measure which is formulated by the EC but whose implementation is managed by authorities at the national or, in some MS, regional level. These differences inevitably have an impact on how success in the implementation of the MAA can be achieved. How can such heterogeneous cases be compared in terms of the factors that determine implementation performance?

In this paper, we propose a framework for analysing such factors as well as their interrelations. This framework builds on a review and integration of insights from various fields of social scientific research, notably on public policy implementation, multi-level governance, and participatory approaches in agricultural policy. To test the framework, we will apply it to data from four case studies of OGs that we conducted in 2020 in the frame of the H2020-funded research project LIAISON (cf. Cronin et al. 2021). OGs are a particularly challenging study object because they are co-funded from the European Agricultural Fund for Rural Development (EAFRD) and the national or, in some MS, regional Rural Development Programmes (RDPs) and are being managed by national or regional public bodies within the legal scope defined by the EAFRD regulation. This means that more levels of governance are involved in OG implementation than in other MA partnerships, especially consortia funded by the EU research fund Horizon Europe or its predecessor H2020. Furthermore, MS/regions implement the OG measure differently through their RDPs. For example, while several MS have designated an innovation support service provider (ISS) to assist the OG with application or problems during

project implementation, not all have done so, and the structure and function of the ISS differs from MS/region to MS/region.

In the next section, we will describe the theoretical background of our framework and define its key variables (2). We then present the main findings from applying this framework to the four OG case studies (3). The article concludes with a discussion of the empirical findings and the framework's benefits and limitations (4).

2. Theoretical background and key variables of the analytical framework

In this section, we define the dependent variable (2.1) and independent variables (2.2) of our framework, together with a visualisation (graph 1). (Numbers in square brackets refer to the respective numbered elements in the graph.)

2.1 Dependent variable: Implementation performance

The core concept of our framework is that of 'implementation'. Implementation means the act of realizing a goal [1] – understood as formulation of a desired state of the world – defined by a public policy (cf. O'Toole 2000). While 'implementation' in this sense can both refer to a single actor's activities or the activities of diverse actors at once, our framework focuses on the implementation performance of a single (individual or collective) actor, or actor type.

For each policy goal, we assume there exist (in reality or hypothetically) objectives which identify the activities that are needed to achieve the policy goals (cf. Aragrande/Argenti 2001). By thus translating goals into concrete mandates that can be attributed to actors, objectives effectively provide the success criteria against which to measure actors' implementation performance.

By 'implementation performance' we mean the extent to which an actor actually manages to comply with the particular objective(s) the policy maker expects him/her to comply with. Accordingly, we consider an actor's implementation performance successful to the extent that s/he complies with the objectives he/she is expected to comply with, and unsuccessful to the degree that s/he does not.

2.2 Independent variables

There is a broad consensus among researchers that implementation performance depends both on the characteristics of the implementing actor and various external factors, i.e. factors beyond the implementer's control (cf. Mazmanian/ Sabatier 1989; Velten/Jager/Newig 2021). As one observer of the field noted as early as 1986, empirical studies of policy implementation as well as conceptual contributions have identified over 300 such potential determinants of implementation performance (cf. O'Toole 1986; cf. Saetren 2014). Our framework represents an attempt to integrate most of these findings into one coherent analytical approach. It is based on the premises that (1) an actor's implementation performance is a function of his or her ability to implement and that (2) this ability is determined to varying, case-specific degrees by the implementation context.

2.2.1 Ability to implement

By an actor's ability to implement we mean all the features of an implementing actor that determine the likelihood of his or her implementation success. We focus here on those actor features that either make implementation success more likely ('assets'), or less likely ('deficits'), compared to a hypothetical state in which those features are not present and in

which all other determinants permit implementation success. While assets constitute a success factor, ‘deficits’ constitute an implementation bottleneck.

We propose that all of an implementing actor’s assets and deficits fall into six categories [2]. The relevance of each of these categories for implementation performance and, within each category, the extent and direction of influence of each determinant, will vary across empirical cases.

Three such categories of determinants are largely uncontroversial. Researchers of various disciplines agree that an actor’s ability to achieve certain goals depends on (a) his or her possession of material resources needed for implementation, such as budget, facilities and time; (b) his or her possession of relevant capacities; and (c) his or her motivation to perform the activities needed for goal achievement (cf. e.g. Mazmanian/Sabatier 1989). Within each of these categories, an actor may feature multiple assets and/or deficits. Which of his or her features may become assets or deficits for implementation depends, among else, on the goal being implemented. For instance, not all goals require the same kinds of resources or capacities to be achieved.

Furthermore, a major interest of practitioners and researchers of policy implementation concerns the normative coherence of implementation, i.e., whether implementation is compatible with certain other norms at a higher or at the same regulatory level (cf. Fischer-Lescano/Teubner 2004). We integrate this concern into our framework by assuming that most policies are associated with a claim to legitimacy. While ‘legitimacy’ can refer to a policy’s compatibility with legal as well as ethical or social norms, the focus of our framework is on legal compatibility, i.e. legality. We further assume that policy implementation may only be considered successful to the degree that it preserves the policy’s legitimacy basis, i.e., does not violate other legal norms that the policy claims to be compatible with. Accordingly, another feature that matters for an implementer’s performance is (d) which legal resources s/he possesses for goal implementation; referring to both the rights and duties that arise for the implementer from the policy itself and from other legal norms the policy claims to be compatible with. While some rights and duties provide the implementing actor both with incentives and options to implement the policy objectives (‘assets’), others may create negative incentives or legal hurdles (‘deficit’).

But even where an implementer possesses appropriate legal resources for implementation, s/he may not always be fully aware of these resources, i.e. of what s/he can and cannot legally do to implement the objectives (cf. Wagner 2009). Since one arguably cannot intentionally observe duties or make use of rights that of which one is unaware, an actor’s degree of (e) certainty about his or her legal resources for implementation is likely to affect his or her implementation performance as well.

Finally, research has shown that the ability of a collective to achieve certain goals is highly dependent on the ability of its individual members to contribute to collective performance (cf. Collective Action, Ostrom 2009). We propose that this has two implications for policy implementation when the implementer is a collective. First, it means that implementation performance does not only depend on how well the collective fares with regard to the above categories of factors (a-e). Rather, performance is also influenced by whether the individual members possess all they need to contribute to the collective’s performance. Secondly, this dependence of the collective on its individual members also means that the collective’s performance will be determined by (f) the quality of collaboration between members, e.g.

whether they have established appropriate mechanisms for decision-making, knowledge sharing, and conflict resolution (cf. e.g. Stokes Berry/Berry/Foster 1998).

Overall, then, our framework considers an actor's ability to implement a certain policy to be comprised of six categories of factors or features:

1. the rights and obligations the actor possesses (category of 'right')
2. the extent he is aware of these rights and obligations ('knowledge of right')
3. the resources he possesses to make optimal use of his or her legal leeway for implementation ('resources')
4. the capacities s/he possesses to make optimal use of these rights and resources for implementation ('capacity')
5. the motivational resources/he possesses to make optimal use of those rights, resources, and capacities for implementation ('motivation')
6. and the mechanisms for collaboration the actor has established internally ('quality of collaboration')

Based on the above considerations, we assume that in collective actors, the first five of these categories apply both to the collective as a whole, and to its individual members. In addition, the sixth category only applies to collective implementers, not individuals.

Determinants of implementation performance may interact with each other both within and across categories in various ways, e.g. strengthen or weaken each other's effects or jointly contribute to or result in a third factor [3]. With this assumption, we account for the fact that the features that comprise an actor's ability to achieve goals are neither causally independent from each other, nor static, but that, very often, assets and deficits accumulate. Including this assumption also invites thinking about how implementing actors may build on their assets to compensate for some of their deficits.

2.2.2 Implementation context

An actor's ability to implement a policy is always influenced to some extent by determinants s/he may not affect (cf. Mazmanian/ Sabatier 1989; Velten/Jager/Newig 2021). These factors comprise his or her implementation context. We assume that some features of this context can strengthen the actor's ability to implement, i.e., constitute success factors of implementation performance, while others can weaken it and thus constitute bottlenecks. Since these factors become effective more 'upstream' in the implementation flow, we propose to call them 'upstream bottlenecks' respectively 'upstream success factors'.

We distinguish between two types of such factors: 1. the activities of actors at higher governance levels, and 2. the wider environment, which consists of activities of informal governance actors as well as aggregate features of the implementation context.

2.2.2.1 Actors at higher governance levels

As mentioned above, our framework takes into account that most policies, including the MAA, are implemented in multi-level governance settings (cf. Hooghe/Marks 2003; Börzel 2020; Jeffery/Peterson 2020) [4]. Analysing the implementation of policies as embedded in multi-level governance settings means recognizing that the ability of an actor to implement a specific

policy will partly be determined by other actors who have authority over him/her, i.e., have a formal right to condition his or her ability for implementation (governance actors).

Governance actors operate at different levels in that they have different degrees of decision-making power relative to one another with regard to the policy goal being implemented. Accordingly, we call an actor an ‚actor at a higher governance level‘ who may define implementation conditions which other governance actors may either only specify further or implement, but not alter or override. In this view, the ‘implementing actor’ occupies the lowest governance level, for s/he has, relative to all other actors, the least governance options (even though s/he may have some discretion in his or her implementation of the policy goal). Our framework also acknowledges that multiple actors may operate at the same governance level and may employ some form of division of labour.

Governance actors need not be governments or public agencies (cf. Börzel 2020). In fact, many current EU policies require the involvement of a broad range of societal actors in their implementation and monitoring (cf. Newig/Koontz 2014). In our framework, the sole criterion for defining an actor as a relevant governance actor is therefore whether that actor has, in relation to the policy that is being implemented, a formal right to intervene in the implementation process at any stage.

Actors at higher governance levels may either affect an implementing actor’s performance directly by positively or negatively affecting one or more of the six categories of factors that comprise his/her ability to implement, especially his/her possession of rights and duties. However, they may also affect his/her performance indirectly, namely by affecting the activities of actors at lower governance levels (who in turn affect his/her ability to implement) or by affecting his/her environment.

Feedback from governance actors at lower governance levels – including from the level of implementation – to actors at higher governance levels or at the same governance level may also impact implementation performance indirectly (cf. Moynihan/Soss 2014) [5]. By feedback we mean any type of activity by actors at lower governance levels that has the potential to alter the activities of actors at higher governance levels. Importantly, our framework does not consider activities here that lead to reformulations of the very policy objectives being implemented, but only activities that change implementation (cf. section 4).

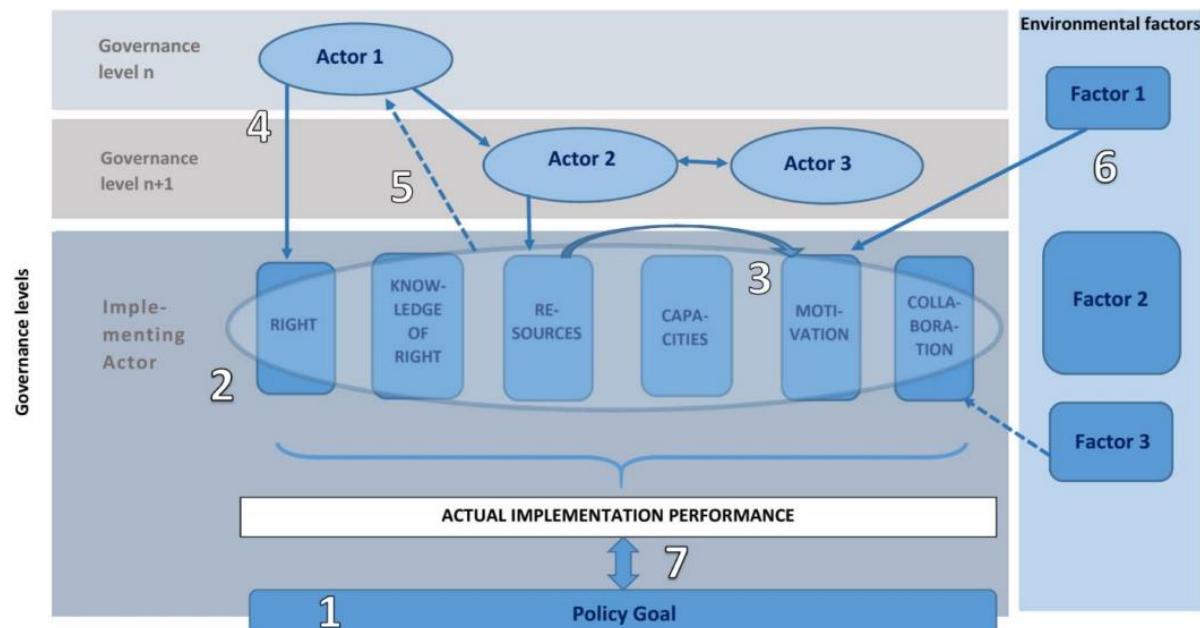
2.2.2.2 Environment

Next to governance actors, a variety of determinants not anticipated in and regulated by the formal implementation procedure are decisive for the outcome of most implementation processes (cf. O’Toole 1986; 2000). In our framework, we use the term ‘environment’ as a catchall denomination for such determinants [6]. This category contains, in turn, two groups of factors: the activities of actors without formal decision-making power in the process, such as informal interest groups (cf. Cahn 2013), and aggregate features of the implementation context such as ecological, demographic and socio-economic conditions as well as policies from other policy areas. Considering the diversity of cases of policy implementation, our framework refrains from precluding which environmental factors will actually be relevant for explaining implementation performance in a particular case. Rather, the analyst must make informed decisions about which environmental factors to include in the analysis.

Like governance actors, informal governance actors and environmental factors may be ranked according to the level of influence they have over each other. According to this logic, features of the global economy are more likely to affect social and economic conditions in a particular

area or sector than vice versa. Ranking environmental factors in this way will help to explain also the kind of influence they each have on implementation performance, and why they may effect certain stages in this process, but not others. Like between governance actors, feedback may occur from less influential environmental factors to more influential ones.

Our framework also assumes that environmental factors interact with the activities of governance actors, and that feedback takes place both from environmental factors to governance actors and vice versa. For instance, global markets (environment) respond to the activities of governance actors, and governance actors respond to markets. Conceptualising an actor's implementation performance thus as a function of his or her ability to implement, which is in turn at least partly shaped by actors at higher governance levels, the implementation context, and feedback mechanisms between these determinants, allows to identify the causal pathways that resulted in a particular performance. Determining such causal pathways of implementation success respectively failure is precisely the aim of our framework [7].



Graph 1: Visualisation of the analytical framework for multi-level policy implementation

3. Determinants of success in the implementation of the Multi-Actor Approach by Operational Groups: Results from four case studies

In this section, we present selected findings from applying the above framework to case studies of four OGs conducted in summer 2020 in the context of the EU research and innovation project LIAISON (2018-2022). The selected OGs were located in different countries (France, Germany, Italy and Poland) and addressed different issues (local introduction of hemp production, reintroduction of two ancient grains, establishment of a laboratory for local producers' shared use, participatory development of area-specific action plans). The collection of data was based on desk studies of relevant documents and interviews (partly face-to-face, partly online) with OG coordinators and various members as well as key stakeholders, e.g. from the managing and granting authority or business partners. Data collection followed an agreed guideline and was documented in a standardised 'case study reporting template' which was reviewed internally to ensure the comparability of data (cf. Cronin et al. 2021; Fieldsend et al. 2020).

Our case studies show that OG members generally approve of the concept of the funding scheme, which offers beneficiaries' of up to 100% funding for the attempt to innovate, rather than making funding conditional on a particular outcome such as an increase in productivity. Beneficiaries did not object to the amount of funding granted, which suggests that the activities they implemented matched the awarded amount. However, some interviewees also mentioned that they applied for funding from additional sources to implement some of their activities. However, there are major bottlenecks in the implementation of MAA by OG. First, practitioners such as farmers or foresters generally have fewer resources and capacity to participate in OGs or in specific OG activities compared to other actors. Reporting requirements impose a particularly heavy administrative burden on small (family) businesses, who often lack administrative capacity and time.

Secondly, differential economic stakes of OG members have a major impact on their cooperation. While the project funding is the main or a major source of income for some partners, it is only an additional support for partners whose main income comes from other sources such as business activities or employment. OG partners of the latter type typically have relatively lower economic stakes in the project results and therefore less incentives to 1. follow the requirements of the Grant Agreement in case of a (perceived) collision with the necessities of their main incomegenerating activity; 2. invest time in project activities or engage in stakeholder activities that yield no economic benefit; and 3. disseminate marketable findings/innovative solutions (risk of losing market advantage). In contrast, similar economic stakes in the project and trust through previous collaboration appeared to be motivational success factors for good internal collaboration.

The implementation context influences OGs' ability to implement the MAA in several important ways.

The inflexibility of the OGs' Grant Agreement with the national/regional granting authorities and (in two cases) the paying agencies' perceived rigidity in implementing them add to the administrative burden of beneficiaries and, sometimes, financial cost. Our case studies also reflect that beneficiaries' rights differ considerably across MS. In some MSs or regions, the OG measure is designed more favourably than in others, offering beneficiaries a comparatively higher maximum amount and a longer funding period, as well as a lower rejection rate and access to innovation support services (ISS). In addition, ISS differ in their design. In some regions/MS, ISS lack rights (limited remit), resources (understaffing) or capacity.

Legal collisions between funding requirements and national/regional laws or procedures (e.g., administrative provisions about funding rates for staff; different budget periods) often lead to legal obstacles or increase the administrative burden. For example, although in principle OGs can apply for investment funds from EAFRD under privileged conditions, the requirements (e.g. the obligation to use acquired machinery for the same purpose for several years, even after the end of the eligibility period) make it more attractive for OGs to pursue other investment funding options. These legal conflicts and shortcomings were insufficiently considered in EAFRD programming at the time of the case study analysis.

The interplay of the governance actors involved also has the potential to greatly influence MAA implementation and the implementation of OGs in general. Notable success factors include good collaboration between funding authorities; their adjustment of the funding measure based on beneficiaries' feedback – which in turn requires the existence of good feedback mechanisms between OGs and the funding authorities, as well as funding authorities' willingness and

capacity to actually improve the measure's design; and their lenience towards beneficiaries in administrative matters.

Apart from differences in MS' implementation of the OG measure, the overall support by the social and policy environment also varies among MS, which also influences implementation performance. Notable bottlenecks include a weak Agricultural Knowledge and Information Systems (AKIS) and funding authorities' unfair privileging of certain actors as well as funding authorities' lack of resources, capacities and/or motivation to improve programming of the measure. In contrast, a strong national, regional or sectoral AKIS; a favourable market situation; good cooperation of local/regional/national public authorities with funding authorities; and the availability of additional funding sources on which OGs can constitute supportive environmental factors.

We further found that the local context is an important determinant of OGs' success in implementing the MAA. First, some of the studied OGs exhibited a strong local embeddedness. This improved their access to resources such as local informal support networks, which in turn provided missing resources (e.g. facilities) and capacities (e.g. in administration). Secondly, our case studies indicate that spatial proximity of partners enhances their motivation to collaborate. Conversely, cooperation in OGs has long-term benefits for partners that can last even beyond their joint activities, which also increase their motivation to participate. Notable benefits include better networks and trust building, as well as capacity building (professional skills, experience with project participation).

4. Discussion

4.1 Empirical findings

The empirical findings confirm that successful multi-actor collaboration in agriculture, forestry and rural development depends both on internal features of the respective partnerships, and environmental factors (cf. Velten et al. 2021) such as the state of the national or regional AKIS and the availability of additional funding sources to supplement OG funding. While the small sample does not allow to generalise findings, some of them, such as observed legal collisions between the OG measure and other EU or national laws, are clearly relevant for OGs and their implementation of the MAA in general. One decisive internal factor that determines OGs' performance in implementing the MAA is how they manage their internal differences, especially with regard to the economic stakes their members have in their joint project. Different economic stakes mean that members have different – and differently strong – motivations to participate in OGs and to engage with others in activities (cf. Molina et al. 2021). Failure of (prospective) OG members to address such differences early on is therefore bound to lead, first, to a low participation of partners with lower economic stakes, which tend to be farmers, and secondly, to suboptimal collective performance and partners' frustration. A particularly important contextual determinant of OGs' performance in implementing the two objectives of the MAA is the multi-level governance of the OG measure, which allows MS to implement the measure differently. As is typically the case with 'differentiated integration' in the EU (cf. Leuffen/Rittberger/Schimmelpfennig 2012), the implementation choices MS make here clearly do not only reflect their governments' legitimate priorities, but also their differences in resource and capacities. If national funding authorities lack budget, staff, or understanding of the measure or the MAA, they are unlikely to improve their implementation of the measure. This can reproduce existing power differences between MS, in that MS that already possess sufficient resources and capacities are likely to reap more benefits from the measure than those MS that lack these resources and capacities. The unequal relation of costs

to benefits of implementation is also likely to make some countries more willing to implement the measure than others.

4.2 Reflections on the framework's benefits and limitations

Next to yielding empirical insights into the determinants of the implementation of the MAA by OGs, our case study analysis also shows the benefits of our framework. Firstly, the framework is able to cover simultaneously a variety of factors that affect OGs' implementation performance, as well as their causal interrelationships. This is certainly required if one wants to explain MAA implementation outcomes in contexts that involve not only multiple governance levels but also a great room for discretion of governance actors at lower levels. In doing so, our framework enables an assessment of implementation bottlenecks and success factors across OGs, despite their embeddedness in considerably different policy and social environments.

The framework may also serve as a starting point for the conceptualisation of various more specific explanatory approaches, as its concepts invite further theoretical elaboration. For instance, an in-depth analysis of the role of motivational resources in explaining implementation performance may operate with a more fine-grained concept of 'motivation' that distinguishes between different types of motivational resources, and otherwise adopt the general concepts proposed by the framework. Likewise, one may apply a particular analytical distinction of different modes of horizontal cooperation between governance actors in order to gain a more differentiated understanding of how such cooperation may affect policy implementation performance.

Moreover, the framework has the potential to bridge a gap between approaches to implementation which consider successful implementation an act of compliance with predefined goals, and approaches that focus on how implementers redefine policies and/or adapt them to their specific contexts (cf. Mazmanian/Sabatier 1989). From the first strand of theories, our framework adopts the understanding of implementation success as 'compliance'. While policies are always intermediate products of an ongoing cycle of formulation, implementation and reformulation, we propose that at some point in any policy process we also have an interest in measuring societal progress towards agreed policy goals and holding implementers accountable. At the same time, our understanding of policy goals is sufficiently broad to allow for policies that, rather than prescribing a particular course of action, only define some minimal criteria for implementers to meet. This definition anticipates that many policies – including the MAA – allow for implementers' discretion. By considering feedback mechanisms an independent variable, our framework also accounts for recursive implementation practices that involve specifications – albeit not actual revisions – of the initial policy goal.

Finally, we also found that by highlighting the multi-variate causes of implementation performance, the framework helps to identify multiple intervention options for optimising implementation. For instance, by reflecting that some of the current failures of OGs to implement the MAA requirements result from an interplay of the measure's design and socio-economic features of the different implementing MS and regions, the framework helps to see that implementation performance may be either improved by altering the measure's design, MS' socio-economic features, or both. However, the framework also faces several shortcomings. For one, as much of current work in implementation research, it is so far purely suitable for qualitative, not quantitative analysis of implementation performance. While it helps to determine some of the factors that contribute to a particular implementation outcome, as well

as the direction of that influence, it does not allow for an assessment of the actual strength of these influences. It would be worthwhile to see how the framework could be adapted to suit quantitative research purposes also.

Although the generality of the framework's assumptions is partly a strength, some assumptions could profit from further clarification. For example, it might be useful to include a more precise understanding of the interrelationships between variables, such as the distinction between moderating and mediating variables (cf. Baron/Kenny 1986). Other assumptions of the framework, on the other hand, may be more ontologically challenging than has been assumed here. For example, one may wonder whether focusing on the activities of actors with a formal right to participate in an implementation process does not overstate their influence compared to informal actors. Thus, Schakel (2020: 767) observes that there is a "significant sharing of authority between governmental actors within and beyond national states even in cases where the formal right to make a decision lies with national governments or the EU legislator". Further testing of the conceptual framework on a variety of empirical cases of multi-level policy implementation will help to better identify key areas for its use and further improvement.

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DECADES OF LEAD, CADMIUM AND MERCURY CONTAMINATION IN NIGERIA ENVIRONMENT, A REVIEW FROM 1996-2016.

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ABSTRACT

Low-level lead, cadmium and mercury exposure contributes much more toward the causation of chronic disease and impaired functioning than previously thought. Environmental contamination and exposure to them has risen dramatically in the past 50 years as a result of increase in the use of metals in industrial processes and products. A search of the terms mercury, lead, and cadmium exposure, source and poisoning in Nigeria, using Google Scholar search and Africa Journal Online digital library was conducted. The use of industrial processes and products, refuse dumping, absence of poison information centers, and poor record keeping; characterized environmental health in Nigeria. In today's industrial society, there is no escaping exposure to toxic chemicals and metals. The level of mercury, lead, and cadmium in blood depends on the bioaccessibility rate. Their concentration in blood is a significant factor to public health. Studies conducted regarding their concentrations in the blood and their relationships with environmental exposure will provide useful information to the general public.

KEYWORDS: mercury, lead, cadmium, Nigeria, environment, contamination.

INTRODUCTION

Nigeria has a population of 152,217,341, birth rate of 36.0/1000, infant mortality rate of 92.9/1000, and life expectancy of 50.2 years based on the 2006 census. Most of these deaths are preventable because they are associated with the quality of air, water, sanitation, and hygiene that may have been resulted from pollutants in the environment which accumulate unnoticed to toxic levels. In an editorial in the African Journal of Environmental Science and Technology, the top ten environmental challenges of Africa were itemized as follows: water disinfection, air disinfection, solid waste management, lead poisoning, smoke pollution, dust pollution, pesticide pollution, drought and deforestation, petrochemical pollution, and physical injury [QEHIDS WHO 2014, WHO 2014].

However, the Koko Waste Dump episode of 1988 signaled the beginning of consciousness on environmental protection in Nigeria as it led to the establishment of the Federal Environmental Protection Agency in 1988. This Agency has mid-wives many environmental sub-agencies of government at the Federal level, and indeed most states of the Federation now have State Environmental Protection Agencies [Asubiojo 2016].

Sources of Lead in Nigeria

Lead is found in the Earth's crust and has been reported to emit from anthropogenic activities, such as combustion of fossil fuels, mining, paint, batteries production, flooding, drought, eye cosmetics and herbal medicaments [Wright et al 2005, Obi et al 2014], Imported glazed ceramics (e.g., drinking mugs, soup bowls, and cooking pots) [Ketiku and Adeyinka 1999], toys and furniture painted before 1976, children's paint sets and art supplies, pewter pitchers and dinnerware, lead bullets, fishing sinkers, curtain weights Plumbing, pipes, and faucets,

hobbies involving soldering, stained glass, jewelry making, pottery glazing, and miniature lead figures [Velaz and O'Connel 2014]. Infant formula, pediatric syrup, canned and non-canned beverage are chief exposure routes for lead poisoning in children [Ikem et al 2002].

Galadima et al. (2011) conducted a study on the levels of heavy metals in effluent water from student halls of Usman Danfodiyo University, Sokoto, Nigeria. The results showed the presence of lead at concentrations that are more than 20 times the recommended international limits. The pollution was attributed to continuous use of contaminated water by the students and the disposal of carrier wastes by the sellers of different items in the residential premises of the students. Ladigbolu and Balogun (2011) reported lead concentrations of 405.0 $\mu\text{g/g}$ in soil profile sediments from Ibadan, Oyo State, in which the pollution was attributed to population growth, urbanization, agricultural activities and uncontrolled direct dumping of wastes and sewages into aquatic environment.

In general, some heavy metals are systemic toxins with specific neurotoxic, nephrotoxic, fetotoxic, and teratogenic effects. Moderate exposure adversely affects neuropsychological developments in children leading to decrease in Intelligence Quotient [Huang et al 2014]. High levels of exposure affect haemoglobin synthesis, cause kidney problems and chronic damage to the system. Also abdominal pain and cramping, aggressive behavior, anemia, constipation, slowed body growth, difficulty getting pregnant, difficulty sleeping, headaches, hearing loss, irritability, and loss of previous developmental skills (in young children).

Sources of Cadmium in Nigeria

Cadmium is from a Latin word “cadmia” and Greek word “Kadmeia” which are ancient names for calamine (zinc carbonate). It was discovered in Germany in 1817 by Fredrick Strohmeyer [Hermann 1818]. It is produced mainly as a byproduct from mining, smelting, pigment, cigarettes smokes, automobiles and refining sulphide ores of zinc, and, to a lesser degree, lead and copper. Small amounts of cadmium (about 10%) are produced from secondary sources, mainly from dust generated by recycling iron and steel scrap. It is found in insecticides, fungicides, sludge, and commercial fertilizers which are routinely used in agriculture. Dental alloys, electroplating, motor oil, tobacco smoking and exhaust.

Cadmium found in soil and water can be taken up by certain crops and aquatic organisms and accumulate in the food-chain [IPCS 1992]. Food constitutes the main environmental source of cadmium for non-smokers. Topsoil enrich in sludge contributes to cadmium accumulation in the blood, milk, hair, liver and kidney of sheep, goat, cow, buffalo [Brebner et al 1993, Patra et al 2007, Swarup et al 2005, Balagangatharathilagar et al 2006]. In aquatic ecosystems, cadmium bioaccumulates in muscle of oysters, shrimps, lobsters and fish.

The levels of cadmium exposure through food, water, and air that are typical for most people are not of major health concern. For example, the intake of cadmium from the diet is usually about 0.0004 mg/kg/day, roughly ten times lower than the typical amount needed to cause kidney damage by this route Oral LD50 values for animals, range from 225 to 890 mg/kg for elemental cadmium, 63 to 88 mg/kg for cadmium chloride, 72 mg/kg for cadmium oxide, and 590 to 1125 mg/kg for cadmium stearate [ASTSDR 2008].

Presence of cadmium at higher concentration than the maximum allowable limits in water, vegetation and food have been reported [Agrawal and Raj 1978, Khandekar et al 1980, Allen 1995, Kumar et al 2008, Asagba 2010]. Arinola et al. reported a plasma level of 0.06 $\mu\text{g/dL}$ in male adults in Ibadan, and a mean concentration of 9 $\mu\text{g/dL}$ for adult men in Nkpor and Nnewi (Anambra State, southeastern Nigeria) [Arinola et al 2014, Orisakwe et al 2014]. The mean

blood cadmium level of pregnant women/nursing mothers in southeastern Nigeria was 0.99 $\mu\text{g}/\text{dL}$, while that of non-pregnant women was .80 $\mu\text{g}/\text{dL}$, with ranges between 0.1–2.8 and 0.1–2.9 $\mu\text{g}/\text{dL}$, respectively [Nkolika and Benedict 2009].

The toxic effects of oral cadmium exposure have been well studied in animals, and a significant body of data from exposed humans has also been accumulated. In humans, most severe cases of oral cadmium toxicity have been associated with ingestion of foods or fluids contaminated by storage in cadmium-plated containers. Oral exposure to cadmium may result in adverse effects on a number of tissues, including kidney, liver, bone, testes, the immune system, and the cardiovascular system [Jarup 1998]. Cadmium has been reported to exert deleterious effects in terms of thyroid function, nephrotoxic, cytotoxic, genotoxic, immunotoxic and carcinogenic.

It can be detected when about 10 milligrams of cadmium contents has been absorbed either through the skin, inhalation or ingestion. The following signs can help to detect cadmium level in the body levated levels of creatine in the blood and urine may confirm cadmium poisoning generally. When a person is exposed to cadmium over a long period of time and in smaller [ATSDR 1999, Lippmann 2000, Risso-de-faverney et al 2001], prostate cancer Martin et al. [Mar n et al 2002] doses, he or she starts noticing shortness of breath, tooth-staining and weight loss resulting in damaged liver and kidney, sweet or metallic taste in the mouth, increased amount of saliva, vomiting, choking, anemia, abdominal pains, spasm of ingested cadmium, chest pain, wheezing, inflammation of the lungs, weakness in muscles and leg pain, diarrhea, stomach pains, severe vomiting, bone fracture, reproductive failure and infertility, damage to the central nervous system, damage to immune system, psychological disorders, possibly DNA damage or cancer development and eventually lead to death. Cadmium is one of six substances banned by the European Union's Restriction on Hazardous Substances (RoHS) directive [Abimbola et al 2012].

Sources of Mercury in Nigeria

Mercury is one of the most toxic elements and a threat to human being because it accumulates and magnifies to unsafe levels in food chains [Madison 2007], it cannot be removed and is rapidly transformed by microorganisms into organic compounds (methyl mercury) that tend to bioaccumulate and biomagnify in animals [Roncheti et al 2006]. All mercury species is toxic, with organic mercury compounds generally being more toxic than inorganic species [Leopolda et al 2010].

Mercury is a major non-essential trace metal not needed in food. Mercury and its compound are nonbiodegradable and so have adverse impact on the environment as they bio-accumulate in the ecosystem. So, they persist in the environment for an extended period killing important microorganisms in the environment. It can travel globally through air, soil and water bodies and accumulates in organisms through food chain.

Air- Metallic, or elemental mercury, is liquid at room temperature and like any other liquid it evaporates into the air, where it can be inhaled. The remaining emissions are in the form of gaseous inorganic ionic mercury (such as mercuric chloride) or bound to emitted particles. Thermometers and sphygmomanometers contain mercury and so do many medical batteries, fluorescent lamps and electrical switches. These forms have a shorter atmospheric lifetime and will deposit to land or water bodies within roughly 100 to 1,000 kilometres of their source. Skin lightening cream, combustion of fossil fuels, where mercury is emitted, coal combustion, is currently the main source of mercury pollution. Coal combustion is worldwide, contributing between 750 and 1500 tons per year. The electrical and electronic manufacturing industry has been one of the largest users of mercury in the world for at least two decades. According to

Electronic Industries Alliance [EIA 2005], mercury can be found in at least 26 categories of electrical and electronic devices, including electrical lighting, switching devices, control instruments, thermostats, laptop/notebook computers, mobile phones, and semiconductors [EIA 2005].

According to the minister, studies mercury used in dental sector harms the environment through wastewater from dentists' offices, improper disposal of mercury amalgam, releases of mercury vapor, cremation of people with mercury in their teeth and fecal excretion from patients with amalgam fillings. Speaking to icirnigeria.org, Oladele Osibanjo, executive director of Basel Convention and Leslie Adogame of Sustainable Research and Action for Environmental Development observed that poor awareness, lack of education about Mercury, and weak regulation all encourage importation of mercury products thus driving pollution. As such its presence in food suggests contamination [Leopolda et al 2010]. Mercury concentration permissible limit is 0.001 mg/L as specified by World Health Organization and Standard Organization of Nigeria.

Mercury has no known function in human biochemistry but causes damage to the brain and the central nervous system. It is a heavy metal that exists in liquid form, at room temperature. It is of major public health concern because it is inimical to human health. Exposure to high levels of metallic, inorganic, or organic mercury can permanently damage the brain, kidneys, cardiovascular system and developing fetus (neuro-developmental deficits). Effects on brain functioning may result in irritability, shyness, tremors, changes in vision or hearing, and memory problems [ASTDR 1999]. It affects fertility, blood pressure regulation and can cause tremors, and numbness of the fingers and toes. Low concentration of mercury can induce the major constituent of intracellular protein inclusions in dopaminergic neurons and can lead to some generative disease such as Alzheimer's and Parkinson's diseases [Zahi et al 2005]. Reduced sensation and strength in the arms and legs, muscle cramps and decreased nerve conduction have been observed.

The Minamata diseases presented mostly with neurological symptoms that include prickling, tingling sensation, paresthesia; impair peripheral vision, hearing, small and fast; slurred speech, unsteadiness of gait and limb, muscle weakness, memory loss, irritability, inability to sleep and depression. Renal damage occurs because mercury bio-accumulates in the kidney and often manifest as frank proteinuria, hematuria and oliguria; these could result to acute renal failure, with degeneration or necrosis of the convoluted tubules [Odinioha 2012].

Mercury determination can be achieved by pre-concentration, separation and detection of total dissolved mercury. The most common technique used to monitor total mercury in natural waters is cold vapor atomic fluorescence spectrometry [Salameh et al 2013].

Role of Nigerian Government

Nigerian government through the Federal Ministry of Environment should engage in variety of activities to phase out these contaminants: promoting use of clean energy in industrial activities, enforcing proper use and disposal of products that contain them, discouraging the use of mercury in gold mining, developing laws to protect the health of Nigerian citizens and finding lasting alternatives to their use.

Both environmentalists who are currently attending the week-long (Nov 3rd-7th) Mercury Negotiations in Bangkok, Thailand, advocate for a mercury-free Nigeria and call upon African countries to impress upon the exporting nations and funding organizations to halt the toxic trade of dental mercury into Africa [Abiose 2014].

In order to phase out mercury, Nigeria became a signatory to the Minamata convention on mercury; a global environment treaty, on 10th October, 2013.

The Role of Individual in Lead, Cadmium and Mercury Contamination Control

A good strategy for reducing emitted these contaminants are by using flue gas cleaning during combustion. Therefore, all new generation sources using fossil fuels and waste incinerators should be equipped with efficient flue gas cleaning systems at the time of construction. Do not buy product that contain them. Also discard every found product under your care that contain any of them

Conclusion

There is need to assess elevated blood lead, mercury and cadmium levels across populations in Nigeria by undertaking sound scientific studies using appropriate sample sizes and methodologies. From the information provided, heavy metals under study are much more released due to the use of industrial processes and products, refuse dumping, absence of poison information centers, and poor record keeping. Nigeria Government and their citizen must put hands together to see that these contaminants are reduced to minimal by playing their respective roles as stated, to improve health of the masses

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EXPLORING THE ROLE OF BLOCKCHAIN IN PROMOTING TRANSPARENCY IN E-INVOICING SYSTEMS AMONG MULTINATIONAL CORPORATIONS IN NIGERIA

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ABSTRACT

Blockchain technology has gained attention because of its potential to increase transparency through decentralized, immutable, and cryptographically secure transaction records. This paper explores blockchain's role in promoting transparency in e-invoicing systems used by multinational corporations (MNCs) operating in Nigeria. E-invoicing automation has gained popularity due to the benefits of reduced costs and improved efficiency. This paper analyses blockchain's applicability by examining its technical architecture, the current state of e-invoicing used by MNCs in Nigeria, key challenges faced, and relevant regulatory frameworks. Pioneering case studies demonstrate blockchain's commercial viability for coordinating complex cross-border business networks. This study suggests a new framework with parts for a public-private blockchain system that can work with each other. This could change the way e-invoicing is clear by rebuilding trust digitally between different parties.

KEYWORDS: Blockchain, E-invoicing, Transparency, Multinational Corporations, Data Security.

A. INTRODUCTION

E-invoicing refer to the digital creation, sending, and handling of invoices between business partners (Tung et al., 2019). In recent years, it has become increasingly popular due to its advantages in cost reduction, enhanced efficiency, and the automation of corporate processes (Celik et al., 2020). Nevertheless, transparency remains a major concern for the numerous e-invoicing systems. Conventional electronic invoicing relies on centralized ledgers that are under the control of single entities, such as governments or private companies (Attaran & Gunasekaran, 2019). This provides the controller with a significant amount of supervision and awareness of transactions, but it restricts the level of transparency available to other individuals or groups involved (Yli-Huumo et al., 2016). Buyers and suppliers lack visibility into the workflows of invoice processing and are incapable of independently verifying records (Kannengießer et al., 2016). In addition, the absence of uniformity across international boundaries and among privately managed records creates isolated data repositories that hinder comprehensive visibility (PwC, 2018).

Resolving errors or conflicts becomes challenging when various entities use separate systems without a clear record of transactions (OECD, 2019). This erodes confidence among business partners, particularly in cross-border commerce (European Commission, 2019). Distributed

ledger technologies offer a potential solution by enabling decentralized consensus without the need for intermediaries (Yli-Huumo et al., 2016). Blockchain, a well-known form of distributed ledger, has gained significant attention due to its capacity to enhance transparency through the use of shared, unchangeable, and cryptographically protected information (Crosby et al., 2016). Blockchain has the potential to resolve existing transparency issues in e-invoicing by providing all parties involved with a centralized and reliable source of information. Nevertheless, additional empirical research is necessary to determine the practicality of implementing it in various industry contexts.

Bitcoin, a cryptocurrency that uses blockchain technology to record transactions on a decentralized public ledger without the need for intermediaries, introduced blockchain technology in 2008 (Nakamoto, 2008). Since that time, blockchain technology has evolved beyond its original use in cryptocurrencies and has become a new type of decentralized database architecture (Yli-Huumo et al., 2016). Blockchain is a distributed ledger that enables several parties to agree on and keep a shared record of transactions via a peer-to-peer network (Crosby et al., 2016). Cryptography protects each transaction, links it chronologically to previous blocks, and stores it on all nodes within the network (Zheng et al., 2017). Even without a central authority, these records remain unchangeable, traceable to their origin, and difficult to tamper with (Yli-Huumo et al., 2016).

The decentralized nature, transparency, and trustless execution of blockchain have generated interest in applications that go beyond payments (Beck et al., 2018). The system's capacity to offer unified and accurate information accessible to all parties involved makes it highly suitable for enhancing transparency in areas such as supply chain management (Kannengießer et al., 2016). Blockchain technology has the potential to resolve existing issues with transparency in e-invoicing. It enables buyers, suppliers, and other entities to verify information on a distributed ledger independently (Tönnissen & Teuteberg, 2020). Blockchain technology ensures equal access and rights for all parties involved, while also eliminating centralized control and the possibility of single points of failure or manipulation (Yli-Huumo et al., 2016). Compared to traditional centralized databases, this enhances transaction transparency, auditability, and resilience against errors or fraud (Beck et al., 2018).

The adoption of electronic invoicing has been increasingly popular among multinational corporations (MNCs) in Nigeria due to its advantages in terms of efficiency, cost reduction, and automation of corporate operations (Adeyeye et al., 2020). Nevertheless, the absence of openness continues to be a significant obstacle. Nigeria, as an emerging economy, poses challenging conditions for multinational corporations (MNCs) due to factors such as policy fluctuations, foreign exchange instability, and infrastructure deficiencies (Okafor et al., 2017). E-invoicing allows multinational corporations to optimize their operations in Nigerian subsidiaries as well as with trading partners (Adeyeye et al., 2020). Nevertheless, the majority of local e-invoicing platforms continue to be centralized ledgers that are under the authority of private vendors. This arrangement provides limited transparency to both buyers and suppliers (Okafor et al., 2017).

Multi-national corporations (MNCs) that operate in many countries encounter challenges in ensuring transparency when reconciling transactions between proprietary e-invoicing ledgers that do not have interoperability. Resolving errors or disagreements becomes challenging in the absence of a shared audit trail that is accessible to all parties involved (European Commission, 2019). This hampers the ability to meet the growing need for transparency in multinational corporations' home countries, as stated by Efionayi-Mäder et al. (2021). Ensuring transparency is crucial for multinational corporations (MNCs) operating in high-risk emerging

markets. This is necessary to minimize compliance risks arising from the actions of local subsidiaries, which have the potential to harm their corporate reputation (Eweje, 2006). However, the existing centralized e-invoicing methods provide insufficient supervision for headquarters to oversee intra-company trading involving Nigerian branches (Okafor et al., 2017). This emphasizes the necessity for inventive measures to enhance transparency in electronic invoicing systems that facilitate multinational corporation activities in Nigeria.

B. OVERVIEW OF E-INVOICING SYSTEM

E-invoicing is the process of electronically exchanging invoices between firms, which allows for the automation of ordering and payment procedures. Historically, electronic invoicing was dependent on exclusive platforms that were under the authority of individual organizations (Tung et al., 2019). Nevertheless, the absence of interoperability across these isolated systems resulted in inefficiencies (OECD, 2019). In response to this issue, numerous governments have established national e-invoicing frameworks to regulate the forms and procedures within their respective territories (Celik et al., 2020). One example is the Nota Fiscal Eletrônica system in Brazil, which enables seamless electronic invoicing between companies and government institutions (Diniz et al., 2014). Italy's Sistema di Interscambio network enables electronic billing between enterprises and tax authorities (Agnoli et al., 2014).

Conversely, the European Union's Directive 2010/45/EU established standards for compatible electronic invoicing in order to facilitate international trade (European Commission, 2010). E-invoicing systems consist of three primary components: an invoice registry, a submission server, and a delivery network (Tung et al., 2019). The registry verifies and archives invoices issued by firms. The submission server is responsible for receiving electronic papers in standard formats. Finally, the delivery network facilitates the transportation of bills between commercial partners (Tönnissen & Teuteberg, 2020). Adopting e-invoicing in a firm offers several advantages, such as reducing processing costs, improving payment cycles, and automating reconciliation (Celik et al., 2020). The lack of a shared audit trail visible to all stakeholders has been a significant problem for shareholders in the industry (Yli-Huumo et al., 2016). The adoption of e-invoicing has revolutionized business operations for companies globally, enabling the seamless electronic transmission of invoices.

COMPONENTS OF E-INVOICING

There are basically three (3) essential components that form the foundation of e-invoicing system. These components work together to facilitate the electronic process of ordering, billing, and payment between the trading partners. Each of the component, play a crucial role in supporting the complete workflow of digital invoicing. Attaran & Gunasekaran (2019) provide an explanation of the components of e-invoicing stated below;

□ THE SUBMISSION SERVER

This serves as the entry point for electronic invoices and its responsible for receiving invoiced documents submitted by businesses and then validating the contents prior to registration (Celik et al., 2020). This process includes verifying the syntactic validity of the file structure as well as the data elements mandated in the e-invoicing (Tönnissen & Teuteberg, 2020).

□ THE DELIVERY NETWORK

This facilitates the exchange of electronic invoices between trading partners after registration in the centralized registry (Tung et al., 2019). On demand, the delivery network securely delivers registered invoices and associated documents to recipient entities (Celik et al., 2020).

Upon retrieval requests initiated by recipients, the delivery network routes archived invoices from the registry through various hubs and gateways, depending on the parties involved (Diniz et al., 2014; Okafor et al., 2023).

□ THE INVOICE REGISTRY

The invoicing register, serves as the central repository for all electronic documents exchanged through the e-invoicing network (Tung et al., 2019). It serves to authenticate issued invoices and store the underlying metadata and transaction records in an organized manner (Celik et al., 2020).

TRANSPARENCY OF E-INVOICING

Conventional electronic invoicing is dependent on centralized ledgers that are under the authority of either private vendors or governments (Yli-Huumo et al., 2016). Although this paradigm improves efficiency, it lacks transparency for buyers and suppliers, who are dependent on intermediaries (Kannengießer et al., 2016). The absence of a common audit trail diminishes openness and obstructs the resolution of disputes when there are discrepancies in records (Tönnissen & Teuteberg, 2020). Without independent verification, it is difficult to uncover and remedy any errors or fraudulent activity (European Commission, 2019). This erodes the confidence necessary for digital transactions between trading partners (Beck et al., 2018).

The lack of compatibility between exclusive ledgers also results in the formation of isolated data repositories, which hinders the capacity to have a comprehensive view of the entire process (OECD, 2019). Blockchain has the potential to solve these gaps by providing all stakeholders with equal access to an unchangeable record, according to its distributed consensus approach (Yli-Huumo et al., 2016). By acting as a publicly accessible ledger, it offers a unified and reliable record, enhancing transparency in contrast to separate centralized databases (Kannengießer et al., 2016). Furthermore, the cryptographic audit trail of blockchain acts as a deterrent against tampering, thereby reinstating confidence by ensuring verifiability (Crosby et al., 2016).

BLOCKCHAIN TECHNOLOGY

First announced in 2008 alongside bitcoin, blockchain is a decentralized system that enables direct transactions between peers without the need for intermediaries (Nakamoto, 2008). The system operates by disseminating an ever-expanding collection of transaction records among a network of participating nodes, achieving agreement on updates in a decentralized manner (Zheng et al., 2017). Cryptography secures each transaction, links it to previous blocks, and creates an unchangeable record that everyone can verify (Crosby et al., 2016). The fundamental characteristics of blockchain, including decentralization, transparency, and security, have generated interest that extends beyond the realm of cryptocurrencies (Beck et al., 2018). The shared ledger form of this technology is particularly suitable for areas that require the ability to audit and establish confidence among parties that do not trust each other (Kannengießer et al., 2016). The blockchain technology architecture as developed by Radović & Bacanin (2021) is illustrated in figure 1;

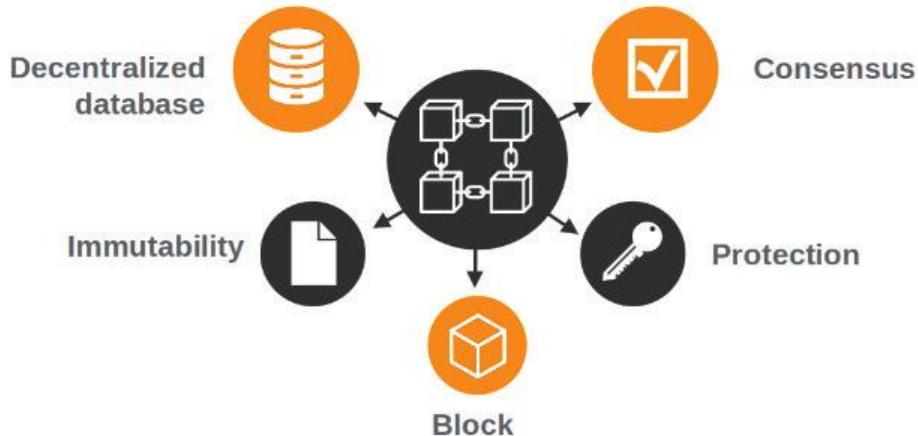


Figure 1: Blockchain Technology Architecture

However, with time, it has become a technology that is having a great impact on modern society due to its transparency, decentralization, and security characteristics. Blockchain technology has the potential to transform the way we live, interact, and perform business. Nowadays, academics, industrialists, and researchers are aggressively investigating different aspects of blockchain as an emerging technology. Internet of Things (IoT) devices have used this technology to authorize, authenticate, and audit data.

BLOCKCHAIN TECHNOLOGY-BASED E-INVOICING

E-invoicing has become a crucial approach for achieving cost reduction as organizations strive to optimize their financial supply chain. This statement is especially important for organizations that handle a large number of documents. Currently, these organizations must carefully examine their internal processes to free up their tied financial resources. This is necessary due to the lack of available credit and the high cost of borrowing (Hugos, 2018). Improving the financial supply chain's efficiency necessitates the use of electronic data, specifically electronic invoicing, commonly known as e-invoicing. According to Hugos (2018), companies believe that the benefits of cost reduction outweigh any potential expenses or inconveniences that may arise from changing their operational methods.

E-invoicing is an automated solution that covers the entire invoice processing process, from invoice creation to final payment. The deployment of an automated system efficiently reduces the need for human intervention by handling tasks such as data entry and harmonization. As a result, eliminating labor-intensive duties brings significant financial advantages. The adoption of e-invoicing eliminates the need for traditional paper invoices, reducing costs associated with printing, mailing, envelopes, physical storage, and transferring to a paperless system. This successfully reduces both direct and indirect expenses. Therefore, this adoption not only conforms to ecological principles but also offers a financially sensible alternative (Bruno, 2019). The human input and processing of data are prone to errors, which can lead to significant disparities, disagreements, and the need for later corrective measures. Automated validation checks specifically design e-invoicing solutions to reduce errors and ensure the accuracy of financial data (Marak & Pillai, 2021).

E-invoicing sometimes involves the use of automated approval procedures, which speeds up the approval process and subsequent payment. The improved efficiency mentioned here helps reduce the administrative effort and resource allocation involved in approving bills, leading to faster payment cycles and improved cash flow. E-invoicing solutions provide immediate access

to relevant information about the current status of invoices and financial activities. This system enhances visibility, resulting in enhanced decision-making, decreased time for status inquiries, and expanded reporting capabilities. Consequently, this system optimizes administrative processes (Marak & Pillai, 2021; Moretto & Caniato, 2021).

The use of e-invoicing allows for fast and accurate payment processing, improving the relationship between suppliers and their counterparts. Reducing payment delays and disputes improves supplier interactions, thereby reducing the administrative overhead of resolving issues. E-invoicing solutions often have built-in compliance verification tools and maintain detailed records of audit trails. The aforementioned approach improves compliance with tax requirements and simplifies audit preparedness, potentially reducing audit-related expenses. You can cite Fairchild (2016) as an academic resource for further investigation and examination. E-invoicing solutions streamline routine administrative activities, allowing organizations to reallocate their administrative resources to more strategic and value-added initiatives. These endeavour may encompass many activities such as financial analysis, supplier negotiations, and process enhancements (Olaleye et al., 2023).

INVENT OF BLOCKCHAIN TECHNOLOGY IN NIGERIA

Nigeria has been a front-runner in cryptocurrency adoption in Africa, mostly because of its youthful and technologically adept population (Oke & Labeodan, 2022). Anticipations in 2021 indicated that over thirteen (13) million Nigerians owned cryptocurrency, with monthly trading volumes surpassing four hundred million (\$400 million) dollars (Fasan, 2022). Nevertheless, the presence of regulatory ambiguity continues to be a challenge, as the central bank implemented a prohibition on banks aiding cryptocurrency transactions in 2021 (Oke & Labeodan, 2022). In addition to payments, local start-ups are investigating the possible applications of blockchain technology in many industries. Businesses such as Farmcrowdy are employing distributed ledgers in agriculture to optimize the process of transactions between farmers and off-takers (Nwosu et al., 2021). Helium Health is a healthcare venture that seeks to use blockchain technology to manage electronic medical information and process insurance claims (Adejumo, 2021). The government acknowledges the strategic significance of blockchain technology, as evidenced by the National Information Technology Development Agency's introduction of a regulatory sandbox and initiatives aimed at supporting domestic projects (Oke & Labeodan, 2022).

Infrastructure difficulties, such as unreliable power supply and limited internet access, hinder the adoption of technology (Nwosu et al., 2021). Skills shortages hinder the development of blockchain, as local colleges are just beginning to offer courses in this field (Adejumo, 2021). Nigeria's start-up environment is showing promise for decentralized technology, as indicated by its thriving ecosystem and active involvement of policymakers (Fasan, 2022). By implementing favourable policies and providing comprehensive skills training, blockchain technology has the potential to revolutionize critical sectors and position Nigeria as a front-runner in Africa.

BLOCKCHAIN-BASED E-INVOICING IN NIGERIA

It is clear that multinational businesses operating in emerging economies such as Nigeria would require new solutions to enhance oversight and transparency in their widely spread business networks. Even though the current centralized models of e-invoicing digitize some processes, they don't provide the visibility and auditability needed to effectively reduce risks like fraud, ensure tax compliance, and protect corporate reputations for large companies with operations in many countries. If carefully linked with public and private ledgers, blockchain's

revolutionary distributed ledger technology (figure 2) as proposed by Liu (2018), has the potential to revolutionize e-invoicing systems. This innovative distributed ledger concept has the potential to fill in the gaps in the current frameworks by enabling a shared system of record that is accessible to all parties involved.

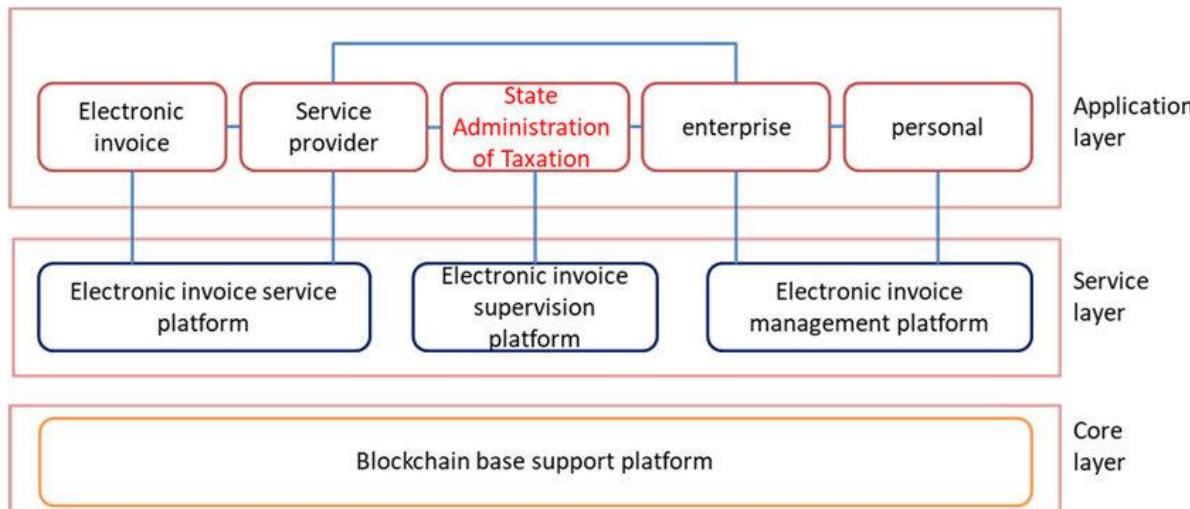


Figure 2: Blockchain-Based Electronic Invoicing System (Source: Liu, 2018)

An issue of significant concern is the absence of a unified ledger, as private networks function as separate entities from public systems (Okafor et al., 2017). This hinders the level of openness required for intricate reconciliations (Adeyeye et al., 2020). Blockchain, as described by Zheng et al. (2017), creates a decentralized shared database that permanently records verified transactions on interconnected digital blocks. Therefore, it provides a unified and accessible system of documentation, visible to all parties involved (Kannengießer et al., 2016). Blockchain technology has the potential to enable more dependable compliance tracking and dispute resolution between multinational corporations (MNCs) and their Nigerian business partners. Nwosu et al. (2021) achieve this by giving buyers, suppliers, and regulators unified access to an unchangeable record of transactions. The presence of a cryptographic audit trail serves as a deterrent to fraudulent billing techniques that currently weaken supervision (Crosby et al., 2016).

Furthermore, smart contracts have the capability to automate conditional payments and incorporate regulatory reporting by utilizing programmable transaction rules (Yli-Huumo et al., 2016). This has the potential to optimise tax remittance procedures that currently necessitate costly manual reconciliations (Oke & Labeodan, 2022).

BENEFITS OF BLOCKCHAIN POWERED E-INVOICING

- Blockchain technology has the potential to overcome the existing limits of e-invoicing systems. If applied wisely, it can offer several distinct advantages through its innovative distributed ledger model:
- By providing all parties with equal access to an unchangeable record of transactions, blockchain offers a unified and transparent source of information that is available to everyone. This enhances supervision in comparison to separate centralized databases and resolves discrepancies across non-integrated ledgers (Yli-Huumo et al., 2016).

- Nwosu et al. (2021) record the time-stamped digital fingerprint of each authenticated transaction. This mitigates concerns regarding vulnerabilities caused by the absence of centralized control (Zheng et al., 2017).
- It enables the automation of conditional invoice payments and regulatory compliance reporting using programmable transaction rules (Okafor et al., 2017). This process simplifies laborious manual reconciliation operations and minimizes conflicts that impede commercial transactions (Adejumo, 2021).
- By utilizing distributed consensus, blockchain offers interoperability across public and private ledgers, overcoming the limitations of existing isolated models (Oke & Labeodan, 2022). This network effect integration allows for full use of big data analytics capabilities.

C. METHODOLOGY

The researchers developed a web-based platform, scripted with JavaScript, structured with HTML, and styled through CSS. Bills were generated through user interfaces, with details such as owner name and ID providing characteristics for smart contracts. These self-executing contracts, embed the terms of buyer-seller agreement directly into their code, enabling secure transactions and agreements between dispersed, anonymous parties without relying on centralized authorities or legal frameworks. To ensure data security, the collected data were stored on the Ethereum blockchain. Ethereum establishes a peer-to-peer network for securely executing and verifying application code, or smart contracts. Contracts were thoroughly tested on separate networks before deployment on the main network. Finally, Solidity was employed for the construction of the contracts while Remix IDE facilitated its creation and deployment, allowing the establishment of transaction record chains as well as the execution of business logic within the blockchain system.

D. IMPLEMENTATION

In this phase, the website's Frontend leveraged on Web3, while JavaScript library facilitated user interaction with the Ethereum blockchain. Initially, the researchers fetched the deployed contract on the blockchain and subsequently generated an instance of it. After creating the instance, it populated parameters with pertinent invoice details such as the receipt number, total amount, seller, and buyer identifications. After setting the parameters, the system described the corresponding events and invoked its emitted functions, making the variables immutable and tamper-proof when stored in the blockchain. This transparent and trustworthy system allowed open access to all the stored blockchain data.

The Frontend encompassed the features (user authentication, real-time updates, and notifications) in order to ensure seamless interaction with the blockchain contract. With an embedded user-friendly interface, it allowed for easy navigations and interactions with the contract, as well as serving as a critical conduit between users and the blockchain contract.

The smart contract for the invoice generation system was developed using Solidity, a language tailored for the Ethereum blockchain. RemixIDE, a web-based integrated development environment, facilitated contract development, testing, and deployment. Ethereum Ropsten TestNet and Ganache were the chosen blockchains for implementation, offering an environment for contract testing and local Ethereum simulations respectively.

The website furnished an intuitive interface offering features such as inventory and order management alongside invoice generation to retailers. This comprehensive functionality,

empowered them with inventories and order oversight, aiding stock management and preventing stockouts. Moreover, real-time updates, notifications, and reports enhanced decision-making capabilities.

In summary, the amalgamation of the smart contract and website Frontend yielded a robust and secure invoice management system, capable of automating invoicing processes, enhancing efficiency, and reducing costs for businesses. The user-friendly interface made the system accessible to businesses of various scales, further amplifying its utility and adaptability potentials.

```
// Smart Contract in Solidity for creating and paying bills
// Define the contract
contract BillContract {
    // Structure to represent a bill
    struct Bill {
        address payable payee;
        uint amount;
        string memo;
        bool isPaid;
    }
    // Initialize an empty list of bills
    Bill[] public bills;
    // Initialize a bill counter to 0
    uint public billCounter;
    // Event to track bill creation
    event BillCreated(uint billId, address payee, uint amount, string memo);
    // Event to track bill payment
    event BillPaid(uint billId);
    // Function to create a bill
    function createBill(address payable _payee, uint _amount, string memory _memo) public {
        // Increment the bill counter
        billCounter++;
        // Create a new bill
        Bill memory newBill = Bill({
            payee: _payee,
            amount: _amount,
            memo: _memo,
            isPaid: false
        }
    }
}
```

```

    });

    // Add the new bill to the list of bills
    bills.push(newBill);

    // Emit an event "bill created"
    emit BillCreated(billCounter, _payee, _amount, _memo);
}

// Function to pay a bill
function payBill(uint _billId) public payable {
    // Fetch bill from list of bills using bill ID
    Bill storage bill = bills[_billId - 1];

    // Check if the bill is unpaid
    require(!bill.isPaid, "Bill has already been paid");

    // Check if the sent value is equal to the bill amount
    require(msg.value == bill.amount, "Incorrect payment amount");

    // Transfer the bill amount to the payee's address
    bill.payee.transfer(msg.value);

    // Mark the bill as paid
    bill.isPaid = true;

    // Emit an event "bill paid"
    emit BillPaid(_billId);
}
}

```

This Solidity code initialized a smart contract for creating and paying bills. It defined a structure for representing bills, initializing empty list of bills, and a bill counters. The createBill function allowed users create new bills by providing the payee's address, bill amount, and memo. The payBill function enabled users to pay bills by providing the bill ID and sending the exact bill amount(s). If the payment is successful, the bill is marked paid, and transferred to the payee's address.

E. CONCLUSION

This study presented a comprehensive examination of an invoice management system that integrates a smart contract, developed through Solidity and a user-friendly website Frontend while leveraging on Web3 technology. By harnessing blockchain capabilities, the system ensures immutable and tamper-proof storage of invoice data, fostering transparency and trustworthiness. The Frontend not only facilitates seamless interaction with the blockchain contract but also provides essential features such as user authentication, real-time updates as well as notifications. This amalgamation of technology, empowers businesses with efficient invoice automation, inventory management, and decision-making support. Finally, the system offers a scalable solution adaptable to businesses of various sizes, promising enhanced efficiency and reduced operational costs in the invoicing process.

F. RECOMMENDATIONS

The following recommendations are made from the study;

- Implementing the proposed system will streamline invoicing processes, reduce manual labor and the associated costs. By automating tasks such as invoice generation and management, businesses can allocate resources more effectively.
- Leveraging blockchain technology ensures data immutability and tamper-proofing, enhancing transparency in transactions. This can foster trust among stakeholders, including customers, suppliers, and regulatory authorities.
- The system's integrated features for inventory and order management provide businesses with real-time insights, aiding in stock management and decision-making. This can help prevent stockouts, optimize inventory levels, and improve overall operational efficiency.
- Developers can learn from this study and adhere to best practices in smart contract development, ensuring security, efficiency, and reliability.
- Developers should prioritize user experience and interface design to ensure seamless interaction with blockchain-based applications.
- The researchers also recommend for further exploratory studies on strategies for addressing security and privacy concerns associated with blockchain technology, particularly concerning sensitive invoice data should be carried as well as conducting studies to understand the factors influencing adoption and acceptance of blockchain-based invoice management systems.

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TEACHING AND LEARNING OF BIOMASS ENERGY IN SECONDARY SCHOOLS: IMPLICATIONS FOR CHEMISTRY EDUCATION

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ABSTRACT

The continuous increase of energy consumption has generally improved the standard of living but it has also caused serious environmental problems. Burning of fossil fuels to generate energy has resulted to many negative environmental problems on the climate, natural environment and the society at large. There is the need o change to other renewable and environmental free sources of energy. Biomass is a biological material that has been recovered from once living organisms. It is a renewable energy source used to reduce our overdependence on fossil fuels and to help reduce air pollution. Secondary school chemistry students need to be taught about this biomass and biomass energy at the early stage of their educational pursuit even as they are the future scientists. Thus, this paper discussed teaching and learning of biomass energy in secondary schools and its implication for chemistry education. The paper examined the concept of biomass and biomass energy, conversion of biomass to energy, advantages of biomass energy over fossil fuels and the implication of teaching biomass and biomass energy to secondary school chemistry students.

Introduction

Developing new energy sources to produce reliable, affordable energy, while respecting the environment is one of today's most compelling needs. Of late, much attention is being focused on identifying suitable alternative and renewable energy sources, which can provide high-energy outputs, to replace conventional fossil fuel energy sources [1]. The total energy stored in terrestrial biomass is not only enormous but is also highly available and renewable. Biomass if properly harnessed can form a substantial part of future energy sources which will reduce the pressures on the global energy crises[1] The quest for biofuels in Nigeria is no doubt, a reasonable ambition. This is so because the focus on biofuel production has assumed a global dimension, and the benefits that may accrue from such effort may turn out to be enormous if the preconditions are adequately satisfied.[2] As a member of the global community, it has become necessary for Nigeria to explore other potential means of bettering her economy[2] . Biomass refers to the diverse materials obtained from plants and animals, which can be used as raw materials for the creation of useful energy in various forms and for diverse purposes

Biomass is fuel that is developed from organic materials, a renewable and sustainable source of energy used to create electricity or other forms of power[3]. Some examples of materials that make up biomass fuels are: scrap lumber; forest debris; certain crops manure; and some types of waste residues. With a constant supply of waste – from construction and demolition activities, to wood not used in papermaking, to municipal solid wastes , bioenergy production can continue indefinitely[3] Biomass is a renewable source of fuel to produce energy because: waste residues will always exist – in terms of scrap wood, mill residuals and forest resources. Also, properly managed forests will always have more trees These trees will always have crops and the residual biological matter from those crops will also continue to exist.. . Biomass fuels come from things that once lived: wood products, dried vegetation, crop residues, aquatic

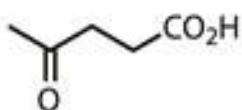
plants and even garbage. It is known as 'Natural Materials'. Plants used up a lot of the sun's energy to make their own food through photosynthesis. They stored the foods in the plants in the form of chemical energy. As the plants died, the energy is trapped in the residue. This trapped energy is usually released by burning and can be converted into biomass energy.[4]

Biomass is such a widely utilized source of energy, probably due to its low cost and indigenous nature, that it accounts for almost 15% of the world's total energy supply and as much as 35% in developing countries, mostly for cooking and heating [4]. In biomass power plants, wood waste or other waste is burned to produce steam that runs a turbine to make electricity, or that provides heat to industries and homes. Fortunately, new technologies — including pollution control and combustion engineering — have advanced to the point that any emissions from burning biomass in industrial facilities are generally less than emissions produced when using fossil fuels (coal, natural gas, oil).

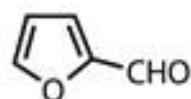
Advancements in technology have allowed biomass energy to be used in a wide variety of applications, including liquids and gases used for biofuels to power transport. Biofuel is any fuel that is derived from biomass—that is, plant or algae material or animal waste [7]. Biofuels are either liquid or gaseous fuel. They can be produced from any source that can be replenished rapidly, e.g. plants, agricultural crops and municipal waste. Current biofuels are produced from sugar and starch crops such as wheat and sugar cane, which are also part of the food chain. One of the key targets for energy researchers is a sustainable route to biofuels from non-edible lignocellulosic (plant) biomass, such as agricultural wastes, forestry residues or purpose grown energy grasses[5]. These are examples of so-called advanced biofuels.

Current biofuels, such as ethanol, have a lower energy content (volumetric energy density) compared with conventional hydrocarbon fuels, petroleum and natural gas. The aim is to produce fuels that have a high carbon content /and therefore have higher volumetric energy density. This can be achieved by chemical reactions that remove oxygen atoms from biofuel chemical compounds. This process produces a so called 'drop-in biofuel', i.e. a fuel that can be blended directly with existing hydrocarbon fuels that have similar combustion properties

Efficient synthesis of renewable fuels remains a challenging and important line of research.



Levulinic Acid



Furfural

Levulinic acid and furfural are examples of potential 'platform molecules', i.e. molecules that can be produced from biomass and converted into biofuels. Levulinic acid can be produced in high yield (>70%) from inedible hexose bio-polymers such as cellulose, which is a polymer of glucose and the most common organic compound on Earth while Furfural has been produced industrially for many years from pentose-rich agricultural wastes and can also act as a platform molecule. Recent reports have highlighted the use of organic chemistry to convert platform molecules like levulinic acid and furfural into potential advanced biofuels by specifically, changing parts of the molecules that are responsible for their structure and function. This process is called 'functional group interconversion' and is part of the basic toolkit of organic chemistry[5]

Organic chemistry is the study of the structure, properties, composition, reactions, and preparation of carbon-containing compounds, which include not only hydrocarbons but also compounds with any number of other elements, including hydrogen, nitrogen, oxygen, halogens, phosphorus, silicon, and sulfur [6]. The range of application of organic compounds is enormous and also includes, but is not limited to, pharmaceuticals, petrochemicals, food, explosives, paints, and cosmetics. Organic chemistry is a highly creative science in which chemists create new molecules and explore the properties of existing compounds. It is a popular field of study for chemists. Organic compounds are all around us. They are central to the economic growth of many countries in the areas of rubber, plastics, fuel, pharmaceutical, cosmetics, detergent, coatings, dyestuff, and agrichemical industries, to name a few.

Considering the importance of knowledge of organic chemistry in the production of biofuels, it is expedient that chemistry teachers should in the process of teaching this branch of chemistry to secondary school students try to incorporate the concept of biomass as an important source of energy. They should also link the study of organic compounds to include those chemical compounds found in biomass. The different methods of obtaining bioenergy from biomass, the main advantages of bioenergy over fossil fuels should also be taught to students. This paper therefore examines the teaching and learning of biomass and biomass energy in secondary schools and its implication to chemistry education.

Concept of Biomass and Bioenergy

The term "biomass" refers to organic matter that has stored energy through the process of photosynthesis. It exists in one form as plants and may be transferred through the food chain to animals' bodies and their wastes, all of which can be converted for everyday human use through processes such as combustion, which releases the carbon dioxide stored in the plant material [7]. Many of the biomass fuels used today come in the form of wood products, dried vegetation, crop residues, and aquatic plants. Biomass has become one of the most commonly used renewable sources of energy in the last two decades, second only to hydropower in the generation of electricity. It is such a widely utilized source of energy, probably due to its low cost and indigenous nature, that it accounts for almost 15% of the world's total energy supply and as much as 35% in developing countries, mostly for cooking and heating [7].

Biomass can be used as a source of biofuels (a renewable energy source) to reduce our dependence on fossil fuels, and to help reduce air pollution Panwar et al. [8] considered biomass as carbon neutral, due to the fact that the amount of carbon released is equivalent to the amount absorbed during its life time. Biomass has been widely considered as major source of energy in both developed and developing nations Examples of biomass and their uses for energy include:

- Wood and wood processing wastes—burned to heat buildings, to produce process heat in industry, and to generate electricity
- Agricultural crops and waste materials—burned as a fuel or converted to liquid biofuels
- Food, yard, and wood waste in garbage—burned to generate electricity in power plants or converted to biogas in landfills
- Animal manure and human sewage—converted to biogas, which can be burned as a fuel

Biomass energy is a relatively clean, renewable energy source involving the use of organic matter which collected energy from the Sun and converted it into chemical energy when it was alive [9]. It is a renewable source as this matter is continually growing and absorbing the Sun's energy, particularly where biomass crops are farmed. Most biomass energy is sourced from plants which have gathered energy from the Sun through the process of photosynthesis. This form of energy has been used by humans for thousands of years, since humans began to burn wood for heat. Advancements in technology have allowed biomass energy to be used in a wide variety of applications, including liquids and gases used for biofuels to power transport. The main uses of biomass energy today are for producing electricity through driving turbines and providing biofuel for transportation such as biodiesel and ethanol[10]. The acceptance of bioenergy has increased together with many modern ways to utilize it, especially in many of the industrialized countries. The use of bioenergy instead of fossil fuels is an attractive option to reduce fossil-fuel dependency and mitigate global climate change.. Biofuels are either liquid or gaseous fuel. They can be produced from any source that can be replenished rapidly, e.g. plants, agricultural crops and municipal waste [3]. Current biofuels are produced from sugar and starch crops such as wheat and sugar cane, which is also part of the food chain. The continuous increase of energy consumption has generally improved the standard of living but it has also caused serious environmental problems. Since the beginning of the pre-industrial revolution, burning fossil fuels during energy production processes has been the main source of anthropogenic emissions of greenhouse gases (GHGs), causing global climate change with potential negative impacts on climatic systems, natural environment, and human society [11,12]. In this context, renewable energies (REs) have emerged as sustainable and environmental friendly sources of energy, which can satisfy our current and future socio-economic needs [8].

Three main categories of bioenergy resources globally used are forestry biomass, agricultural biomass and wastes biomass. There exist forest and agriculture-based highly developed bioenergy sectors in countries such as Finland, Sweden, Germany, Austria, Brazil, and the United States of America [13]. The spread of the modern bioenergy sector is, however, still in its primary stages in many of the developed and developing countries in the world.

Converting Biomass to Energy

Solid biomass, such as wood and garbage, can be burned directly to produce heat. Biomass can also be converted into a gas called biogas or into liquid biofuels such as ethanol and biodiesel. These fuels can then be burned for energy.[7]

Biogas forms when paper, food scraps, and yard waste decompose in landfills, and it can be produced by processing sewage and animal manure in special vessels called digesters. Ethanol is made from crops such as corn and sugar cane that are fermented to produce fuel ethanol for use in vehicles. Biodiesel is produced from vegetable oils and animal fats and can be used in vehicles and as heating oil. . Some examples of biofuels and how they can be processed is shown Table 1 [source [7]

	Processing	Use
Biogas	Bacteria break down sewage in a digester	The methane in biogas can be used as a fuel for heating homes
Bioethanol	Yeast breaks down the sugar in sugar cane to produce alcohol	Bioethanol is used in Brazil to fuel cars
Fast-growing timber	Trees such as willow can be burned in power stations	Electricity is generated using renewable biomass instead of fossil fuels

The methods involved in the conversion of biomass to energy include the following [4]

1. 1) Burning:

This is a very common way of converting organic matter into energy. Burning stuff like wood, waste and other plant matter releases stored chemical energy in the form of heat, which can be used to turn shafts to produce electricity. A simple illustration of how biomass is used to generate electricity. is shown as follows:

2. Energy from the sun is transferred and stored in plants. When the plants are cut or die, wood chips, straw and other plant matter is delivered to the bunker
3. This is burned to heat water in a boiler to release heat energy (steam).
4. The energy/power from the steam is directed to turbines with pipes
5. The steam turns a number of blades in the turbine and generators, which are made of coils and magnets.
6. The charged magnetic fields produce electricity, which is sent to homes by cables.

Other ways in which organic matter can be converted into energy include:

2) Decomposition:

Things that can rot, like garbage, human and animal waste, dead animals and the like can be left to rot, releasing a gas called biogas (also known as methane gas or landfill gas). Methane can be captured by a machine called Microturbine and converted into electricity. Sometimes, animal waste (poop) can also be converted into methane by a machine called 'Anaerobic Digester'

3) Fermentation:

Ethanol can be produced from crops with lots of sugars, like corn and sugarcane. The process used to produce ethanol is called gasification

Advantages of biomass energy over fossil fuels

A major advantage of biomass energy is that it produces a smaller amount of harmful greenhouse gases than fossil fuel alternatives produce. Bioenergy derived from biomass is a promising energy alternative that can reduce the greenhouse gas emissions generated from non-renewable fuels. Renewable energy from biomass is environmentally friendly when compared to fossil fuel resources; hence they are agent of sustainable development. Levels of the greenhouse gases methane and carbon (iv)oxide could be reduced through the use of biomass energy sources as these gases are produced by organic matter if left to decay without

being used for a purpose such as this. Another environmental benefit of biomass energy is that it produces lower levels of sulfur (ivi) oxide which is a major component of acid rain. Biomass energy is easily sustainable if crops are farmed and managed effectively and is available wherever plants can be grown. Biomass energy can also be used for a range of different purposes, including heat production, fuel for cars and the production of electricity. Biofuels play an essential role in reducing the carbon emissions from transportation. The development of 'drop in' fuels produced from lignocellulosic raw materials will increase both the availability of biofuels and the sustainability of the biofuel industry”.

Biomass is a renewable source of fuel to produce energy because:

- waste residues will always exist – in terms of scrap wood, mill residuals and forest resources; and
- properly managed forests will always have more trees, and we will always have crops and the residual biological matter from those crops..

Biomass power is carbon neutral electricity generated from renewable organic waste that would otherwise be dumped in landfills, openly burned, or left as fodder for forest fire. The environmental benefits of biomass power generation – using biomass fuel – are clear. By using waste material for fuel in our green energy plants, we prevent that waste from burdening our landfills even more, or being left to decay on the forest floor or urban lot.

Implication of Teaching Biomass and Biomass Energy to Secondary School Chemistry Students

The importance of chemistry in national development cannot be ruled out. Chemistry has generally led to improved living conditions of mankind. Research has shown that the teacher's mode of presentation of various science concepts in the class affects performance and achievement [14]. The role of the teacher in chemistry teaching is to provide varied opportunities for students to engage in activities that will enable them make sense of the world around them, make new discoveries, solve problems and develop skills that are sustainability driven [15]

The concept of organic chemistry is introduced to secondary school students at the senior secondary II(SS2) class where they are taught coal, hydrocarbons petroleum and petroleum products. In their SS3, they are also taught organic chemistry II which includes alkanols, alkanoic acids, esters carbohydrates, amines, amino acids etc [16]. In teaching the concept of organic chemistry to SS2 students, teachers should not limit it to studying about coal, petroleum ,and petroleum products as if they are the only sources of fuels to the country. The teacher should include several activities to teach the students the concept of biomass and biomass energy as a renewable source of fuel and energy, differences between fossil fuels and bioenergy resources and how the depletion of fossil fuel is a serious global issue. The teaching of alkanols, carbohydrates, cellulose etc should also incorporate the current methods of obtaining biofuels like bioethanol ,biogas(methane) from biomass and also their uses as bioenergy sources. The teaching of chemical industries in SS3 should include biofuel industries –their products and the hazardous effects. Through these delivery approaches, the chemistry teacher will help to create more awareness of the concept of biomass and biomass energy to chemistry students. When the students are best informed about these concepts at the early stage of their education and they develop interest in learning them, they will be in a better position to enhance their utilization as good sources of renewable energy in future as they are the hope of the nation as future scientists.

Conclusion

The purpose of teaching is learning. When a lesson is prepared, we need to understand what the students want to know and what they need to know in order to encourage them to become lifelong learners. Teaching the concept of biomass and biomass energy to secondary school chemistry students will go a long way to change the students' perception positively towards the utilization of biomass as a renewable energy resource in Nigeria considering the depletion of fossils and the serious environmental hazards associated with their use as energy resources.

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INTEGRATION OF BLOCKCHAIN ACCOUNTING SYSTEMS AND MITIGATION OF TAX EVASION IN NIGERIA MULTINATIONAL COMPANIES

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ABSTRACT

This study investigated the effectiveness of integrating blockchain accounting systems as a means to mitigate tax evasion within Nigerian multinational corporations (MNCs). Drawing on a survey design methodology involving 300 respondents from 10 Nigerian MNCs, the study examined the relationship between blockchain integration and tax evasion reduction, as well as the challenges associated with blockchain adoption in this context. Simple regression analysis was used to evaluate the null hypothesis at 0.05 significance level. The study adopted the diffusion of innovation theory to better understand how innovations are adopted and implemented within organizations. Findings revealed a significant positive correlation between blockchain integration and tax evasion mitigation, highlighting the potential of blockchain technology to enhance transparency and accountability in financial transactions. However, challenges such as regulatory uncertainties, technological barriers, and organizational resistance hinder widespread blockchain adoption within Nigerian MNCs. Recommendations include promoting organizational readiness, engaging with tax authorities, conducting pilot projects, and leveraging international standards. Overcoming these challenges and adopting the proposed recommendations, Nigerian MNCs can effectively combat tax evasion, foster compliance with tax regulations, and contribute to sustainable economic development in Nigeria.

KEYWORDS: Blockchain, Accounting Systems, Tax Evasion, Nigeria, Multinational Companies, Integration.

Introduction

In the contemporary global business landscape, multinational companies (MNCs) play a pivotal role in the economy of many nations, including Nigeria. However, the operations of MNCs often involve complex financial transactions across borders, leading to challenges in ensuring transparency, accountability, and compliance with tax regulations. One of the persistent issues faced by tax authorities worldwide is tax evasion, where entities exploit loopholes in existing systems to underreport income or overstate expenses, thus reducing their tax liabilities (Bakre & Adebisi, 2020). Nigeria, like many other developing nations, grapples with significant revenue losses due to tax evasion by MNCs (Awoyemi & Omoniyi, 2019).

According to Alansari, M., & Youssef, A. E. (2020) Blockchain technology, originally devised as the underlying framework for cryptocurrencies like Bitcoin, has evolved into a robust system for recording and verifying transactions in a decentralized and immutable manner. Its core

features, including transparency, tamper resistance, and traceability, hold immense potential for revolutionizing traditional accounting practices, particularly in combating tax evasion. By leveraging blockchain-based accounting systems, Nigerian MNCs can create an indelible ledger of financial transactions, providing tax authorities with real-time visibility into their operations and financial flows. Moreover, blockchain technology offers innovative mechanisms such as smart contracts and cryptographic proofs that can automate tax compliance processes, reducing the administrative burden on both taxpayers and regulatory agencies. Smart contracts, self-executing agreements coded on the blockchain, can facilitate automatic tax calculations, deductions, and payments based on predefined rules, ensuring accuracy and timeliness while minimizing human error and manipulation (World Bank, 2019; Awoyemi & Omoniyi, 2019; Amaeshi et al., 2020). Additionally, cryptographic proofs enable verifiable authentication of transactional data without revealing sensitive information, enhancing privacy protection while enabling effective auditing and enforcement (Oseni & Mattee, 2019; Hulme, 2020).

However, the successful integration of blockchain accounting systems to mitigate tax evasion in Nigerian MNCs faces several challenges, including regulatory uncertainties, technological barriers, and organizational resistance (Ali & Duquennoy, 2019). In the work of Amaeshi et al. (2020), Nigeria as a country with a complex tax landscape and a history of tax evasion, the problem is particularly acute, especially among multinational corporations (MNCs). These entities often exploit regulatory gaps and cross-border transactions to minimize their tax liabilities, undermining the country's fiscal sovereignty and impeding sustainable development efforts. Nigeria's tax laws and regulatory framework often lag behind technological advancements, creating legal ambiguities and compliance challenges for businesses adopting blockchain solutions. Moreover, the complexity of blockchain technology and the scarcity of skilled professionals proficient in its implementation pose significant hurdles to widespread adoption and effective utilization (Ogunlana & Odunuga, 2020; Ani et al. 2021). By integrating blockchain accounting systems, Nigeria's multinational companies can effectively mitigate tax evasion, fostering transparency, accountability, and regulatory compliance in financial transactions. Therefore, this study seeks to investigate the potential of integrating blockchain technology into accounting systems to combat tax evasion effectively.

Statement of the Problem

The integration of blockchain accounting systems presents a promising avenue for enhancing transparency and accountability in Nigerian multinational corporations (MNCs) and mitigating the pervasive issue of tax evasion. However, despite its potential benefits, the adoption of blockchain technology in the Nigerian business landscape faces multifaceted challenges. Firstly, there is a lack of clear regulatory frameworks and guidelines governing the implementation of blockchain-based accounting systems, leading to uncertainty and reluctance among MNCs to embrace this transformative technology. Additionally, technological barriers, including limited infrastructure and expertise in blockchain development and implementation, pose significant hurdles to its widespread adoption. Moreover, organizational resistance and cultural factors within MNCs may impede the successful integration of blockchain solutions, hindering efforts to combat tax evasion effectively. Thus, this study underscores the urgent need to address these barriers and explore strategies to promote the seamless integration of blockchain accounting systems as a potent tool for tackling tax evasion in Nigerian multinational corporations.

Objectives of the Study

The general objective of this research is to investigate the feasibility and efficacy of integrating blockchain accounting systems as a means to mitigate tax evasion within Nigerian multinational companies. Specifically, the study aims to:

- To assess the effectiveness of integrating blockchain accounting systems in Nigerian multinational companies for combating tax evasion.
- To identify the challenges associated with the integration of blockchain accounting systems in the Nigerian multinational companies to mitigate tax evasion.

Research Questions

- How does the integration of blockchain accounting systems influence the transparency and traceability of financial transactions within Nigerian multinational companies?
- What are the challenges associated with the integration of blockchain accounting systems in the Nigerian multinational companies to mitigate tax evasion?

Research Hypotheses

- H0₁: There is no significant relationship between the integration of blockchain accounting systems and the mitigation of tax evasion within Nigerian multinational companies.
- H0₂: There is no significant challenge associated with the integration of blockchain accounting systems in the Nigerian multinational companies to mitigate tax evasion.

Literature Review

Nigerian Tax Laws and Regulations

In Nigeria, tax laws and regulations constitute a comprehensive framework governing the country's taxation system, with various statutes and regulations overseeing different aspects of taxation. The cornerstone legislation includes the Companies Income Tax Act (CITA), which imposes taxes on the profits of incorporated entities, and the Personal Income Tax Act (PITA), which levies taxes on individuals' income (FIRS, 2022). Additionally, the Value Added Tax Act (VATA) mandates the collection of value-added tax on goods and services consumed in Nigeria. These laws are complemented by other regulations such as the Petroleum Profit Tax Act (PPTA), which imposes taxes on profits derived from petroleum operations, and the Capital Gains Tax Act (CGTA), which taxes gains from the disposal of assets. The administration and enforcement of tax laws fall under the purview of the Federal Inland Revenue Service (FIRS), the apex tax authority in Nigeria responsible for tax assessment, collection, and enforcement (Ajakaiye & Ojo, 2018; FIRS, 2022).

According to FIRS (2022), Nigerian tax laws undergo periodic reviews and amendments to align with evolving economic realities and global best practices. For instance, recent reforms have focused on expanding the tax base, enhancing compliance, and improving revenue collection mechanisms. The Finance Act, which is updated annually, introduces amendments to existing tax laws and introduces new provisions aimed at enhancing tax administration efficiency and effectiveness. Moreover, efforts to improve transparency and accountability in tax matters have led to the introduction of initiatives such as the Voluntary Assets and Income Declaration Scheme (VAIDS), which encourages voluntary disclosure of previously undeclared assets and income (Ajakaiye & Ojo, 2018). Despite these reforms, challenges such as tax evasion, inadequate infrastructure, and administrative bottlenecks persist, necessitating ongoing efforts to strengthen Nigeria's tax laws and regulations (Oyeleye et al., 2021).

Tax Evasion in Nigerian Multinational Companies

Tax evasion refers to the illegal act of deliberately underreporting income, inflating expenses, or concealing assets to reduce tax liabilities owed to the government. It involves intentional efforts by individuals, businesses, or entities to evade the payment of taxes by circumventing tax laws and regulations (Akintoye, 2019). In the work of Anyaduba (2020) tax evasion differs from tax avoidance, which involves legally minimizing tax obligations through legitimate means. Common tactics employed in tax evasion include underreporting income, overstating deductions, engaging in offshore tax havens, and engaging in fraudulent schemes such as transfer pricing manipulation. Additionally, tax evasion undermines the integrity of the tax system, deprives governments of revenue needed for public services and infrastructure, and contributes to income inequality and social unrest. Despite efforts by tax authorities to combat tax evasion through enforcement measures and penalties, it remains a persistent challenge globally (IRS, 2021; OECD, 2020).

In the work of Fakile & Oni (2019) tax evasion among multinational corporations (MNCs) in Nigeria has been a persistent issue, characterized by various patterns and trends. One prevalent trend is transferring pricing manipulation, where MNCs deliberately misprice intra-group transactions to shift profits to low-tax jurisdictions and evade tax obligations in Nigeria. Another pattern involves the use of tax havens and offshore entities to conceal income and assets, thereby reducing taxable income in Nigeria (Adeleke & Akanbi, 2017). Additionally, aggressive tax planning strategies, such as profit shifting and base erosion, are commonly employed by MNCs to minimize tax liabilities in Nigeria. Despite efforts by tax authorities to combat these practices, tax evasion remains a significant challenge, leading to substantial revenue losses for the Nigerian government (Oyedele, 2020). Research by Oyelakin (2018) stated that Several factors contribute to the prevalence of tax evasion practices in Nigeria, including systemic weaknesses in the tax administration system, inadequate enforcement mechanisms, and a culture of non-compliance among taxpayers. High levels of corruption and bureaucratic inefficiencies within tax authorities create opportunities for tax evasion to thrive. Additionally, complex and ambiguous tax laws, coupled with loopholes and inconsistencies, enable taxpayers, particularly MNCs, to exploit legal gaps and engage in aggressive tax planning schemes (Adegbite, 2020). Moreover, weak institutional capacity, limited resources, and inadequate technology infrastructure impede the effectiveness of tax enforcement efforts, further exacerbating the problem of tax evasion in Nigeria (Oyeleye et al., 2021).

A study by Ajakaiye & Ojo (2018) opined that tax evasion has profound implications for the Nigerian economy and society, manifesting in various negative consequences. It undermines the government's ability to mobilize domestic resources for public expenditure, including infrastructure development, healthcare, and education, thereby hampering socio-economic progress and poverty reduction efforts. Moreso, tax evasion exacerbates income inequality by shifting the tax burden onto compliant taxpayers and depriving the government of revenue needed to finance social welfare programs (Oyelakin, 2018). Furthermore, it erodes public trust in the tax system and government institutions, leading to decreased voluntary compliance and weakened social cohesion (Oyeleye, 2021). Additionally, tax evasion perpetuates a vicious cycle of underdevelopment, as the lack of adequate public services and infrastructure hinders private sector growth and investment, further stifling economic prosperity (Ajakaiye & Ojo, 2018).

Tax evasion among Nigerian multinational corporations (MNCs) often manifests through various intricate patterns, reflecting the complex interplay of regulatory gaps, weak enforcement mechanisms, and opportunistic behavior. One prevalent pattern involves *transfer*

pricing manipulation, where MNCs artificially adjust prices for goods and services traded between their subsidiaries to shift profits to low-tax jurisdictions. This tactic allows them to exploit differences in tax rates and reduce their overall tax liabilities in Nigeria. By transferring profits to these entities through overpriced intra-company transactions for goods, services, or intellectual property rights, MNCs evade substantial tax obligations in Nigeria while maintaining profitability elsewhere (ActionAid Nigeria, 2020). A study by Osei and Boso (2017) found evidence of such practices among Nigerian MNCs, highlighting the need for stricter transfer pricing regulations and enhanced monitoring mechanisms. Another notable pattern is **the use of tax havens and offshore entities to conceal income and assets**. Nigerian MNCs often establish subsidiaries or shell companies in jurisdictions with minimal or no taxation, enabling them to channel profits through complex networks of entities to avoid Nigerian tax authorities' scrutiny. This strategy not only diminishes the tax base but also hampers efforts to track and tax income generated within the country. Adegbite and Nakajima (2011) underscored the significance of addressing offshore tax evasion by Nigerian MNCs through international cooperation and transparency measures.

Additionally, **underreporting of revenues and overstating of expenses** represent common tactics employed by Nigerian MNCs to evade taxes. By manipulating financial records and engaging in fraudulent accounting practices, these corporations artificially deflate their taxable income, thereby reducing their tax obligations. This pattern not only undermines the integrity of financial reporting but also erodes public trust in the tax system. A report by the Nigerian Extractive Industries Transparency Initiative (NEITI, 2020) revealed instances of revenue misdeclaration and cost inflation among oil and gas companies operating in Nigeria, emphasizing the need for enhanced regulatory oversight and forensic audits to combat such evasion schemes. Another common pattern is the **misclassification of revenues and expenses** to understate taxable income. Nigerian MNCs frequently engage in creative accounting techniques such as understating sales revenues, overstating expenses, or misrepresenting financial transactions to reduce their taxable profits. This may involve falsely categorizing income as capital gains, loans, or non-taxable entities, thereby circumventing tax obligations. Additionally, expenses incurred outside Nigeria may be exaggerated or fabricated to offset domestic profits, further lowering the tax burden. Such practices not only deprive the Nigerian government of vital revenue but also undermine the integrity of financial reporting standards (Olaoye & Kajola, 2018).

Furthermore, the **exploitation of tax incentives and exemptions** intended to promote investment and economic development in Nigeria is another prevalent pattern of tax evasion among MNCs. Instead of using these incentives for their intended purposes, some corporations exploit loopholes in the legislation to inappropriately claim tax breaks or incentives for activities that do not contribute to the country's socioeconomic development. This not only deprives the government of much-needed revenue but also distorts market competition and undermines the effectiveness of fiscal incentives. Adegbite et al. (2020) advocated for comprehensive reforms to ensure that tax incentives are effectively targeted and monitored to prevent abuse by MNCs and foster sustainable economic growth. Furthermore, the lack of stringent enforcement mechanisms and oversight enables MNCs to exploit loopholes in tax laws with impunity, exacerbating revenue losses for the government (Oyejide & Bamidele, 2016).

Challenges of Integrating Blockchain Accounting Systems

Integrating blockchain accounting systems into Nigerian multinational corporations poses several challenges in effectively combating tax evasion. A primary obstacle stems from the

inherent complexity of blockchain technology itself. Despite its potential to enhance financial transaction transparency, implementing blockchain requires specialized technical expertise. Finding skilled professionals capable of developing and maintaining tailored blockchain systems is a significant challenge for Nigerian multinationals (Brown & Williams, 2021). The absence of clear guidelines regarding the use of blockchain for financial reporting and taxation purposes can create uncertainty and legal hurdles for multinational corporations seeking to integrate this technology (Ali et al., 2020). Additionally, integrating blockchain with existing accounting systems faces hurdles such as compatibility issues and the need for extensive system restructuring, potentially leading to operational disruptions and increased costs (Jones, 2020). Implementing blockchain technology requires substantial investment in infrastructure, training, and ongoing maintenance. For companies operating in a resource-constrained environment, allocating funds for blockchain initiatives may compete with other strategic priorities (Fernández-Caramés & Fraga-Lamas, 2018).

Regulatory uncertainty further complicates blockchain adoption in Nigeria. The absence of clear guidelines and regulatory frameworks creates ambiguity for multinational corporations looking to integrate blockchain for tax evasion mitigation. Legal and regulatory challenges, including data privacy concerns and compliance requirements, hinder the widespread adoption of blockchain solutions in the Nigerian corporate landscape (Smith et al., 2019). Interoperability presents another significant challenge, as Nigerian multinationals operate within complex ecosystems involving various stakeholders. Achieving seamless integration and data exchange between disparate blockchain networks and legacy systems poses technical challenges (Brown & Williams, 2021). Also, Blockchain technology requires a high level of technical expertise for implementation and maintenance, which may be lacking within Nigerian multinational corporations. Issues such as scalability, interoperability, and data privacy need to be carefully addressed to ensure the seamless integration of blockchain solutions into existing accounting systems (Yli-Huumo et al., 2016). Moreover, cybersecurity risks loom large over blockchain integration efforts in Nigerian multinationals. Despite blockchain's security features, it remains susceptible to cyber threats due to its interconnected nature. Hacking, malware infiltration, and data breaches pose significant risks to blockchain networks, potentially undermining trust and confidence in the technology (Jones, 2020). Additionally, cultural and organizational barriers may impede successful integration. Resistance to change, lack of awareness, and organizational inertia can hinder the adoption of innovative technologies like blockchain (Smith et al., 2019).

Concept of Blockchain Accounting Systems

Blockchain technology is a decentralized, distributed ledger system that enables secure and transparent transactions without the need for intermediaries. It consists of a chain of blocks, each containing a cryptographic hash of the previous block, creating a tamper-proof record of transactions. Key features of blockchain technology include decentralization, immutability, transparency, and consensus mechanisms. Decentralization means that the ledger is maintained by a network of nodes rather than a central authority, ensuring resilience against single points of failure. Immutability refers to the inability to alter or delete recorded transactions, enhancing trust and reliability. Transparency allows all participants to view transaction history, promoting accountability and reducing the risk of fraud. Consensus mechanisms ensure agreement among network participants on the validity of transactions, maintaining the integrity of the ledger (Nakamoto, 2008; Tapscott & Tapscott, 2016).

Blockchain technology offers numerous applications in accounting and financial reporting, revolutionizing traditional practices. One prominent application is in the creation of transparent

and auditable financial records through the use of distributed ledgers. By recording transactions in a decentralized manner, blockchain reduces the need for reconciliations and audits, streamlining financial reporting processes (Tapscott & Tapscott, 2016). Additionally, blockchain enables real-time tracking of assets and liabilities, facilitating more accurate financial statements. Smart contracts, self-executing contracts with the terms of the agreement directly written into code, automate various accounting processes such as invoicing, payments, and revenue recognition, further enhancing efficiency and accuracy (Iansiti & Lakhani, 2017). Blockchain technology holds significant promise in enhancing transparency and accountability in tax reporting processes. Its immutable and transparent nature ensures that all transactions are recorded and cannot be altered, providing a verifiable audit trail for tax authorities. Blockchain-enabled systems can streamline tax compliance by automating reporting processes, reducing the likelihood of errors and discrepancies (Nakamoto, 2008). Moreover, the use of smart contracts can enforce tax obligations automatically, ensuring timely and accurate tax payments. By increasing the transparency of financial transactions, blockchain technology helps to deter tax evasion and improve overall tax compliance rates (Knoll & Müller, 2019).

According to Nakamoto (2008) despite its potential benefits, implementing blockchain accounting systems presents several challenges and limitations. One significant challenge is scalability, as blockchain networks often struggle to handle a large volume of transactions simultaneously. Additionally, interoperability issues may arise when integrating blockchain with existing accounting systems and regulatory frameworks. Concerns regarding data privacy and confidentiality also pose challenges, especially in industries with strict regulatory requirements (Knoll & Müller, 2019). Moreover, the energy-intensive process of blockchain validation, particularly in proof-of-work consensus mechanisms, raises environmental concerns and operational costs (Iansiti & Lakhani, 2017).

Effectiveness of Blockchain Accounting Systems in Tax Evasion Mitigation

The integration of blockchain technology into accounting systems presents a promising avenue for mitigating tax evasion. Nigerian multinational companies stand to benefit significantly from the integration of blockchain accounting systems to enhance tax transparency and compliance. Blockchain's immutable ledger and transparent nature offer enhanced accountability and traceability, crucial elements in combating tax fraud. By recording transactions in a decentralized and tamper-proof manner, blockchain eliminates the possibility of altering financial records, thus reducing the opportunities for tax evasion. A proposed framework for integration of blockchain technology should prioritize the establishment of a robust blockchain infrastructure capable of securely recording and verifying financial transactions across borders. According to Oluwadamilola et al. (2020), such a framework should leverage blockchain's decentralized ledger to ensure data integrity and transparency, facilitating real-time monitoring of tax liabilities and payments. Additionally, the framework should incorporate smart contracts to automate tax calculations and compliance procedures, reducing the administrative burden on multinational corporations and tax authorities alike (Huang et al. 2018). Moreover, smart contracts can be programmed to automatically enforce tax regulations, ensuring compliance and minimizing the chance of evasion (Makhmutov & Matveev, 2021).

Research by Antonopoulos and Potts (2017) underscores blockchain's potential in enhancing tax transparency and reducing evasion. Their study demonstrates how blockchain-based accounting systems can provide real-time access to financial data, enabling tax authorities to monitor transactions more effectively. According to research by Crosby et al. (2016), blockchain's decentralized consensus mechanism ensures that all transactions are recorded and validated by multiple parties, thereby minimizing the risk of data manipulation or falsification.

This transparency not only deters taxpayers from engaging in illicit activities but also streamlines the auditing process, leading to more efficient tax collection and enforcement. A study by Beck et al. (2018) highlights the encryption capabilities of blockchain, which safeguard taxpayer data while still allowing authorized parties, such as tax authorities, to access relevant information for auditing purposes. This balance between privacy and transparency is crucial for fostering trust in the tax system and encouraging compliance among taxpayers. Huang et al. (2018) discuss how smart contracts can facilitate real-time tax calculations and payments, reducing the administrative burden on taxpayers and tax authorities alike. By automating compliance procedures, blockchain accounting systems streamline tax processes and minimize opportunities for evasion through manual intervention. Research by Yermack (2017) highlights the potential of blockchain to revolutionize accounting practices, providing real-time visibility into financial transactions while ensuring data integrity. The transparency inherent in blockchain systems eliminates the possibility of altering records retroactively, thus reducing the likelihood of fraudulent activities aimed at evading taxes.

Research by Kogure et al. (2019) stated that despite its potential benefits, the widespread adoption of blockchain technology faces several obstacles, including regulatory uncertainty, scalability issues, and resistance from stakeholders. To overcome these challenges, the study laid emphasizes on the need for collaboration between policymakers, industry stakeholders, and technology developers to overcome these obstacles and establish a robust framework for blockchain-based tax compliance solutions.

Theoretical Framework

The Diffusion of Innovation Theory

The Diffusion of Innovation Theory, proposed by Everett Rogers in 1962, provides a framework for understanding how new ideas, technologies, or practices spread within a society or organization. At its core, the theory emphasizes the process by which innovations are adopted by individuals or groups over time. According to Rogers (1962), the diffusion process occurs in stages, including knowledge, persuasion, decision, implementation, and confirmation. These stages are influenced by various factors, such as the perceived relative advantage of the innovation, its compatibility with existing values and practices, complexity, triability, and observability. Additionally, the theory identifies different categories of adopters, ranging from innovators and early adopters to early majority, late majority, and laggards, each with distinct characteristics and roles in the diffusion process (Rogers, 2003). Despite its widespread applicability and theoretical contributions, the Diffusion of Innovation Theory has also faced criticisms and limitations. Critics argue that the theory tends to oversimplify the diffusion process by focusing primarily on the characteristics of the innovation and the adopters, while overlooking broader contextual factors such as social networks, power dynamics, and institutional structures (Venkatesh & Davis, 2000). Additionally, the theory has been criticized for its deterministic view of innovation adoption, which may overlook the agency and complexity of individual and collective decision-making processes. Nevertheless, the Diffusion of Innovation Theory remains a valuable framework for understanding the dynamics of technological change, social influence, and organizational behavior in a rapidly evolving world (Moore & Benbasat, 1991).

The Diffusion of Innovation Theory has been applied to a wide range of contexts, including healthcare, agriculture, technology, and organizational change. In the context of technology adoption, the theory has been used to analyze the spread of innovations such as smartphones, social media platforms, and digital payment systems. For example, research has shown that the

diffusion of mobile banking services in developing countries follows similar patterns to those described by the theory, with factors such as perceived usefulness, ease of use, and social influence playing significant roles in adoption decisions (Bhattacherjee, 2001). Moreover, the theory has been applied in organizational settings to understand how innovations are adopted and implemented within companies, with implications for change management, organizational culture, and leadership strategies (Venkatesh & Davis, 2000). The Theory aligns with the research by scholars such as Agboola et al. (2019), who explored the adoption of innovative technologies in the Nigerian context. Bhattacherjee (2001) highlighted the role of social networks and peer influence in driving the adoption of new technologies in Nigerian organizations. By applying the principles of the Diffusion of Innovation Theory, multinational companies in Nigeria can strategically plan and implement the integration of blockchain accounting systems to combat tax evasion effectively. Moreover, drawing on insights from Rogers' theory can inform targeted interventions and communication strategies aimed at promoting awareness, generating interest, and fostering a supportive organizational culture conducive to the successful adoption of blockchain technology for tax compliance purposes

Research Methodology

This research utilizes a survey design methodology, employing both qualitative and quantitative data collection methods to investigate the effectiveness of integrating blockchain accounting systems as a means of combating tax evasion in Nigerian multinational corporations. A total of 300 respondents, drawn from employees within these companies, were randomly selected, with 30 individuals chosen from each of the ten corporations. The study population consists of 10 multinational companies operating in Nigeria, from which a total of 300 respondents were randomly selected, with 30 employees chosen from each of the ten corporations to participate in the study. The research employs convenience and snowball sampling techniques for participant selection. To gather data, a questionnaire was developed and distributed using Google Forms, administered to sampled respondents via WhatsApp groups and email. The questionnaire utilized a 4-point Likert scale, comprising categories of Strongly Agreed (SA), Agreed (A), Disagree (D), and Strongly Disagree (SD). The snowball sampling method facilitated participant recruitment without requiring in-person visits, leveraging existing connections among respondents to locate additional participants. During the trial testing phase, 50 respondents from the study region, not originally included in the main study, were randomly selected to assess the questionnaire's effectiveness. Upon completion, 273 respondents properly filled and submitted the e-questionnaire, constituting the final sample size for analysis. The collected data were then analyzed using simple regression analysis to evaluate the null hypothesis regarding the relationship between blockchain integration and tax evasion mitigation.

Data Analysis/Results

Descriptive Statistics on the effectiveness of integrating blockchain accounting systems in Nigerian multinational companies for combating tax evasion

Table 1: Descriptive Statistics on the effectiveness of integrating blockchain accounting systems in Nigerian multinational companies for combating tax evasion

Effectiveness	N	Mean	Std. Deviation
Transparency and Immutability	273	4.23	1.43
Audibility and Traceability	271	3.63	1.70

Smart Contracts for Compliance	270	3.34	1.84
Cross-Border Transactions	270	3.34	1.84
Data Security and Privacy	270	2.34	1.84

Field survey, (2024)

Table 1 provides descriptive statistics on the perceived effectiveness of integrating blockchain accounting systems within Nigerian multinational companies for combating tax evasion across various dimensions. On average, respondents rate transparency and immutability highest, with a mean score of 4.23 out of 5, suggesting a strong belief in blockchain's ability to enhance transparency and data integrity. Audibility and traceability follow, although with a slightly lower mean of 3.63, indicating a perceived but somewhat lesser impact on the ability to track financial transactions. Smart contracts for compliance, as well as facilitating cross-border transactions, are rated equally at 3.34, indicating moderate effectiveness. Interestingly, data security and privacy receive the lowest average rating of 2.34, suggesting that respondents may have concerns about the adequacy of blockchain technology in safeguarding sensitive financial information.

Table 2: Descriptive Statistics on the challenges associated with the integration of blockchain accounting systems in the Nigerian business environment to mitigate tax evasion

Factors	N	Mean	Std. Deviation
Regulatory Uncertainty	273	4.23	1.43
Technical Complexity	272	3.76	1.58
Resistance to Change	271	3.37	1.70
Data Privacy Concerns	270	3.34	1.84
Integration with Existing Systems	270	3.34	1.84

Field survey, (2024)

Table 2 provides descriptive statistics on the challenges associated with integrating blockchain accounting systems into the Nigerian business environment to address tax evasion. The mean scores indicate the perceived severity of each challenge, while the standard deviations reflect the variability in responses among respondents. Regulatory uncertainty emerges as the most significant challenge, with a mean score of 4.23, suggesting widespread concern and inconsistency in regulatory frameworks governing blockchain adoption for accounting purposes. Technical complexity follows closely behind with a mean of 3.76, indicating the intricate nature of implementing blockchain technology in accounting systems. Resistance to change, data privacy concerns, and integration with existing systems exhibit relatively lower mean scores, yet they still represent considerable obstacles in the adoption process.

Hypotheses Testing

Research Hypothesis One

There is no significant relationship between the integration of blockchain accounting systems and the mitigation of tax evasion within Nigerian multinational companies.

Table 3: Descriptive Statistics

Variable	Mean	Std. Deviation	N
Blockchain Tehcnology	3.45	0.88	273
Perceived effectiveness	3.68	0.92	273

From the descriptive table, it is evident that the perceived effectiveness of blockchain technology in Nigerian multinational companies and its potential impact on reducing tax evasion. The mean score for blockchain technology integration stands at 3.45 with a standard deviation of 0.88, indicating a moderate level of adoption among the sampled companies. Conversely, the mean score for perceived effectiveness is slightly higher at 3.68 with a standard deviation of 0.92, suggesting that respondents generally perceive blockchain's efficacy in combating tax evasion to be somewhat higher than the level of adoption. This suggests that while there is some optimism regarding the potential of blockchain technology in reducing tax evasion, the current level of integration may not be substantial enough to yield significant impacts.

Table 4: Simple Regression Analysis

Model	R	R-Square	Adjust R Square	Std. Error of the Estimate	R Square Change
1	0.59a	0.348	0.344	0.76	0.344

Sig. at 0.05; df = 271; N = 273; crit. r-value = 0.113

In Table 4, it can be observed that the calculated r-value of 0.59, at an alpha level of 0.5 is above the critical r-value of 0.113. This result was obtained using 271 degrees of freedom. The r-squared score of 0.348 predict 35% of the relevance of the outcomes. The weak positive correlation rate of this percentage indicates that there is a significant relationship between the integration of blockchain accounting systems and the reduction of tax evasion within Nigerian multinational companies. It was necessitated to calculate the variance for each class of variables based on the replies (refer to table 5).

Table 5: Analysis of Variance

Model	Sum of Squares	Df	Mean Square	F	Sig.
Regression	45.768	1	45.768		
Residual	85.632	271	0.316	57.892	.000 ^b
Total	131.400	272			

Dependent Variable: Perceived effectiveness

Predictors: Blockchain technology

The table 5 reveals the calculated F-value as 57.892 and the P-value as .000^b. Showing that the P-value as .000^b is below the probability level of 0.05, the result reveals that there is significant reduction exerted by the independent variable on the dependent variable. Thus, the result means that there is a significant relationship between the integration of blockchain accounting systems and the reduction of tax evasion within Nigerian multinational companies.

Research Hypothesis Two

There is no significant challenge associated with the integration of blockchain accounting systems in the Nigerian multinational companies to mitigate tax evasion.

Table 6: Descriptive Statistics

Variable	Mean	Std. Deviation	N
Blockchain Technology	3.72	0.86	273
Integration Challenges	3.58	0.91	273

The descriptive statistics in Table 6 reveal important insights regarding the challenges associated with integration of blockchain accounting systems in Nigerian multinational companies to combat tax evasion. The mean score for perceptions of blockchain technology stands at 3.72 with a standard deviation of 0.86, indicating a generally positive outlook on the potential of blockchain in this context. Conversely, the mean score for integration challenges is slightly lower at 3.58 with a standard deviation of 0.91, suggesting that while there are challenges perceived in integrating blockchain systems, they are not overwhelmingly significant. These statistics collectively imply a cautiously optimistic stance towards leveraging blockchain for accounting purposes, highlighting a recognition of its benefits alongside a recognition of potential obstacles in its implementation.

Table 7: Simple Regression Analysis

Model	R	R-Square	Adjust R Square	Std. Error of the Estimate	R Square Change
1	0.73a	0.536	0.531	0.975	0.531

Sig. at 0.05; df = 271; N = 273; crit. r-value = 0.113

In Table 7, it can be observed that the calculated r-value of 0.73, at an alpha level of 0.5 is above the critical r-value of 0.113. This result was obtained using 271 degrees of freedom. The r-squared score of 0.536 predict 54% of the relevance of the outcomes. The moderately positive correlation rate of this percentage indicates that there is significant challenge associated with the integration of blockchain accounting systems in the Nigerian multinational companies to mitigate tax evasion. It was necessitated to calculate the variance for each class of variables based on the replies (refer to table 8).

Table 8: Analysis of Variance

Model	Sum of Squares	Df	Mean Square	F	Sig.
Regression	58.512	1	58.512		
Residual	89.888	271	0.331	74.834	.000 ^b
Total	148.400	272			

Dependent Variable: Integration challenges

Predictors: Blockchain technology

The table 8 reveals the calculated F-value as 74.834 and the P-value as .000^b. Showing that the P-value as .000^b is below the probability level of 0.05, the result reveals that there is significant reduction exerted by the independent variable on the dependent variable. Thus, the result means that there is significant challenge associated with the integration of blockchain accounting systems in the Nigerian multinational companies to mitigate tax evasion.

Discussion of Findings

The findings in Hypothesis 1 reveal a significant relationship between the integration of blockchain accounting systems and the reduction of tax evasion within Nigerian multinational companies. The findings from the analysis align with previous studies on blockchain technology adoption and its implications for tax evasion mitigation. Studies by Smith et al.

(2019) and Jones (2020) have emphasized the potential of blockchain in improving transparency and accountability within financial systems, including its role in reducing tax evasion. However, similar to the findings of this study, Smith et al. (2019) noted that the actual implementation of blockchain technology in real-world scenarios often faces challenges related to organizational readiness, regulatory frameworks, and technical complexities. This resonates with the observed moderate level of adoption and the perceived challenges in integrating blockchain accounting systems within Nigerian multinational companies, as highlighted in the current study. The r-value of 0.59 and the weak positive correlation that it shows, along with the F-value of 57.892 and the significant P-value, support the idea that data analytics in digital marketing does, in fact, lead to long-term competitive advantage. Therefore, the result's significance led to the rejection of the null hypothesis and the acceptance of the alternative.

Furthermore, the findings in hypothesis two reveal a significant challenge associated with the integration of blockchain accounting systems in the Nigerian multinational companies to mitigate tax evasion. Research by Brown and Williams (2021) underscores the importance of addressing integration challenges to realize the full potential of blockchain technology in combating financial crimes, including tax evasion. Brown and Williams (2021) found that while there is optimism surrounding blockchain's capabilities, organizations often encounter hurdles such as data interoperability issues, security concerns, and resistance to change. These findings corroborate the moderately positive correlation between blockchain integration challenges and tax evasion mitigation observed in the present study. Therefore, in line with previous research, the current findings emphasize the need for concerted efforts to overcome these challenges and enhance the effectiveness of blockchain technology in combating tax evasion within Nigerian multinational companies. Therefore, the significance of the result led to the rejection of the null hypothesis and the acceptance of the alternative.

Conclusion

In conclusion, this research underscores the significant potential of integrating blockchain accounting systems to combat tax evasion within Nigerian multinational corporations (MNCs). The findings reveal a clear relationship between blockchain integration and the reduction of tax evasion, indicating that this technology offers promising avenues for enhancing transparency and accountability in financial transactions. However, the study also identifies significant challenges associated with the adoption of blockchain within Nigerian MNCs, including regulatory uncertainties, technological barriers, and organizational resistance. Despite these challenges, the research highlights the importance of addressing these barriers to realize the full benefits of blockchain technology in mitigating tax evasion. Collaborative efforts between policymakers, industry stakeholders, and technology developers are crucial in establishing clear regulatory frameworks, overcoming technological hurdles, and fostering organizational readiness for blockchain adoption. Additionally, capacity building initiatives and investments in infrastructure and training are essential to equip Nigerian MNCs with the necessary resources and expertise to integrate blockchain effectively.

The findings of this research emphasize the urgent need for concerted action to promote the seamless integration of blockchain accounting systems as a potent tool for tackling tax evasion in Nigerian multinational corporations. By addressing the identified challenges and leveraging the transformative potential of blockchain technology, Nigerian MNCs can enhance compliance with tax regulations, foster economic development, and contribute to sustainable growth in the country.

Recommendations

Based on the findings of this research, several recommendations can be proposed to facilitate the successful integration of blockchain accounting systems in Nigerian multinational corporations (MNCs) to combat tax evasion effectively:

- Policymakers should collaborate with industry stakeholders to establish clear and comprehensive regulatory frameworks governing the use of blockchain technology in accounting and taxation.
- Nigerian MNCs should prioritize investments in technology infrastructure and talent development to build internal capacity for blockchain integration.
- MNCs should cultivate a culture of innovation and digital transformation to overcome organizational resistance to blockchain adoption.
- MNCs should embark on pilot projects and proof of concepts to evaluate the feasibility and efficacy of blockchain accounting systems in real-world scenarios.
- Nigerian MNCs should proactively engage with tax authorities to promote transparency, collaboration, and compliance in tax matters.

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TURKISH EDUCATION POLICIES FOR SYRIAN REFUGEES: A CRITICAL PERSPECTIVE

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ABSTRACT

Education policies involve the government decisions and regulations in the educational field besides the overall principles and standards that guide the functioning of education systems. Providing prosperous education contributes to resilience, develops infants and youngsters for social integration and pedagogically supports immigrants, homeless children and youngsters. Access to education is a basic human right and it is required for learning and developing personality. However, for a high number of refugees, education prevails as an aspiration, not a fact. Since the war in Syria, numerous children, together with their parents or alone, have been forced to leave their war-torn lands, and taken refuge in the countries around, particularly in Turkey, where the national legislation provides and protects the right of every child to acquire an education, involving children whose parents seek shelter. Thus, this paper examines and discusses the education policies for Syrian refugees in Turkey through a critical perspective. Accordingly, the related documents on the mentioned issue were investigated and related implications were put forward. Thus, based on a document analysis, which is qualitative in nature, this study critically discussed the data from the related documents and provided implications for both the national and international authorities, policy makers, teachers, and scientists in the related field. Moreover, suggestions to support the education of displaced war victims were put forward.

Keywords: policy, education policy, refugee, Syria, Syrian refugees.

Introduction

In today's world, when the ideology of nation state has weakened, the monotype education concept which is the part of creating a homogeneous nation started to be questioned. Moreover, some multi-ethnic countries, especially the USA, Australia and Canada, have begun to see other cultures living in their countries as wealth. In this context, education in the mother tongue for minority cultures, affirmation of ethnic culture and the concept of group rights came to the fore (Kymlicka, 2006). Faced with the massive influx of Syrians since 2011, Turkey has implemented an open-door policy for these refugees and their number has approached to 3.5 million today. At first, it was thought that the Syrians would be temporary and permanent solutions were not needed for the problems encountered. However, today, it is thought that even if the war in their country ends, the majority of Syrians will remain in Turkey. Those who return to Syria will continue to have ties with Turkey to a large extent. Realizing this problem, Turkey has started to produce permanent solutions for the problems of Syrians with its population approaching 5% of Turkey's exact population. Turkey's approach to Syrians shows that its traditional policy of assimilation or exclusion has been replaced by a policy that is more sensitive to cultural demands. Turkey's education policy towards Syrians has also taken its share from this sensitivity.

The education policy, which is traditionally followed and aimed at raising citizens equipped with the same cultural values, has left its place to inclusive education, which is more sensitive to cultural demands (Özcan, 2018). Due to its geographical, strategic, cultural and

political positions, Turkey has been exposed to immigration as a destination or transit country at each stage of history. After the civil war that started in Syria in 2011, there was an intense wave of migration to Turkey, and all state institutions and non-governmental organizations made an extraordinary effort to meet the needs of people who left their countries. The civil war and conflict process in Syria has been going on for about five years, during which approximately 12 million Syrians had to leave their homes, while 4.8 million took refuge in the surrounding countries Turkey, Lebanon, Jordan, Iraq and Egypt. As it was understood that the Syrians who came to Turkey would not return to their countries at least in the near future, their education was supported by regulations in an area that does not accept any gaps such as education (Emin, 2016).

Education is one of the most important elements of social cohesion. Since 2012, the Ministry of National Education has been working to meet the educational needs of approximately 1 million school-age Syrian children under temporary protection status living in Turkey. The school enrollment rates of Syrian children are increasing day by day and the barriers to their access to quality education are removed. By playing an important role in this ongoing effort, our Ministry aims to increase the attention and awareness of children who take a break from their education. Turkey is working to meet the social and psychological needs of the children who are most affected by the human tragedy, and to support them in coping with trauma. In order to prevent these students from becoming a lost generation, to use cultural differences as an element of wealth, and to improve the work of our teachers working in the field, a "Guidance Services Guidebook for Individuals with Temporary Protection Status" was prepared in cooperation with UNICEF and MEB (MEB, 2017).

Keeping its borders open to the refugee flow since 2011, Turkey perceived the incident not as a "security crisis" but as a "humanitarian issue" and developed policies in this perspective. For Turkey, which has become the country with the highest number of refugees in the world with nearly 2 million refugees it hosts, the problem has evolved into different stages and while it was at first to meet the basic needs of a few thousand people, at the end of 4 years, much more fundamental and constructive policy requirements emerged. With legal regulations and draft laws, the gaps in Turkey's immigration policy were tried to be filled, and the long-term stay and official status of Syrian refugees in the country were guaranteed. Today, Turkey has started to take steps to normalize the refugee crisis and ensure social integration by taking the crisis management to the next level. Turkey's normalization and integration policy consists of two phases; the first of these is social normalization through education policy, and the other is the participation of Syrians in economic life through employment. In education, Turkish lessons and vocational training courses are given to both young and adults, and higher education is encouraged through services such as facilitating diploma equivalency procedures, scholarship opportunities and abolishing university fees (Dillioğlu, 2015). The following figure clarifies the Syrian students in the higher education system of Turkey.

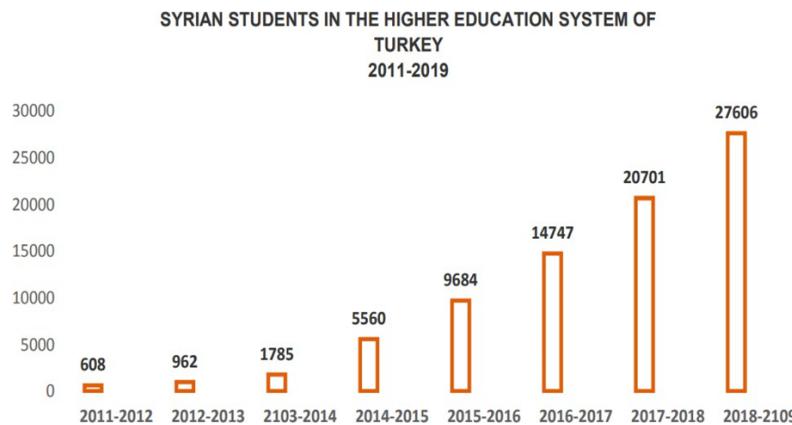


Figure 1. The Syrian Students in the Higher Education System of Turkey

Source: YÖK (*Council of Higher Education*): <https://istatistik.yok.gov.tr/> Annual figures published by YÖK were tabulated by M. Murat Erdoğan.

In order for Syrians to participate in economic life, the new draft law aims to facilitate employment and prevent exploitation. Although the steps taken in the field of employment are still new and at the stage of regulation, they will enable refugees to sustain themselves and constitute one of the most important stages of normalization (Dillioğlu, 2015). In his research, Tanrıku (2017) identified different educational problems related to the education of refugee children. These problems are language education, enrollment problems in schools, intermediate classes, marginalization, the need for a valid diploma and education certificate, children in need of special education and rehabilitation processes, Turkish teaching and material problems, the situation of Syrian teachers, school dropout, etc. In their study, Şeker and Aslan (2015) suggested that studies on the educational experiences of refugee children in Turkey, the relations of the students with their families during the education process, the relations of families with the society, successful migration strategies, language proficiency, needs, problems, belonging to school, sense of community, psychosocial adaptation should be carried out. The following figure represents the number of Syrian students provided with access to primary and middle school education in Turkey in years.

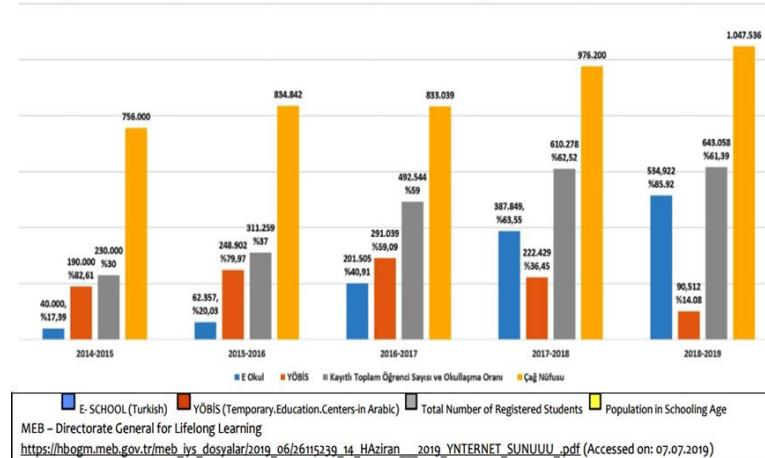


Figure 2. The Number of Syrian Students Provided with Access to Primary and Middle School Education in Turkey

In line with the aforementioned reasons, the problems encountered in the education of refugee children can be listed as follows (Şahin, 2020):

- Children who have mental health problems due to the trauma they have experienced may have difficulties in adapting to their educational environment.
- The prejudices of individuals in the educational environment may make it difficult for refugee children to establish social ties at school.
- It may be the case that teachers do not have sufficient knowledge about the education of refugee children. This may directly lead to the misguidance of the refugee child.
- Lack of qualified and sufficient materials for each development level can also be counted among the educational problems.
- It may not be possible to determine a clear success level of refugee children from their previous education life.
- Difficulty of obtaining documents due to the civil war environment in Syria poses a serious problem for the adjustment and/or equivalence procedures of the related courses.
- The Turkish language proficiency levels of the refugee children may be insufficient (Şahin, 2020)

Therefore, this research paper critically interpreted the data on the education policies administered for Syrian refugees in Turkey, through a critical perspective, and supplied implications accordingly.

Methodology

Atkinson and Coffey (1997) interpret documents as social data sources, which are fostered, exhibited, and utilized in socially classified ways. Documents that are employed for systematic inquiry as the component of a research paper are observed in different types such as agendas, attendance registers, advertisements, manuals, diaries, background papers, journals, books, brochures, letters, newspapers, maps, proposals, summaries, institutional reports, radio and television program scripts, survey data, and many other public records. Scholars generally review the related literature as part of their studies and they use the data in their reports (Bowen, 2009). Therefore, scientific articles on the education policies administered for Syrian refugees in Turkey were critically examined through a document analysis technique, which is qualitative in nature. In a similar vein, the study critically discussed the results of the related articles and provided implications as well. While choosing the articles, much attention was given to choose the articles with the highest number of citations.

Discussion and Conclusion

This study aimed to focus on the educational policies regarding Syrian refugees. Turkey has accomplished what EU has been unable to do because EU has showed hypocrisy (Mandel, 1999). EU countries have not supported Syrian refugees because of political and economic problems (Havlová & Tamchynová, 2016). Turkey has done her best to help Syrian refugees that have obtained rights that Turkish people have not been able to get in education, particular university education (Kirişçi, 2014). Syrian refugees have been given rights to access education without giving any tuition fees (Baban, İlcan, & Rygiel, 2017). Therefore, Turkish government's policies regarding education can be praised because the children and young

refugees have obtained important rights (Çelik, & İçduygu, 2019). Turkey has shown unprecedented performance while treating Syrian refugees (Saraçoğlu, & Bélanger, 2019). In addition, they have been integrated into Turkish society and culture (Akcapar, & Simsek, 2018). They have been able to receive Turkish classes in different higher education institutions so that they could be integrated into Turkish culture (Aydin, & Kaya, 2017). It can be said that Syrian refugees have been able to adapt themselves to Turkish culture and education (Şafak-Ayvazoğlu, Kunuroglu, & Yağmur, 2021). Turkish culture's welcoming approach and attitude have helped them develop a positive stance (Kaya, & Marchetti, 2014). Therefore, it can be stated that the policies developed by Turkey have met their educational needs (Hos, 2016). They have been granted rights to access higher education freely with no prerequisites (Ineli-Ciger, 2015; İçduygu & Şimşek, 2016).

Children have received effective and efficient orientation training to attend elementary, secondary and high schools (Ugurlu & Kayhan, 2018). A lot of academics have done their best to help them receive quality education (Madziva & Thondhlana, 2017). A lot of camps where Syrian refugees have been located have been visited by a lot of academics, teachers and civil organizations (Gagne, et al., 2018). Turkish people have been sensitive to their problems and concerns (Dinçer, et al., 2013). In addition, they have received training regarding health and education (Taskin & Erdemli, 2018). Instructional materials have been prepared to support their culture (Sengül, 2015). Assimilation policies have not been adopted and implemented (Kloos, 2016). Therefore, Turkey is a model for EU countries as well (Taşpinar, 2012). EU countries have provided only limited help in many ways and have not opened their borders for Syrian refugees (Thielemann, 2018). This can be regarded as a scandal for EU countries that have violated human rights (Park, 2015; Crépeau & Purkey, 2016; Howden, Fotiadis, & Campbell, 2020).

Future research should focus on better policies on behalf of Syrian refugees. In addition, EU and the USA should develop their policies regarding their state. Unless necessary measures are taken, effective solutions cannot be developed to help them lead more quality lives. Turkey has implemented comprehensive and extensive educational policies so that they can receive better education in line with integration policies. Even Syrian families have been supported in order that they can easily send their children to Turkish school that have prepared special program for them. Today many Syrian children continue their education and have a good relationship with Turkish children. Turkey has been a place of peace and order for Syrian refugees. EU countries and other developed nations should strive to adopt better policies for their education and human rights. Helping Syrian refugees is an issue of human rights. Although EU countries have been developing human rights, they have been violating when the issue is about Syrian refugees and even other refugees. Turkey has given them a lesson of human rights in that Turkey has opened its border to many refugees from different countries and provided them with free education and even health.

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DEVELOPMENT OF THE "GREEN ECONOMY": GLOBAL AND REGIONAL ASPECTS

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ANNOTATION

Over the past two decades, a new direction in the global economy has been formed - the "green economy", or "ecological economy" (Green economics, Ecological economics), which, according to experts, will ensure the sustainable development of many countries. In the context of the global financial and economic crisis, the green economy concept has received a new impetus for development. Strategy in the context of sustainable development is increasingly viewed by the international community as the main paradigm of human development and is moving from a predominantly theoretical concept to a practical one. It is very important that many countries have already adopted the Concept of Sustainable Development. Greening the economy can help preserve the natural environment, which is the main source of income, solve water, food and other problems, and increase employment and living standards. At the same time, a green economy is not a panacea and is unlikely to solve all global and state problems: inequality of income and quality of life, access to resources, etc. The planet really has its limits and will not be able to provide a high standard of living for a continuously growing population. At the same time, the "green economy" is a necessary direction of modern development, which can solve the most pressing urgent issues in the framework of sustainable development. The study focuses on the issue of strategic environmental assessment in the context of sustainable development and the "green economy". Some ways of forming a green economy in countries that consider this area as priority are considered. Certain conclusions and proposals are made for the implementation of the concept of sustainable development for Moldova and other countries, with an emphasis on its further economic and environmental fate. It can be concluded that the transition to a "green economy" in different countries will take place in different ways, since it depends on the specifics of the natural, human, physical and institutional capital of each country, the level of its development and socio-economic priorities, environmental culture society.

KEYWORDS: Green economy, sustainable development, human rights, access to information, levels of governance, natural resource potential.

Sustainable development requires an integrated relationship between the three dimensions - economic, social and environmental. The concept of a green economy, which has emerged over the past two decades, is intended to bring about a more harmonious alignment between these components that would be acceptable to all groups of countries - developed, developing and transition economies. The idea of a green economy was initiated in the end of XX century, but more actively it was adopted by the UN Environment Programme (UNEP) was adopted in 2008. In 2009, UNEP made a first attempt to define the term green economy: "it is an economic activity associated with the production, distribution and consumption of goods and services that leads to the improvement of human well-being in the long term, while at the same time not exposing future generations to significant environmental risks and reducing environmental resource scarcity". [2]. in 2011, UNEP gave a different definition: "a

green economy is a resource-efficient, low-carbon development economy that improves human well-being and social equity while significantly reducing environmental risks and preventing the loss of biodiversity" [8]. UNCTAD (United Nations Conference on Trade and Development) in 2011 provided the following definition: "a green economy is an economy that pursues long-term social benefits in the short term and results in improved human well-being and reduced inequalities without exposing future generations to significant environmental risks and ecological scarcities" [7]. The Coalition for a Green Economy believes that "a green economy is a sustainable economy that provides a better quality of life for all within environmental constraints" [4].

The International Chamber of Commerce describes a green economy as "an economy in which economic growth and environmental responsibility mutually reinforce each other while supporting social development progress" [5]. Most interpretations of the green economy recognize that ecosystems, the economy, human well-being and related types of capital are closely linked. The concept of green economy incorporates ideas from many other areas of economic science and philosophy related to sustainable development issues. Proponents of the green economy concept believe that the current prevailing economic system is flawed. Although it has produced some results in improving the living standards of people in general, and especially of its individual groups, the negative consequences of this system are significant: environmental problems (climate change, desertification, loss of biodiversity), depletion of natural capital, widespread poverty, shortages of fresh water, food, energy, inequality of people and countries. All these pose a threat to present and future generations. The current economic model is referred to as the "brown economy" [9]. There is not yet a broad consensus on what the expression "green economy" means. In the Nusa Dua Declaration, the UNEP Governing Council acknowledged that the term 'green economy' needs further clarification. There is, however, a consensus that a green economy must be seen in the context of sustainable development and consistent with the Rio principles.

Many researchers stressed that there was no one-size-fits-all recipe, but many possible pathways leading to a green economy, or green growth, depending on national circumstances [11]. To reorient the global economy towards an economically, socially and environmentally sustainable growth model, the principles of the green economy must be integrated into ongoing structural reforms. Experts identify four main channels (identifying their respective effects) through which the formation of a green economy and related structural reforms can serve as engines of economic growth, including GDP growth.

First, the transition to a green economy can increase the inputs of natural, physical and human capital (these are input effects). It is about increasing the productivity of natural resources (forests, fisheries, farmland, etc.) through better management of natural capital, about increasing the quality of human capital from improved health and reduced population morbidity due to improved environmental conditions, and finally about reducing economic losses from losses of physical capital due to better management of environmental risks, including forest fires, floods, other natural hazards. Secondly, this transition must be accompanied by favorable structural change, and involves significant investments in a number of systemically important sectors, including energy, construction, housing and utilities, etc., aimed at upgrading production facilities, improving energy efficiency, switching to alternative energy sources and reducing greenhouse gas emissions. All these results are reflected in a broader increase in the efficiency of basic sectors of the economy (efficiency effect). At the same time, thirdly, investments in green infrastructure, including water supply and sewage systems, public transport oriented to alternative fuel sources, etc., are independently singled out as an important growth factor. These structural changes and significant investments can

boost economic growth on both the supply and the demand side, while expanding employment and contributing to a reduction in unemployment (especially significant in times of crisis). These are stimulus effects. Finally, fourth, the transition to a green economy stimulates innovation activity, including at the firm level (usually measured through R&D expenditures and patent activity), which should be supported, along with the creation of a favorable competitive environment, also by regulatory methods, including the introduction of standards and regulations. These are the innovation effects. Fourthly and finally, the transition to a green economy stimulates innovation activity, including at the firm level (usually measured through R&D expenditure and patent activity), which should be supported by regulatory methods, including the introduction of standards and regulations, in addition to the creation of a favorable competitive environment. These are the innovation effects.

Let's consider some ways of forming a green economy in the countries that consider this direction a priority. One of the world leaders is South Korea which has been implementing an ambitious green growth plan since 2008. In 2009, a committee prepared and published the National Green Growth Strategy, a long-term green growth programme until 2050, and five-year plans until 2013, 2018 and 2023 were formed. There were 10 policy areas aimed at achieving these goals and 50 policy programmes also covering these areas. The five-year plans included, among other things, the allocation of 2% of the annual GDP for green growth policies and projects. These five-year plans resulted in the establishment of the Global Green Growth Institute and the hosting of the Green Climate Fund in Songdo. This strategy has also helped stimulate the expansion of smart grids and encouraged Korean companies to develop green technologies. And major South Korean companies such as Samsung and Huynundai are pursuing sustainability policies, becoming "green leaders". The effectiveness of green payments is also worth noting, as a total of 14.35 million green cards have been issued since their launch in 2020, reducing emissions by 1.96 million tonnes of CO₂ [10]. During the recent National Assembly elections, President Moon Jae-in and the ruling Democratic Party of Korea (DPK) supported the implementation of the Green New Deal. "The Green New Deal" is part of the Moon administration's larger "New Deal" package, which includes the "Digital New Deal" and is designed to prepare the South Korean economy for economic growth after the downturn caused by COVID-19. Rather than replacing Lee's green policies, the Moon administration hopes to update them. Under the plan put forward by the DPK in the election, South Korea pledges to achieve zero emissions by 2050 and pass a law to support this goal. It will also stop funding the construction of coal-fired power plants abroad and set a target of reducing fine dust domestically by 40 per cent by 2040. The plan would also establish a training centre to help workers transition to green jobs. In the medium to long term, the plan calls for a carbon tax to fund the Green New Deal.

The US has chosen the development of alternative energy as the main focus of the green economy. In 2009, the American Recovery and Reinvestment Act was passed. Of the \$787 billion economic stimulus programme, \$90 billion has been earmarked for stimulating innovation and growth in green business as well as increasing the number of green jobs. In 2008, the Emergency Economic Stabilization Act was passed, which included \$18.2 billion in tax credits and incentives for the renewable energy sector. In 2012, President B. Obama put forward the Blueprint for an America Built to Last, which envisages getting 80% of electricity from domestic clean energy sources by 2035 by incentivizing producers. The new US president, Joe Biden, has taken a pro-active approach to developing a green economy. In particular, he has promised to ban the use of fracking technology (used in shale oil and gas extraction) on federal lands (we are talking about new, future projects). New nuclear power stations will be built and the market for electric transport will develop. By the way, the government will provide subsidies to customers who give up their gasoline-powered cars and

buy an electric car. Biden's goal is to achieve "zero emissions" in the electricity sector by 2035. Almost all EU countries have green measures for energy, public transport and infrastructure, eco-villages and recycling systems. There are multi-million-dollar subsidies for purchasers of electric cars. The UK has adopted the green economy as its national development strategy, and has announced its green projects, aiming to create 100,000 new jobs. A number of countries have implemented programmes to develop a green economy, minimizing economic and social impact on nature.

In Canada, conservation activities are carried out discretely, in connection with periods of activation of environmental sentiment in the society. Land titling has been established as a mechanism to protect protected areas in the Canadian Arctic. There is a national plan for combating climate change, pursuing green growth, and conserving natural resources [1]. Germany has been actively developing an ambitious environmental policy at national and international level in recent decades. In 2002, the National Sustainable Development Strategy was adopted. Large-scale, complex initiatives in the areas of biodiversity, climate change, etc., have been implemented, which have significantly increased the energy and resource efficiency of the German economy. The United Arab Emirates, for its part, is a leader among the Gulf States in the use of clean technology and alternative energy sources. The long-term Great Green Wall programme in Africa is regarded as a tool for making deserts greener by planting a wide, continuous swath of trees from Senegal to Djibouti. An integrated approach to large-scale land rehabilitation, with the active involvement of local communities, allowed approximately 12,000 ha of degraded land to be greened between 2015 and 2017. The project is expected to significantly enhance landscape diversity and quality of life. The economies of the Eastern Partnership (EaP) countries are characterized by low resource and/or energy productivity and often by the predominance of low value-added sectors. Governments in all EaP countries recognize the need for structural changes to support economic diversification and strengthen high value-added sectors, recognizing that this requires innovation and widespread adoption of modern technologies, hence policy reforms and efforts at the enterprise level. Market signals point to growing support for green economy objectives, especially with regard to energy and water tariffs, but incentives for efficient use of resources remain weak.

In the EaP countries, new national environmental strategies/strategies for sustainable development have recently been improved (particularly in Georgia and Ukraine) or are being finalized (Belarus, Moldova), integrating sustainable consumption and production and green economy concepts. Green economy objectives are integrated into environmental policies and supported by many sectoral strategies. In most EaP countries, green business opportunities are mainly related to energy and organic (or sustainable) agricultural production. Due to energy security concerns, energy efficiency and support for renewable energy are increasingly high on the political agenda of the countries. Clean energy projects are being actively developed in Azerbaijan, Georgia and Moldova. Organic agricultural production is becoming increasingly visible in the income structure of the agricultural sector in Armenia, Moldova and Ukraine [3]. Countries will need special conditions to make the transition to a green economy. These enabling conditions include the states of national economies, domestic and foreign policies, subsidies and incentives, as well as international market and legal infrastructure, trade and technical assistance to developing countries. Currently, the enabling environment is largely created and stimulated by the dominant brown economy, which is overly dependent on fossil fuels, depleting resources and degrading the environment. The Republic of Moldova has an Environmental Strategy for 2014-2023, which is based on environmental reform to ensure the functioning of institutional and administrative system of environmental management, aligned with the requirements of the European Union and ensuring environmental sustainability and improving the quality of environmental factors. As part of this strategy, the principles of

environmental protection, sustainable development, green economic development and adaptation to climate change are being implemented in all sectors of the national economy.

"Green" economy is a long-term development perspective for any state ensuring human welfare and environmental protection in the context of globalized world economy. The economy aims to link the economic, environmental and social aspects of a country's sustainable development, so that long-term economic development is achieved by investing in safe and environmentally friendly technologies and processes. According to the UN Resolution (A/RES/66/288) [6] the green economy must comply with the following

- not contrary to international law;
- take into account the national interests of each country;
- support civil society at all levels, with the government playing a leading role
- promote inclusive economic growth and respect for the rights of all people;
- take into account the needs of developing countries;
- strengthen international cooperation;
- bridge the technological gaps between developed and developing countries;
- enhance human well-being and avoid endangering their cultural heritage;
- address the problems of inequality and promote social inclusion;
- promote sustainable production patterns, etc.

The green economy is becoming a mainstay of many international strategies as a tool to achieve sustainable development. For the Organization for Economic Co-operation and Development (OECD), the green economy has become the answer to major global sustainability challenges. Existing strategies for the implementation of green economy create conditions for sustainable development of society, but at the same time problems remain. There are certain risks to the transition to green economy, which include the following: mutual influence of economic growth and ecology at different stages of development, differences in priorities of national policy of each country, non-uniform policies in economic sectors, etc. One of the risks is technological inequality associated with integration of global green technologies into the national policy of the state. Green technologies are most widespread in the economically developed countries of Western Europe. At the same time, there is an inverse trend - the role of developing countries in implementing clean technology is increasing. In addition, there is another risk - lack of investment, which is shown in limited and unprepared investments from government and business.

In most cases, international investments are catalysts for development of green policies in the national economy. As a result, in world practice, international financial resources are often inaccessible to developing and most poor countries, which does not allow them to ensure sustainable development. Based on the above, we can conclude that despite the early attention to environmental aspects in the economy, the concept of green economy is only evolving. The green economy has certain features, which are manifested in the main elements and characteristics, international provisions and sectoral structure of the economy. The analysis of the main theories and principles of the topic under study has allowed us to identify the key elements of the green economy, among which the environmental aspect is of particular

importance. So, in the nearest ten years the ecological aspect will be introduced in each branch of national economy, reducing carbon emissions and environmental pollution. Another important aspect of transition to green economy should be governmental support at all levels. Only joint elaboration of the new model of economy on the basis of intergovernmental agreements, as well as cooperation between business, public organizations and academia should become a priority objective to achieve sustainable development of national and world economy.

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ORIENTALISM AS A CULTURAL POLICY: ORIENTALIST PRESENTATION OF TURKEY IN COVID-19 NEWS

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ABSTRACT

Orientalism, which is expressed as the depiction of Eastern countries through the eyes of the Western world, appears as a cultural policy. The concept of Orientalism, which includes evaluations according to the criteria of Western culture, is gaining visibility in the media, in the written and visual press news, in the film and TV series sector, in literature and artworks. It is seen that the West made a conscious effort in constructing Orientalism as a cultural policy. The media is used by the West as a strategic tool at this point. The visuals, images, stereotypes, language, and discourse used in the news, especially in Western media, reproduce the Orientalist images that the West reflects and spread worldwide. The constant repetition of Orientalist images attributed to Eastern countries in the media paves the way for dangerous false beliefs and prejudices that are hard to break. This study aims to draw attention to the ongoing Orientalism, including the global pandemic, and to examine Turkey's Orientalist presentation in the news about COVID-19 through current examples. For this purpose, the images and contents used in the news of COVID-19 reflected by the Western media were evaluated in terms of Orientalism. In this study, conducted by qualitative research was followed, the case study method was used. Images and news content that will serve as a rich example of the study subject represent the sample of the research. As result, the Orientalist perspective on Turkey was revealed in the news of COVID-19. Due to the current examples in the research has shown that the Orientalist approach towards Turkey continues, the perception of Turkey in the Western media has not changed and Orientalism continues to exist as a popular cultural policy.

Key Words: Orientalism, Media, Culture, Stereotype, Prejudice

GİRİŞ

Doğu medeniyetini inceleyen ve Batı gözünden Doğu ülkelerinin tasvir edilmesini açıklayan Oryantalizm, günümüzde ideolojik bir kültür politikası olarak işlev görmektedir. Oryantalizmin doğuşu, Doğu ve Batı arasında en başından beri süregelen ideolojik mücadelenin başlangıcına kadar uzanmaktadır. Küresel dünyayı ve uluslararası ilişkileri yönlendiren Oryantalist yaklaşım, arka planda derin bir tarihsel süreç barındırmaktadır. Sunar'a (2007: 29-30) göre Doğu ve Batı kavramları coğrafik bir imleç olmaktan çok daha fazlasını ifade etmekte ve sembol görevi görmektedir. Nitekim Doğu ve Batı'yi belirleyen görünmez sınırlar her daim bir mücadele konusu olagelmiştir. Sınırlar, kültürlerin kendi örüntülerini belirlemekte ve her kültüre kendine has özellikler yüklemektedir. Doğu ve Batı arasındaki bu sınırlar, her şeyden önce iki ayrı kültürün farklılığını belirtmektedir. Bu noktada Corm (2003), Doğu-Batı ayırmasının esasen hayali bir kırılmaya işaret ettiğini dile getirmekte ve bu ayırmının temelinin ideolojik ve kültürel zeminde aranması gerektiğini savunmaktadır. Nitekim Batı kendini Avrupa'nın bile Doğusundan ayırtmakta ve kendine göre Doğulu gördüğü her medeniyeti ötekileştirmektedir. Yerdelen'e (2017: 56) göre Batılı düşünürler de bu ötekileştirmeyi desteklemekte ve Avrupa medeniyetinin yalnızca Batı'ya ait olduğunu ve

Doğu ülkelerinin hiçbir zaman Batı uygarlığının içinde yer alamayacağının altını çizmektedirler. Dolayısıyla dünya barışının önündeki en büyük engellerden biri olan Doğu'nun ötekileştirilmesi bir eğilim olarak emperyalizmin gelişmesiyle ilerleyen zamanlarda da artarak devam etmiştir. Doğu'nun Batı tarafından sürekli ötekileştirilmesi ise Doğu'nun sömürgeleştirilmesinin önünü açmıştır. Sömürgeleştirme, içinde yaşadığımız yüzyılda özellikle küreselleşmenin etkisiyle şekil değiştirip dönüşmüştür ancak ortadan kalkmamıştır. Uluslararası ilişkilere yön veren bilinçli stratejilerle ve hem ideolojik hem de kültürel politikalarla sömürgeleştirme devam etmektedir. Okmeydan (2021: 470), günümüzde Doğu bilimi (Şarkiyatçılık) olarak da bilinen Oryantalizmin, genel bir ifadeyle Doğu ve İslam toplumlarının kültür, dil ve sosyolojik yapılarını inceleyen araştırma alanlarını ifade ettiğini vurgulamakta ve bu açıdan bakıldığından Oryantalizmin akademik disiplin olarak ortayamasına rağmen emperyalizmin gelişmesiyle nesnellikten uzaklaştığına dikkat çekmektedir. Bu noktada Doğu medeniyetlerine yönelik merakın sistematik hale dönüşüp bilimsel şekilde incelenmesiyle ortaya çıkan Oryantalizm, emperyalizmin gelişip siyasi emellere alet olmasıyla yeni sömürgeciliğe hizmet eden bir araç haline gelmiş ve emperyalizmin güç kazanmasında stratejik bir rol üstlenmiştir. Bu açıdan bakıldığından Batı'nın Doğu'yu var olduğu haliyle kavramak, anlamak veya anlatmak niyetinin olmadığını, aksine var olan gerçekler yerine kendi çıkarlarına uygun Doğu ya da Doğulu imajı oluşturduğu söylemeyi bilmektedir. Esasen Batı tarafından bilinçli şekilde oluşturulan ve çeşitli iletişimsel yöntemlerle pekiştirilen Doğu veya Doğulu imajı tamamen Doğu medeniyetlerinin itibarsızlaştırılması üzerine kurulu bir politikadır.

Kim'e (2020) göre Orient (Doğu); Asya'yı, Kuzey Afrika, Arap Yarımadası, İtalya, Türkiye ve Doğu Avrupa'yı belirtmek için kullanılan bir tanımlayıcı olarak halen birey, toplum ve halk/kamu sağlığına ilişkin kültürel algıların ve politikaların temelini oluşturmaktadır. Dolayısıyla Oryantalizm, Batı'nın kültürune göre şekillenen bir öğreti (doktrin) olarak ideolojik boyut taşımakta ve kültürel bir politika olarak temellenmektedir. Batı kendi kültürel ideolojisinden ve uzun bir tarihsel süreç sonucunda oluşan ön yargılardan hareketle Doğu'ya yönelik saldırısını meşrulaştırmak için özellikle medyadan yararlanmaktadır. Batı, tekelindeki medya sektörü aracılığıyla Doğu'yu kendi istediği şekilde sunmakta ve kendi gözünü ve perspektifini tüm dünyaya egemen kılmaya çalışmaktadır. Oryantalist bakış açısı ile Doğu'yu istediği şekilde büründürüp medya üzerinden tüm dünyanın Doğu'yu tektipleştirip ötekileştirmesine hizmet etmektedir. Bu çalışmada Oryantalizm ideolojik bir kültür politikası olarak ele alınmış ve Batı tarafından Türkiye'ye yönelik geliştirilen Oryantalist tutumun COVID-19 pandemisinde haberlere nasıl yansığının güncel örnekler üzerinden aktarılması amaçlanmıştır. Böylelikle pandemi sürecinde Türkiye'nin Batı medyasındaki Oryantalist sunumunun açığa çıkarılması amaçlanmıştır. Bu amaç doğrultusunda örnek olay yöntemi izlenmiş ve pandeminin başından itibaren Batı medyasında yer bulan Oryantalizm içerikli Türkiye haberlerinin her biri birer örnek olay kategorisinde değerlendirilmiştir. Batı medyasından tüm dünyaya servis edilen haberlerde Türkiye'ye yönelik kullanılan dil ve söylem ile haber içeriklerini tanımlayan görseller, Oryantalist perspektiften incelenip betimlenmiştir. Literatür taramasından yola çıkan ve örnek olay yönteminde hareket eden bu çalışma, COVID-19 pandemisinde Batı medyasındaki haber içeriklerinde Oryantalist yaklaşımı güncel örneklerle ortaya koymayı hedeflediğinden alanyazına katkı sağlama noktasında önemli görülmekte ve bu nedenle özgün bir değer taşımaktadır. Konuya kuramsal temel oluşturabilmek için öncelikle Oryantalizme yönelik genel bilgiler aktarılacak ve Oryantalizm ideolojik ve kültürel bir politika unsuru olarak ele alınacaktır. Kuramsal çerçeveyenin ardından pandemi sürecinde Türkiye'nin Batı medyasındaki Oryantalist temsilini açığa çikaran güncel örnekler incelenip değerlendirilecektir.

KÜLTÜREL POLİTİKA OLARAK ORYANTALİZM

Oryantalizmin ilk kez ne zaman ortaya çıktığına yönelik halen görüş birliğine varılamamış olsa da 1312 yılında Viyana Konsülü'nün toplanarak Batı üniversitelerinde Arap Dili kursuerlerinin kurulmasına yönelik kararın çıkışmasına kadar uzandığı ve özellikle Vasco de Gama'nın 1498'de Ümit Burnu'ndan Asya'yı keşfetmesine dayandığı ileri sürülebilmektedir (Turner, 2003: 68). Bu gelişmelerle Oryantalizmin doğuşu hızlanmış, 16. yüzyıldan itibaren Doğu ve Batı arasında ekonomik ve siyasi ilişkilerin gelişmesiyle Doğu'ya seyahat eden gezginlerin (seyyah) artmasının yanı sıra 17. ve 18. yüzyılda Avrupa'da yaşanan aydınlanma ve akılcılık hareketine istinaden Avrupa'nın ötesindeki yeni dünyaları ve yaşamları keşfetme arzusu da Oryantalizmin gelişmesine hizmet etmiştir (Köse ve Küçük, 2015: 112-113). Bu noktada Oryantalizmin, 1704 ile 1717 yıllarından itibaren özellikle Binbir Gece Masalları'nın basılmasıyla başladığı kabul edilmekte ve Doğu'ya seyahat eden Avrupalı/Batılı erkeklerin Doğu'yu keşfetmeleri ve hayal etmeleriyle gelişen Oryantalist yaklaşımın sonucunda Doğu uygarlığının edebiyata, resme ve müziğe konu olmasıyla Doğu hakkında Batı'da kolektif bilinç oluştugu dile getirilmektedir (Taşar, 2011: 154). Bu görüşlere göre Oryantalizm, özellikle 18. ve 19. yüzyıl arasında biçimlenmiş ve çoğu zaman olumsuz anlamlar cağırtıracak şekilde kullanılan ve Batılı araştırmacıların Doğu medeniyetlerini betimlemeye yönelik çalışmaları simgelemek için geliştirilmiş bir kavramı ve yaklaşımı ifade etmektedir (Dikici, 2014: 46). Oryantalizmin içeriği esasen Batı'nın kendi konumunu inşa etmek, güçlendirmek ve meşru kılmak için kendi karşısına konumlandığı ve Batı'nın dışında gördüğü Doğu toplumlarını dışlayıp ötekileştirdiği ideolojik ve kültürel politikalara dayanmaktadır.

Coşkun'a (2019: 216) göre Batı politikası haline gelen Oryantalist yaklaşım, 19. yüzyılın ortalarında edebiyat, müzik, opera, tiyatro ve mimari gibi birçok alana yayılan ve çeşitlenen sanat stilini ifade etmek için kullanılmış ve sonrasında ise günümüzdeki anlamına istinaden Doğu toplumlarının yaşantisını ve bütünüyle Doğu medeniyeti ile ilgili araştırmaları kapsayacak şekilde genişlemiştir.

Edebiyat profesörü Edward Said ise Oryantalizmi sistematik ve bilimsel bir incelemeye tabi tutan isim olarak öne çıkmıştır. Said; Batı'nın, Doğu'yu kendi görüşleri ve varsayımları ile değerlendirdiğini gündelik yaşamdan örneklerle açıkladığı 'Oryantalizm' (1998) isimli eserinde Batı'nın, Doğu'yu yalnızca kendi çıkarlarına hizmet edecek şekilde tasvir ettiğini ve bu nedenle Doğu medeniyetlerini çoğu zaman sahte ve abartılmış imajlara hapsettiğini dile getirmektedir. Yerlikaya (2015: 9), Oryantalizmin Doğu ve esasen İslam dünyasına yönelik yerleşik algı ve ön kabulleri temele alan bir bakış açısı sunduğunu savunmakta ve bu bakış açısından uzantısı olarak Doğu coğrafyasının yüzyıllardır Batı tarafından inceleme nesnesi olduğunu vurgulayarak Doğu'nun var olan gerçeklik ile değil Batı'nın zihninde üretilen tipolojilerle açıkladığını belirtmektedir. Bu sayede gerçek olan hikayat ile ön kabuller ve kalıplaşan algılar arasındaki sınır giderek muğlaklaşmakta ve Doğu ile Batı ayrimı diyalektik şekilde ele alınmaktadır. Tekeli'ye (1998: 87) göre Doğu ve Batı arasındaki ayrim, 'biz' ve 'öteki' kavramlarını yaratmış, bu düüalist görüş doğrultusunda grup bilinci geliştirilmiş ve bir gruba mensup üyelerin, diğer grup üyelerine yönelik ortak ön kabulleri ise kalıp yargılara dönüşmüştür. 'Biz' kavramı üstünlük ile eşleştirilirken dışlamaya içkin 'öteki' kavramına ise alçaklık ve aşağılama gibi çeşitli olumsuzluklar atfedilmektedir. Kendi üstünlüğe inanan 'biz' grupları, aşağılayıp alçaltılan ve dışlanan 'öteki' olarak gördüğü grupları edilgen, pasif, yönetilmeye muhtaç ve tamamen akıl dışı olmakla itham etmektedir (Bilici, 2011: 4-8). Ötekiler üzerinde denetleyici erke sahip olan gruplar, aynı zamanda meşruiyet elde edebilmek için kendi hayal gücünü, düşlerini vefantazyalarını imgeler ve sözcüklerle birleştirip Doğu algısı inşa etmektedir.

Batı temsilcilerinin hayal gücüne dayalı Oryantalizm kalıplar, Batı'nın tekelinde görülen özellikle film ve medya endüstrisi başta olmak üzere sanat, bilim, siyaset ve habercilik gibi pek çok alanda etkisini hissettirmektedir. Klasik Oryantalizm olarak adlandırılan bu süreç, günümüzde yerini yeni Oryantalizme (Neo-Oryantalizm) bırakmıştır. Taşçı (2006: 163), Batı tarafından işgal edilen Müslüman ülkelerin yer altı ve yer üstü kaynaklarından yararlanmak ve bölgeyi kontrol altına alabilmek için sömürgeciliğe dayalı siyasal ilişkilerin oryantalizmle sıkı bağına işaret etmekte ve yeni Oryantalizmin siyasal ideolojilerin ve kültürel politikaların ürünü olduğuna dikkat çekmektedir. Behdad ve Williams'a (2010: 284) göre içinde yaşadığımız yüzyılda özellikle Orta Doğu ve Arap ülkeleri başta olmak üzere Müslüman ve Kuzey Afrika ülkelerine yoğunlaşan ve Batı'yı merkeze alarak Doğu medeniyetleri üzerinde siyasi, ahlaki, ekonomik ve kültürel üstünlüğüne dayanan yeni Oryantalizm, Doğu medeniyetlerini tarif edebilmek için kullanılagelmektedir. Bununla birlikte Tuastad (2010) ise yeni Oryantalizmi, esasen Oryantalizmin popüler ve daha görünür hale gelmesi olarak ifade etmekte ve inceleme nesnesi olarak Doğu'yı sahte algılarla yeniden üretmek için yaygın ve hızlı medya ortamlarına, bilişim teknolojilerine, internete, sinemaya ve modaya ihtiyaç duyduğunu dile getirmektedir. Oryantalizm çerçeveden Doğu'yı tanımlayan Batı, aslında kendi bilincini ifade etmekte ve kendini konumlandırmak için Doğu'ya ihtiyaç duymaktadır. Bulut'a (2004: 9) göre Batı, kendi kimliğini tanımlamak ve kendi varlığına ve politikalarına meşruiyet kazandırmak için Doğu'ya muhtaçtır, öyle ki Doğu yoksa Batı da var olamaz ve bu nedenle Doğu, Batı'nın en mükemmel ötekisi olarak konumlandırmaktadır. Dolayısıyla Oryantalizm, öncelikle ideolojik bir yaklaşımı ve ideolojilerden beslenen kültürel politikalara ait bakış açısını ifade etmektedir. Bu nedenle Batı, Doğu'ya karşı ideolojik ve kültürel saldırılara meşru zemin hazırlayabilmek için Oryantalizmi bilinçli şekilde kullanmaktadır.

Dahası Batı, internet sayesinde tüm dünyada popüler bir temsil biçimine dönüsen ve Doğu'ya atfedilen olumsuz imajları ve çağrımları bilişim teknolojilerindeki gelişmelerle tüm dünyaya yaymaktadır.

Oryantalizm yaklaşımında Batı için önemli olan nokta, Doğu medeniyetlerinin ve bu medeniyetlere dair her konunun Batı açısından algılanıp anlamlanması ve Batı gözünden aktarılmasıdır. Uluç ve Soydan'a (2007: 37) göre Batı'nın baktığı Oryantalizm penceresinden Doğu her zaman tek şekilde algılanmakta ve anlatılmaktadır.

Bu nedenle Batı'nın pis, rasyonel olmayan, pasif, kendini bile yönetemeyen, yönetilmeye muhtaç, hayalperest ve cahil Doğu algısı, Batı'nın ideolojik indirgemeciliği ile şekillenmiş bir ideoloji ve kültürel politika olarak sanattan bilime kadar her yere sırayet etmiştir. Söz konusu indirgemeci yaklaşım, kalıp düşünceler olarak da ifade edilen stereotipler aracılığıyla yaygın kazanmakta ve belleklere kazınmaktadır. Özellikle medya aracılığıyla yayılan algılar ve ötekileştirme, çoğunlukla stereotiplere dayanmaktadır. "Oryantalizmin temelinde bulunan 'biz' ve 'öteki' ayrıımı stereotiplerin özünü oluşturmaktadır. Dolayısıyla medyada üretilen çeşitli stereotipler, Oryantalizm yaklaşımı inşa etmekte ve yeniden üretilmektedir. Zira medya, stereotipleşen resimleri ve görüntüleri zihinlere kazıyan etkili bir araçtır" (Okmeydan, 2021: 458). Herhangi bir algının yerleşmesinde medyaya yansyan ve hafızalara kazınan stereotipler önemli bir rol oynamaktadır. Örneğin, filmlerdeki Müslüman erkekler, tipik olarak başında 'takke' ve elinde 'tespih' ile gösterilmekte veya karikatürlerde bu şekilde standartlaştırılarak resmedilmektedir (Okmeydan, 2019: 104). Stereotipleştirme ile bir kültürün tüm üyelerine istisna gözetmeksiz toptancı bir yaklaşım benimsenmektedir.

Stereotiplerin medya aracılığıyla süreklilik kazanması ve giderek tek gerçeklik haline gelmesi ön yargılara oluşumunu hızlandırmaktadır. Günlük hayatı farkında olmadan kararlarımıza ve seçimlerimizi yönlendiren düşünsel süreçler stereotip (kalıp yargı) olarak

adlandırılmakta; bu kalıp yargıların sonucunda ortaya çıkan tutum ve davranışlar ise ön yargı olarak ifade edilmektedir. Bu doğrultuda tutumun bilişsel (düşünsel) boyutunu stereotipler, tutumun duygusal ve davranışsal boyutunu ise ön yargılar oluşturmaktadır (Harding vd., 1969; İlhan ve Çevik, 2013; Kağıtçıbaşı, 2010; Secord ve Backman, 1974). Stereotipler ve ön yargılar, bir milletin veya bir ırkın diğerlerine bakış açılarına etki etmekte ve diğerlerini kendilerinden ayırip ötekileştirmeye yol açan etmenlere dönüşmektedir. Bunun sonucunda ortaya çıkan etnomerkezcilik ise bir kişinin kendi ait olduğu grubu veya kültürü merkez olarak diğerlerinden üstün görmesi ve diğerlerini buna göre konumlandırmasıdır. Böylece kişi, kendi grubu dışında olan ancak kendi grubuna en çok benzeyen kültürleri en yakına ve aradaki farklılıkların düzeyine göre diğer kültürleri kendinden uzağa ve en uzağa olmak üzere derecelendirmektedir (Mora, 2008: 210). Oryantalizm, Doğu ve Batı arasındaki ayrımı dayandığından ve Batı'nın Doğu karşısındaki üstünlüğünden doğan bu farkı en başından kabul ettiğinden özü itibariyle etnomerkezciliği beslemektedir. Uluç'a (2009: 95) göre etnomerkezcilik (etnosantrizm), günümüzde 'yeni ırkçılık' olarak görülmekte ve kültürler ile kimlikler arasına konulan mesafe ve farklılık, üçüncü dünya olarak Doğu'nun yani Türkluğun, İslam'ın ve Araplığın Batı'yı ve Batılılığı temsil eden Avrupa'ya uymadığı düşüncesini geliştirmektedir. Etnomerkezci tutum ise özellikle medyada görünürülük kazanmakta ve Batı tarafından Doğu'nun dışlanması, ötekileştirilmesine, aşağılanması ve çarpıtılmasına zemin hazırlamaktadır. Batı'nın bu tutumu Doğu toplumları tarafından hoş karşılanması ve zaman zaman eleştirel sesler çıksa da yine medya tekeline sahip Batı tarafından bu eleştirel sesler gündeme getirilmemektedir. Oryantalizmde ötekileştirilen milletlerin veya kültürlerin nasıl algılandığı, günümüzde çoğu zaman mevcut gerçekliğin ve hakikatın önüne geçmektedir.

Batı tarafından Doğu bir ülke olarak görülen ve ötekileştirilen Türkiye de Oryantalizm sınırları içeresine hapsedilmekte ve diğer Doğu ülkelerine yapıldığı gibi Türkiye için de Batı tarafından çoğunlukla gerçeği yansıtmayan, uydurulan veya abartılan imajlar ve algılar yaratılmakta ve bunlar, bilişim teknolojilerinin gücüyle tüm dünyaya aktarılmaktadır. Batı'nın Türkiye'yi geri kalmış ve antidemokratik bir İslam ülkesi olarak dünyaya anlatma çabası ve Türkleri stereotipleştirmesi Türk kamuoyunda tepkilere neden olmaktadır. Bu durum özellikle medya haberlerinde görünürülük kazanmakta ve ortaya çıkan gerilim, uluslararası ilişkilerin ve Batı ile diplomatik temasların zarar görmesi ile sonuçlanmaktadır. Batı'nın Türkiye'ye yönelik Oryantalist tutumu, COVID-19 pandemisinde dünya kamuoyuna yansıyan haberlerde de kendini göstermekte ve Oryantalizmin hız kesmeden devam ettiğinin bir göstergesi olarak kabul edilmektedir.

COVID-19 HABERLERİİNDE TÜRKİYE'NİN ORYANTALİST SUNUMUNA YÖNELİK GÜNCEL ÖRNEKLER

Dünya Sağlık Örgütü (DSÖ) tarafından 11 Mart 2020'de pandemi olarak kabul edilen yeni koronavirüs (COVID-19) salgını; sağlık, ekonomi, eğitim, sosyoloji, psikoloji ve iletişim gibi yaşamın içinde olan alanlara çok boyutlu etkiler getirmiştir. Bilimsel çalışmaların odağına yerleşen COVID-19 pandemisinde bir yandan toplumsal sağlık açısından virüsle nasıl mücadele edilmesi gereğine yönelik kapsamlı stratejiler geliştirilirken (Okmeydan, 2021: 331-332) öte yandan dünya medyasında geniş yankı uyandıran haberler ile bu haberlerde kullanılan söylemler ve görseller çeşitli tartışmalara konu olmuştur. Söz konusu tartışmaların başında ise Batı medyasına yansıyan haber içeriklerinin ve görsellerinin Oryantalizm ekseninde üretildiği eleştirileri gelmiştir. "Salgının Batı ülkelerine ulaşmasıyla birlikte Çin ve Çinli düşmanlığının (Sinofobi) hızla arttığı görülmüş, eski ABD Başkanı D. Trump sosyal medya hesaplarındaki iletisimlerinde ve konuşmalarında Koronavirüs demek yerine 'Çin Virüsü' ve Çin kökenli olan Kung Fu dövüş sanatından esinlenerek Kung Flu (Kung Gribi) ifadesini kullanmıştır. Ayrıca göçmenlerin ABD'ye hastalık taşıdığını belirten Trump, göçmenlerin

yoğun olarak geldiği Afrika ülkeleri için de ‘pislik deliği ülkeler’ (shithole countries) diyerek bu süreçte Oryantalist bir bakış açısından hareket etmiştir” (Aydın, 2020; Banerjee vd., 2020: 104). Böylece Oryantalizm, medyada yer alan söylemlere ve haber içeriklerine yansıarak gündelik yaşam içerisinde girmiştir ve kolektif bilinçte yer etmiştir.

Bunun yanı sıra dünyyanın onde gelen dergileri ve gazetelerinde de benzer Oryantalist yaklaşımlar izlenmiştir. Örneğin, Almanya'nın en ünlü dergisi Der Spiegel'de virüs 'Çin Yapımı' (Made in China) olarak tanımlanırken İngiliz Daily Mail ve The Sun ise Çin'de yarasa gibi çeşitli hayvanlar yendiği için bu virüsün insanlara bulaştığını haberleştirerek Çin'i suçlayıcı ve ötekileştirici bir dil geliştirmiştir. Washington Times ise Çin'in siyasi rakiplerine zarar vermek amacıyla virüsü biyolojik bir silah olarak laboratuvara ürettiğini iddia etmiştir. COVID-19'un pandemiye dönüşeceğini öngören çeşitli siyasi ve kültürel haberlerde ise Asyalılar veya Doğulular, 'öteki' olarak vurgulanmış ve nefret söylemi ile hedef gösterilmiştir" (Chan ve Strabucchi, 2020; Garret, 2020; Roche, 2020). Bu nedenle COVID-19 pandemisi sadece sağlıkla ilgili bir olgu olmaktan çıkmış ve Oryantalizme kadar uzanan geniş psikososyal ve kültürel etkileri olan bir nitelik kazanmıştır.

COVID-19 süreci sadece bir virüs salgınına değil, virüse dayalı yeni Oryantalizme de sahne olmaktadır. Özellikle günümüzdeki yeni Oryantalizmin medyadaki temsiller ile tüm dünyaya yansığı görülmektedir. "Batı medyasına yansyan bir haberde konu Türkiye olduğunda Batı'nın ön yargılı ve taraflı haber içerikleri karşımıza çıkmaktadır.

Batı medyasının Türkiye için geliştirdiği haber içerikleri, haber dili ve söylemi ile haberlerde kullandığı görsellerin, geçmişten gelen Osmanlı korkusunun ve İslam dinine yönelik İslamofobiye dayalı Oryantalist yaklaşımdan türediği dikkat çekmektedir" (Yerlikaya, 2015: 12). Bu yaklaşımın COVID-19 pandemisinde de geçerliliğini koruduğu gözlemlenmektedir.

Batı, sahip olduğu ve tekeline aldığı güçlü medya ve sinema endüstrisi ile Türkiye'yi de Oryantalist bakış açısından geri kalmış bir Orta Doğu ülkesi olarak konumlandırip tasvir etme çabasına girmektedir. Bu nedenle Batı medyası özellikle filmlerde veya haberlerde Türkiye'nin sosyo-ekonomik düzeyi en düşük semtlerini, stereotipleştirilmiş kadın ve erkek görüntülerini, Oryantalist figür olarak kadraja yerleştirilen eski yıpranmış tarihi yapılarını ve İslamofobiyi canlı tutacak şekilde camilerini kurgulayarak tüm dünyaya servis etmektedir. Böylece dünyaya bir Doğu ülkesi olarak tüm Türkiye'nin bundan ibaret olduğu mesajı verilmeye çalışılmaktadır. Oysa Batı medyası tarafından yansıtılan Türkiye görselleri çoğu zaman gerçek bağlamından koparılmış kurgu görüntülerden ibarettir ve gerçeğin abartılmış ya da çarpılmış halini sunmaktadır. "Zira Türkiye; modern kentleri, metropol kent merkezlerindeki hareketli gece hayatı, ödüllü plajları ve turistik mekâlarının yanı sıra cazibe merkezi olarak öne çıkan tarihi alanları ile daha farklı görüntülerle eşleştirilme potansiyeline sahip bir ülkedir" (Okmeydan, 2021: 447).

Ancak Batı gözünden Türkiye'nin COVID-19 sürecinde de her zaman olduğu gibi Oryantalist politikalarla ötekileştirildiği görülmektedir. Görsel 1, Türkiye'nin ötekileştirilmesine örnektir.

Görsel 1. The New York Times Gazetesinde Türkiye'nin Oryantalist Sunumu



Kaynak: The New York Times, 2020.

Görsel 1'de, The New York Times Gazetesindeki COVID-19 ile ilgili bir haberde eski ABD Başkanı Trump'ın söyleminin Türkiye ile ilgili olmamasına rağmen haberde Türkiye'ye ait bir fotoğrafın kullanıldığı izlenmektedir. Fotoğrafta görülen Türk bayrağı, görüntünün Türkiye'ye ait olduğuna işaret etmektedir. "Trump, Avrupa'dan Seyahatleri 30 Gün Askıya Aldı" başlığıyla sunulan haberde kullanılan görselin başlıklı ilgili olmadığı izlenmektedir. 13 Mart 2020 tarihinde COVID-19 sürecinde seyahat kısıtlamaları ile ilgili verilen haberde Türkiye'nin seyahat kısıtlaması getirilen ülkeler arasında olmamasına rağmen Türkiye'den bir caminin kadraya yerleştirildiği fotoğraf kullanıldığı görülmektedir.

Caminin önünden geçen ikisi erkek ve biri kadın olmak üzere toplam 3 kişinin, Türkiye için çizilen stereotiplerle uyumlu olduğu gözlemlenmektedir. Ayrıca cami görselinin önünden geçen fotoğraflanan erkek vatandaşlardan birinin yüzünde maske olmadığı anlaşılmaktadır. The New York Times Gazetesinden yapılan açıklamada ise İstanbul fotoğrafının karışıklık sonucu kullanıldığına deðinilerek bu karışıklığın fark edilmesiyle fotoğrafın hemen haberden kaldırıldığı bilgisi paylaþılmıştır (Independent, 2020). Söz konusu görselde Türkiye'nin Oryantalizm yaklaşımından hareketle ötekileştirildiği ve ötekileştirilmeye uygun şekilde temsil edildiği söylenebilmektedir. Spivak, Batı'nın kendini özneleştirip Doğu'yu nesneleştirmesini 'epistemolojik şiddet' olarak isimlendirmekte ve Doğu'nun Batı'nın da Doğu için 'öteki' statüsünde yer aldığı görüşe uygun politikalarla konu edildiðini dile getirmektedir (Ersöz ve Uslu, 2005: 70-71). Bu doğrultuda Görsel 1'deki fotoğraf, COVID-19 sürecinde Türkiye'nin Oryantalist sunumuna bir örnek olarak karşımıza çıkmaktadır.

Görsel 2. BBC News ve Türkiye'nin Oryantalist Sunumu



Kaynak: BBC News, 2020.

Görsel 2'de de ilk görsele benzer bir örnek görülmektedir. BBC News'in aktardığı haberde "ABD seyahat yasağı, İtalya mağazalarının kapanması ve daha fazlası" başlık olarak kullanılmıştır. Başlıkta ve içerikte Türkiye ile ilgili haber olmamasına rağmen Türkiye'deki bir caminin dezenfekte edildiği görüntüsünden bir kare haber görseli olarak paylaşılmıştır. Oryantalist yaklaşım, Müslümanlığı ve İslam dinini ötekileştirirken İslamofobinin güçlenmesine yol açmaktadır. "İslamiyete ve Müslümanlara karşı duyulan ön yargıya ve ayrımcılığa dayalı korkuyu ifade eden İslamofobinin gelişmesinde özellikle Batı medyası aktif rol oynamaktadır. Batı'nın Doğu'yu kategorilendirme süreci olan Oryantalist bakış açısından Batı'nın, İslam dinini tehdit olarak görüp algılaması ve Oryantalist söylemle İslamiyeti ve Müslümanları tasvir etme süreci İslamofobinin yaygın kazanmasında etkili olmaktadır" (Temel, 2019: 94-95). Benzer şekilde Behdad (2007), Batı nezdinde Doğu'nun tüm kötülüklerin kaynağı olarak görüldüğüne ve evrensel yaşam pratikleri için kendini üst akıl olarak konumlandıran Batı'nın yegâne gayesinin Doğu'yu her açıdan tahakküm altına almak olduğuna dikkat çekmektedir. Bu görüşler doğrultusunda ilgili görselde virüsün geri kalmış Doğu ülkelerinden yayıldığı ve İslamiyetin ve Müslümanlığın temsilcisi camilerin ise virüsün yayılmasında bir tehdit unsuru olduğu bilinçaltına işlenmektedir.

Görsel 3. ABC News & Reuters ve Türkiye'nin Oryantalist Sunumu



Kaynak: ABC News, 2021; Reuters, 2021.

Görsel 3, ABC ve Reuters haber ajanslarının COVID-19 sürecinde Türkiye ile ilgili haber başlıklarının ve görsellerinin birleştirilmesinden meydana gelmiştir. Soldaki (ABC News) haber karesinde "Türkiye, vaka sayıları dünyanın dördüncü en yüksek seviyesine ulaştığı için tam COVID kısıtlamasına giriyor" başlığı izlenmiştir. Başlık için kullanılan görselde semt pazarından bir fotoğraf karesi görülmekte ancak haber başlığında Türkiye adı geçmese ülkenin klasik bir Orta Doğu ülkesi ile karışabileceği anlaşılmaktadır. Oryantalist ideoloji; pis, dar ve karmaşık sokaklar, sokaklarda dolaşan vatandaşlar ve bu vatandaşlara atfedilen stereotiplere uygun görüntüler, açıkta satılan ve hijyenden uzak yiyecekler (Okmeydan, 2021: 459) ile kendini her defasında yeniden inşa etmektedir. Sağdaki karedeki (Reuters) haber ise "Türkiye son 24 saatte 59.187 yeni koronavirüs vakası ile tüm zamanların en yüksek seviyesini kaydetti" başlığıyla sunulmuştur. Yine soldaki kareyle benzer olarak fotoğrafa yansyan Türkçe tabelalar, yazılar ve Türk bayrağı olmasa ya da başlıkta Türkiye adı geçmese bu görüntü de tipik bir Orta Doğu ülkesini çağrıştırmaktadır. Her iki haberde de salgının kontrol altına alınamadığına ve artan vaka sayılarına yönelik haber içeriğinin korku söylemi ile üretildiği ve Oryantalizm ekseninde Batı'nın, Müslüman Doğu ülkesi olarak görüp yarmak istediği Türkiye imajına uygun inşa edilen stereotipleşen görüntülerle aktarıldığı görülmüştür. Said'in (1998: 25) Oryantalizm eserinde belirttiği gibi Batı'nın akılcılığına ve sürekli mantık yürütmesine zıt şekilde Doğulu mantıksız, cahil ve inisiyatiften yoksun ve sokakta yürümekten bile aciz şekilde tanımlanmaktadır. Görseldeki karelerin bu görüşe uygun

olduğu saptanmıştır. Zira her iki haber karesinde de sokakta dolaşan veya pazardan alışveriş yapan insanların sosyal mesafe gözetmedikleri, kendilerini virüsten koruyamadıkları ve bu nedenle Orta Doğu ülkesi olarak görülen ve ötekileştirilen Türkiye'nin virüsle mücadele etmede başarısız olduğuna dair ön yargılara pekiştirilmiştir.

Görsel 4. Reuters ve Türkiye'nin Oryantalist Sunumu



Kaynak: Reuters Resmi Twitter Hesabı, 2021.

Görsel 4, Reuters haber ajansının resmî Twitter hesabından COVID-19 kısıtlamalarının kaldırılacağına yönelik haberleri temsil etmektedir. Bu haberlerde aynı başlık kullanılsa da haber içerikleri için seçilen görsellerin tamamen Oryantalist düşünceye uygun olması dikkat çekmiştir.

Nitekim haber ajansı tarafından Avrupa ülkeleri ve Türkiye için tercih edilen fotoğraflar birbirinden taban tabana zıtlık göstermiş ve Türkiye'nin Batı gözünden ötekileştirilmesi açık şekilde resmedilmiştir. Haberlerde "Finlandiya, İrlanda, İngiltere ve Türkiye'nin COVID kısıtlamalarını daha da hafifleteceği" başlığı kullanılmıştır. Ancak habere konu edilen Finlandiya, İrlanda ve İngiltere için bu haberi destekleyen görsel seçimi, bu ülkelerin en güzel mekânlarından veya bu ülkeleri temsil eden yapıların ve yaşam tarzlarının görüntülerinden oluşmuştur. Avrupa ülkelerinin fotoğraflarına bakıldığından Finlandiya'da barda buluşan ve içki içen üç erkek vatandaşın, İrlanda'da çocuğuyla parkta gezen bir annenin, İngiltere'de ise yüksek bir tepeden güzel bir manzaraya bakan gençlerin konu edildiği görülmüştür. Oysa aynı haber başlığı Türkiye söz konusu olunca sosyo-ekonomik düzeyi düşük vatandaşların yaşadığı belli olan dar bir ara sokakta geçimini sağlamak için çöp toplayan bir kişinin fotoğrafıyla sunulmuştur. Sağ alttaki kareye ait olan fotoğraf, Türkiye'deki kısıtlamaların hafifletileceğine yönelik haber içeriği bağlamından kopuktur. Ancak bu durum, Oryantalizm ideolojisinin Batı medyasındaki yansımاسını göstermesi açısından önem taşımaktadır. Bu noktada Kaya (2017: 649), Batı'nın Doğu üzerindeki tahakküm arzusunun ve ötekileştirmeye yönelen ideolojik tavrinin; Doğu ülkelerini ve Doğuluları aşağılayan, ezen, köleleştirten ve dışlayan eylemlerle birlikte günlük yaşamın hemen her alanında ve anında görmenin mümkün olduğunu hatırlatmaktadır. Söz konusu haberin, bu görüşe uygun görsellerle ve Oryantalist yaklaşımla üretildiği görülmektedir.

SONUÇ

Batı, kendini konumlandırmak amacıyla ötekileştirdiği ve Doğu olarak gördüğü ülkelere karşı yüzyıllardan beri Oryantalist politikalar geliştirmekte ve bu ideolojik politikaları bilinçli şekilde uygulamaktadır. Batı'nın Oryantalizm çerçevesinde sosyolojik, psikolojik, ahlaki, kültürel ve ideolojik ötekileştirmesinin arasında emperyalist amaçları yer almaktadır. Günümüzde emperyalizm ve sömürgecilik kılık değiştirmiş durumdadır. Dönüşen ve çağ'a uygun hal alan emperyalizm ve sömürgecilik sonucunda Doğu ülkelерinin tarih, din, dil ve toplumsal yaşam açısından ayrıntılı şekilde incelenmesi yoluyla Doğu üzerinde tahakküm kurmanın bir aracı olarak Oryantalizm de gelişmiş ve hız kazanmıştır. Oryantalizm sayesinde Batı, Doğu'ya karşı girdiği her türlü emperyalist saldırısını meşrulaştırmaktadır. Bu noktada Batı'nın elindeki en büyük koz, sahip olduğu güçlü sinema ve medya endüstrisidir. Nitekim Batı, tekelinde tuttuğu bu iki gelişmiş endüstri aracılığıyla Doğu'yu istediği gibi resmedip Oryantalizme uygun stereotiplerle tüm dünyaya servis etmektedir. Bilinçli stratejilerle ötekileştirilen Doğu ve Doğular ise Batı'nın tahakkümü karşısında kendini yeterince ifade edememekte, çoğu zaman kendisine yöneltilen ve pekiştirilen ön yargılara teslim olmaktadır. Bu süreçte Batı, Doğu'nun kendisini olduğu gibi ifade etmesine izin vermemekte ve Doğu üzerindeki egemenliğini sürekli kılmak için Doğu'nun sesini kısmakta, mevcut gerçekleri çarpmakta ve Doğu'yu kendi inşa ettiği kalıplara hapsetmektedir.

Doğu ve Batı arasındaki farklılıklara dayalı gelişen Oryantalizm sonucunda Türkiye'nin de Batı tarafından İslam dinine ve Müslüman kimliğe sahip olduğundan Batı'nın kendi grubuna uzak ve marjinal bir Doğu ülke olarak konumlandırılmasına yol açtığı görülmektedir. Türkiye'ye yönelik Oryantalist yaklaşımın, COVID-19 pandemisinde medyaya yansyan haber içeriklerinde ve görsellerinde de devam ettiği anlaşılmaktadır. Bu çalışmada yer verilen ve incelenen dört görselde, pandemi sürecinde Türkiye'nin Batı medyasında yine Oryantalist bakış açısıyla ve kendisine biçilen stereotiplere uygun şekilde yer aldığı gözlemlenmektedir. Çalışma kapsamında incelenen görsellerde Batı'nın kendi içinde birlik olduğu ve 'biz' grubunda yer alan, kendine yakın gördüğü diğer ülkeleri yükseltmeye ve Doğu karşısında üstünlük kurmaya çalıştığı görülmektedir.

Buna karşın Batı, Oryantalizm ekseninde Doğu olarak gördüğü ülkelere ideolojik tavrını devam ettirmekte ve medya aracılığıyla Müslüman Doğu ülkesi stereotipine uygun konumlandırdığı Türkiye'yi dışlayıp ötekileştirerek tüm dünyaya kendi gözünden yansıtmaktadır. Ancak Batı medyasından dünyaya yansyan görüntülerde Türkiye, kendi gerçekleri yerine genellikle abartılan ve çarptılan görsellerle temsil edilmektedir. Çalışmada yer verilen haberlerde ve görsellerde Batı medyasının Türkiye'yi Doğu ülkesi olarak görüp dışladığı ve çoğu zaman İslamofobi düzeyinde düşmanlaştırarak ötekileştirdiği göze çarpmakta ve Oryantalist yaklaşımın pandemi sürecinde de aşılamadığı ortaya çıkmaktadır.

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THE ROLE OF CULTURE IN THE SELF-OTHER/UNIVERSAL-LOCAL RELATIONSHIP OF GLOBALIZATION AND EGALITARIAN GLOBALIZATION

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ABSTRACT

In the global age, where space and time are becoming more and more accessible and communication opportunities are increasing, identities should have also met in a relationship in which they will not marginalize each other. However, the relationship between the “self” and the “other” on the one hand, and the “universal” and the “local” on the other, is representative of the contradictions of the global age. This paper takes the cultural conflict between “self-other”/“universal-local”, as one of the main problematics of globalization, integrating as well a perspective on the West-East relationship. As a proposition, egalitarian globalization through its methodologies of developing dialogical capacity as applies on communication, depends on mutual understanding with the inclusion of different cultural contents and sub-titles in the “central West/universal” debate. Egalitarian globalization therefore takes its force from bringing nations, societies and civilizations closer within the transforming power of culture.

KEYWORDS: Culture, globalization, self-other, universal-local, West-East.

INTRODUCTION

Encompassing increasing global connectedness in governance, trade, finance, production, migration, communication, culture and the environment (Held et al 1999), globalization is a multi-dimensional term, with multi-dimensional challenges. Although mainstream approaches to globalization associate it with Western cultural imperialism, claims of homogeneity and uniformity; globalization does not actually operate totally as a homogenization process, contrary to the general assumption. In response to the conceptions of the West, universal and the self, globalization also creates these conceptions' counters. The emerging East, localization and otherization appear in this case, also terms within which globalization occurs. Although categorical approaches between universal and local, East and West, self and other may be contested, such abstraction seems as well meaningful to point out the inequality-producing character of globalization. In fact, all these concepts taken together means that globalization is far from eradicating differences. In this context, the question this article asks, from a cultural perspective is: How will self and the other, universal and local, West and East reconcile in a world where differences do not disappear?

Within this context, the phenomenon of localization, occurs particularly within a dialectic process with globalization (Hermans and Dimaggio 2007, p.49). On the other hand, in the face of the Western claims of universality, the East also emerges with its locality within globalization. But even this dialectic does not challenge the West-centered dynamic of globalization, as revealed in the paper. On the other hand, outside the framework of the dialectic between affirmations of localization and globalization, there are groups who can as well develop a radical repulsion in the face of globalization again as regards “difference”. Their methodologies of resistance may include the use of violence, as such is the case with global religious terrorism, for example. But even they paradoxically actually use the tools of

globalization such as internet. In fact, all this phenomenon whether positive or negative, bare together one most important consequence:

“Globalization enables each of us, wherever we live, to reach around the world farther, faster and cheaper than ever before and at the same time allows the world to reach into each of us farther, faster, deeper, and cheaper than ever before” (Friedman 2002, p.64 in Lieber and Weisberg 2002, p.294). In this case, the problem in globalization is not a question of connection but content. Oppositions to globalization result from and occur through particularly its cultural content. But, in fact, in the global age where space is more and more accessible, time is getting shorter and communication opportunities are increasing, identities should have met in a relationship style where the possibilities of interaction with each other would increase and they would not marginalize and/or other each other. But in the global age, othering is paradoxically experienced intensely, and both the subject and object of othering is cultures. However, culture may as well be a reuniting element between nations, societies and civilizations due to egalitarian globalization. In this sense, this paper refers to the egalitarian conceptualization of globalization as a suggestion. In summary, here, it is discussed including the self-other relationship, how the West-centered globalization which produces claims of universality face to East and local, can be brought to an egalitarian ground. The greatest contribution of this paper is in the conceptualization of egalitarian globalization in the face of current globalization’s West- centered character.

Globalization Reproducing Self-Other, West-East, Universal-Local Controversies

Depending on Hall’s (Hall 1991, p.58) approach to hegemony as “the articulation of differences which do not disappear”, globalization may as well be depicted as a hegemony of cultural difference. Then globalization might as well be seen as the hegemony of Western cultural difference. Hegemony of Western cultural difference, is also produced within orientalism, as theorized by Edward Said (1979). As Said noted, the West defined its difference by reference to the East, in all the epistemological and ontological senses. And it established its hegemony through this difference, by othering the East. The conceptualization of the West “as developed, logical and civilized” by reference to the representation of the East as “underdeveloped, emotional and barbarian”, reveals the “othering” of the East in orientalism. Islam’s marginalization by the West, could then be related to an orientalist attitude within globalization. On the other side of the coin however, religious terrorism emerged in the Middle East, especially as a consequence of cultural repulsion to the global hegemony of the West. Both sides of the coin, contradicts the definition of “globalization as an interconnected world of common benefit for everybody” and reproduces the oppositional relationship between the “self” and “other”.

On the other hand, the self-other relationship as created by globalization also includes the center-periphery dichotomy of globalization, as could be appreciated through the exclusion by the central West, of immigrants, originating from the peripheral regions. In an environment where politicians in the West also rely on populism, a threat perception, posed by the challenges that immigrants would bring to the economic well-being of the settled population or to their culture, is the most fundamental problem in the othering of immigrants. In fact, a foreign cultural content could be positioned through threat perception in the concern that this content may destabilize and even destroy the settled cultural values of the nation. In the West, the concerns that these immigrants are only there to get a share of the economic welfare of the West, that they would not want to be integrated into the value system of the Western society, and that even if they do integrate, this will take a very long process, explains how this issue

gained a problematic aspect. Then what is called “globalization” remains rather short of creating an inclusive attitude on the perception of identities.

In this context, reactions to globalization both occur in the developed West and the periphery, especially when it is about closed regimes in the periphery. The tendency for controlling or resisting the global cultural content, especially originating from the center West, has given rise to self-reclosing cultural attitudes in certain parts of the peripheral world, paradoxically to globalization. In this direction, the threat perception towards global contents and culture infiltrating the borders of the states is because that cultural content contradicts the interests of the governing elite in closed systems with autocratic structures. The fear that the masses within the borders of these states, will revolt against the administration, once the Western cultural content infiltrates in these countries, explains the perceived threat perception to Western cultural content as a reflection of culture acting upon the socio-political order. In this environment, cultural introversion goes hand in hand with reference to security measures which actually serves to surround the psychology of fear in the perception of the other. In response, in the face of this globalization process, the situation emerging in the West is that, the central West also exhibits reactive approaches that are just as self-contained, due to its disappointment of the “inability” of the local cultures to Westernize. Disappointment in the West about alternative identities not being (able to be) Westernized today has produced “conflict” thesis on culture and civilization.

In this sense, in the early 1990s, Samuel Huntington (1993) proposed his theory of clash of civilizations, with his foresight on the inter-civilizational nature of future conflicts, confronting Islamic and Western worlds. His theory therefore also revealed the unreconciliatory relationship between Western globalization and local identities. It seems that it is for this reason that Huntington avoids in his theory, an interest and concern for the differences encouraged by the uniqueness of each civilization and therefore avoids an effort to understand. According to Huntington, that the West’s claim to universality creates a perception of threat, means already the defeat of the Western model in the global age. Briefly, Huntington’s perception is that the Cold War is over, but this time, the cultural threat perception has replaced the ideological threat perception. On the other hand, especially in realist approaches, the issue of culture is considered as unnecessary issue in the power race of states over each other. Therefore, culture is accepted as a data dependent on domestic politics. Indeed, the promotion of a certain authentic and civilizational culture can become the most important mission of domestic political authority. Such efforts, within the globalization process, may be appreciated through the discourse on multiculturalism, as a remarkable perspective against the cultural hegemony of the West. But is multiculturalism a strong enough trend to challenge the West-centric dynamic of globalization?

West-Centered Globalization versus Grassroots Globalization

According to one view, globalization manifests itself not more than just a culture of consumption (Banarjee and Linstead 2001). But what is consumed is not only goods and services, but also ideas, signs and symbols (Baudriallard 1988). For this reason, some conceptualize globalization as a cultural capitalism or cultural imperialism (Petras, 1993; Ritzer, 1993). Such point of view could well be appreciated in the criticism brought by Mohammed Khatami, ex-President of Iran (Hebron and Stack 2001 in Lieber and Weisberg 2002, p.281):

[Globalization is] a destructive force threatening dialogue between cultures. The new world order and globalization that certain powers are trying to make us accept, in which the

culture of the entire world is ignored, looks like a kind of neocolonialism. This imperialism threatens mutual understanding between nations and communication and dialogue between cultures.

In this perspective, the West's perception over its own "universal" value system as the "most moral" has reduced local-based approaches as products of an inferior culture. As a result, discussing this situation in terms of human rights Goodhart (2003) argues that the peripheral cultures have conceived Western values, and neoliberal globalization and the proliferation of universal human rights as a form of cultural hegemony and adds that "there is an obvious tension between the values associated with neoliberalism and many traditional cultural values elsewhere" (Goodhart 2003, p.941). In this sense, Fukuyama's (1992) thesis of the "end of history", declaring the victory of liberal democracy after the Cold War, is in serious crisis in the face of such an objection to Western norms, values and culture. Thence, globalization is not only a homogenization process.

An optimistic view, however, takes globalization as a process where non-Western societies, in other words, the local, participate and take their place in globalization. According to Banarjee and Linstead (2001) cultural boundaries are being transformed from barriers to junctions by this two-way movement and post-colonial subject positions are being constructed. Therefore, grassroots understanding of globalization also emerges. The grassroots agency, can affect globalization in line with its own aspirations and interests, eliminating therefore the corrosive, exclusionary, and destructive effects of globalization on indigenous culture. In this sense, we may also talk about globalization that comes from below, especially in the relationship between the rich and poor worlds, in dialectical and often unexpected ways (Archer, et. al. 2007, p.5,6). Then while globalization is in continuity with West-centered globalization, at the same time, it also undermines the hegemonic project of Western modernization which has developed around grand narratives and it decentralizes the world system. In this context, post-modern, post- colonial and post-Western challenges to West-centered globalization are also occurring. This is especially when the West is taken as "discursive space, a set of positionalities, a network of economic and power relations, a domain of material and discursive effects" (Moore 1994, p.132).

But, although globalization also includes post-Western approaches and tendencies, they are yet incapable of undermining the priority of the West, which determines the structural character of globalization with its sources, goals and methods. Given the unequal structure of globalization that produces asymmetric power relations, grassroots globalization even if it can prevent the pervasive negative effects of globalization on its existence, does not change the fact that globalization is directed by the West as the technological advantage lies in this continent. Especially as applied to East-West relationship, R. Radhakrishnan (2001, p. 329) notes: In a world-historical situation where materialism and technology are valorized more than spirituality and matters 'interior', it is inevitable that oriental dependency would position itself in a weaker position within the (Western) global structure.

Therefore, despite grassroots agency within globalization, the ability to determine globalization's direction has not yet passed to the local, East and the poor world. Capitalist globalization is not only a product of the last two centuries, but a product of a historical process that has been going on since the 16th century, and it will again require long historical processes to shake this structure. In this direction, the following question comes to mind: How can the priority given to Western culture within globalization be allowed to include local culture and other on an egalitarian ground? So, what should an egalitarian globalization look like?

Conclusion: Towards Egalitarian Globalization

First of all, egalitarian globalization, conceptualized in terms of cultures, rejects the cultural hegemony of the West. It proposes that globalization should occur within a dialogical capacity as a communicative process in which alterities are recognized. In fact, “cultural and historical differences require a well-developed dialogical capacity (Watkins 2003 in Hermans and Dimaggio 2007)”. This dialogical capacity in dealing with differences means: “(the required) capacity to recognize and respond to the other person or group in its alterity. Alterity, as a central feature of well-developed dialogue, is a necessity in a world in which individuals and cultures are confronted with differences that they may not understand initially but that may become comprehensible and meaningful as the result of a dialogical process” (Hermans and Dimaggio 2007, p.36).

Then the most important consequence of recognizing alterities through a dialogical capacity, would be understanding as “intelligibility” requires understanding. In this context, it does not seem possible to create an interest for being understood without understanding the other. The actions of understanding and being understood will take place through the communication of the culture with the other(s). Another criterion to be taken in egalitarian globalization, should be the principle of inclusiveness as applies on participation. By participation, Alkire signal the way in which learning from one another can refine and reformulate values. (Alkire 2002 in Gough 2004, p.6). Briefly, (As) Imported beliefs cannot be simply added on to existing beliefs, participation can help integrate new beliefs into the identity or character of a community... This amounts to a sophisticated argument combining respect for local knowledges with recognition, indeed support for, change, improvement and development (Gough 2004, p.6-7). In this way, egalitarian globalization will be prospective, not retrospective, and will involve the creation of a real communication mechanism, through inclusive processes. What is expected from such a mechanism is yet again the act of understanding the “other” through its cultural system of values.

Egalitarian globalization, then draws attention with its feature of understanding, that brings societies closer. But any culture that shuts itself down at the point it has reached or departures from an argument of singularity, will not “understand” the other. And because it does not understand, it ultimately cannot transform. In this sense, an egalitarian globalization which involves the dialogical capacity over the principle of inclusiveness, would lead to an understanding which would then result with mutual transformation in beliefs and value systems. In this context, cultural structures that are closed on themselves and that reject transformation are destined to stay only on the edge of history, far from catching historical mobility.

Throughout history, civilizations may have taken something from each other each time they came across, but more so than that, they were able to survive, that is, to transform, as a result of their interaction with each other. While doing this, each civilization that came upon another civilization did not reject the other, but multiplied by enriching the other. The main area where this transformation took place included culture and the process of cultural production expressed the plus value that different civilizations added to one another. Because although it may seem destined to be overlooked, ignored or even described as a barrier at the beginning, culture, as regards beliefs and value systems, is a transformative and transforming force in the long run. In this sense, egalitarian globalization will rise on the phenomenon of culture as a transformative and transforming power. The methodology to arrive to this point, lies in the continuity of the dialogical capacity both universally and locally, and in inclusiveness as applies on participation. Egalitarian globalization then represents a transition from the

universal-local/West-East/self-other contradictions to a working relationship. The result of this relationship would be the “understanding” that can occur in the perception of civilizations, nations and cultures towards each other and which furthermore offers the capacity for mutual enrichment.

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STUDIES ON THE ADSORPTION PERFORMANCE OF SELECTED ZEOLITES FOR ENVIRONMENTAL REMEDIATION OF TETRACYCLINE ANTIBIOTICS

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ABSTRACT

Water pollution as a result of the growing world population and industrialization is major challenge and the need to minimize the presence of toxic chemicals in the environment has attracted an increasing interest of researchers. A discovery of a sustainable and effective material applicable as adsorbent in adsorption technique is a promising approach. The present study aims at investigating the performance of H-MOR, H- β , and H- ZSM-5 zeolites in the adsorption of tetracycline antibiotics. The morphology, functional groups, and elemental composition of the zeolites samples were studied using scanning electron microscopy (SEM), Fourier Transform Infrared Spectroscopy (FTIR), and electron diffusion spectroscopy (EDS) techniques, respectively. The zeolites exhibit varying porosity albeit with similar functional groups and elemental composition. The H- β zeolite with higher porosity and more concentrated key elements (O and Si) was demonstrated to be the most effective adsorbent for tetracycline. On the other hand, the lowest adsorption performance was recorded in H- ZSM-5 zeolites. The adsorption activity of these zeolites was further established from the kinetic data. The variation in the adsorption performance of these zeolites is ascribed to the differences in their morphologies and elemental compositions. Overall, H- β zeolites were shown to be a better adsorbent for environmental pollutant remediation

KEYWORDS: Environmental remediation; Pollution; Tetracycline; Adsorption; Zeolite

1. INTRODUCTION

Water pollution occurs when wastes from industries, households, farm lands, and hospitals are indiscriminately released into water bodies resulting in the alteration of the physiochemical properties of water from their normal states [1,2]. The presence of these toxic chemicals also leads to the death of aquatic organisms due to the shortage of oxygen, which is competitively used by microorganisms for the biodegradation of the pollutants. The contamination of water bodies is a major concern to humans since their livelihood depend on the healthy nature of water and aquatic animals [3]. Over the years, strategies for the remediation of wastewater have been researched [4]. Although some of these strategies have been demonstrated to be effective, the reagents utilized also poses threat to environment [5]. Other safer techniques are found to be less effective and slow in the remediation of pollutants. Generally, an ideal remediation strategy should be effective, harmless, and sustainable. Thus, research interest in the discovery and synthesis of materials that are effective as adsorbents is gaining momentum nowadays [6]. Among the adsorbents reported so far, zeolites are established to be high performance adsorbents for the removal of pollutants [4]. Several works have been carried out using zeolites as adsorbent for inorganic metals adsorption from wastewater [7]. On the other hand, the adsorption of organic pollutants using zeolites has also been studied by a number of scientists. Pharmaceuticals are a large class of pollutants which form a significant fraction of the total pollution in water bodies [8]. An example of these

pharmaceutical which is commonly discharged into the environment is the tetracycline (TC) antibiotics [9]. Adsorption technique has been employed for the treatment of wastewater containing TC pollutant [7]. Although zeolite adsorbents are promising adsorbents for the removal of TC molecules, we still do not know which of them is the most effect among the myriads of zeolites available. Therefore, the present study aims to investigate the adsorption performance of a selected series of zeolites adsorbents H-MOR, H- β , and H-ZSM- 5 in order to establish the most effective adsorbent among these. The model pollutant used in this study is the TC antibiotics. The adsorption performance of the zeolite samples were determined from the experimental data obtained using ultraviolet visible spectrometer after adsorption studies.

2. EXPERIMENTAL

2.1 Materials and methods

The H-MOR, H- β , and H-ZSM5 are commercial zeolites were obtained from Nankai University Catalyst Co., Ltd. The SiO₂/Al₂O₃ molar ratios of H-MOR, H- β , and H-ZSM-5 are 24, 25, and 25, respectively. Tetracycline hydrochloride (C₂₂H₂₄O₈N₂.HCl) with a purity ca. 95% manufactured by Yangzhou Pharmaceutical Company Limited was acquired from a local pharmacy. A gram of the tetracycline hydrochloride powder was weighed and dissolved in 1 L of deionized water to prepare 1000 mg/L stock solution. A lower concentration of the stock solution was prepared by serial dilution. Adsorption study was performed by weighing a given amount of the zeolites sample in a specific volume of tetracycline solution and agitated for several minutes. Thereafter, the agitated samples were centrifuged to separate the zeolite adsorbents from the adsorbates. The concentration of the adsorbates were measured using the absorbance values obtained using the ultraviolet visible spectrophotometer.

2.2 Characterization

The scanning electron microscopy (SEM) (Phenom ProX, Eindhoven Netherlands), Fourier transform infrared spectroscopy (FTIR) (Shimadzu, FTIR-8400S, Japan), and electron diffraction spectroscopy (EDS) were employed to study morphology, functional groups and elemental conformation of the zeolite samples. The FTIR analyses of the zeolite samples were performed at a resolution of 4 (cm⁻¹).

3. RESULTS AND DISCUSSION

The morphologies of the selected zeolites were studied using the SEM technique and the images obtained are shown in Figures 1 a-c. The zeolite samples displayed dissimilar nanostructures. While the particles of H- MOR appeared to be fine and relatively smaller sizes, the H- β and H-ZSM-5 are larger in sizes. The particles in H-ZSM-5 were observed to stick together with lower porosity than the H- β zeolites. The FTIR technique was employed to investigate the main functional groups present in the zeolite samples. Figure 1d shows a combined FTIR spectrum for the zeolites, analysed in the range 438.58 – 4000 cm⁻¹. The stretching vibrations at 791.44, 800.01, 801.44 cm⁻¹ confirms the presence of Si-O-Si groups in H- β , H-MOR, and H-ZSM5, respectively. The band at 455.72 cm⁻¹ represents the bending vibrations of Si-O-Si or Al-O-Si groups in H- β and H-MOR zeolites. H-ZSM5 displays a similar vibration at 438.58 cm⁻¹.

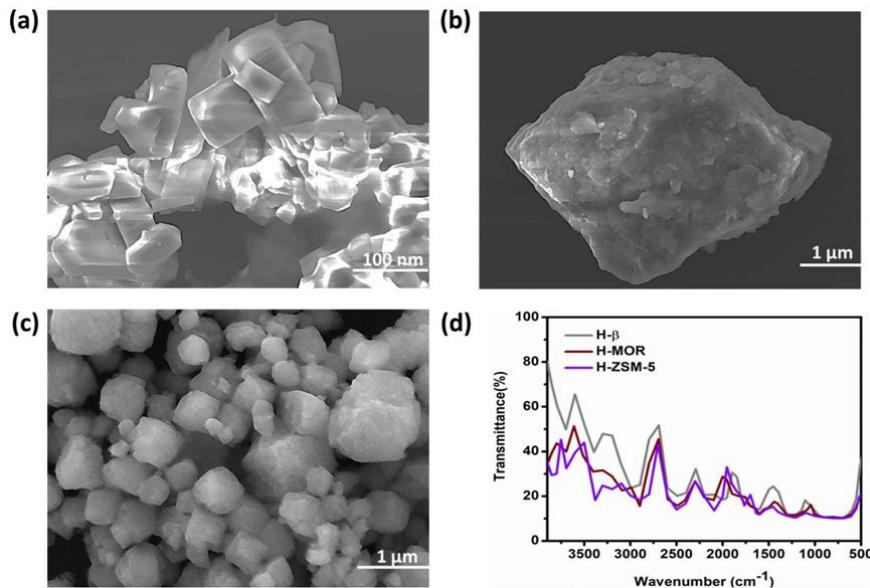


Figure 1: SEM micrographs of (a) H-ZSM-5, (b) H-MOR and (c) H- β at resolutions (d) FTIR spectra of the zeolite samples.

Additionally, the bulk compositions of the key elements in the zeolites were studied using the EDS technique. Figures 2 a-c, while H-ZSM-5 showed the highest amount of O (51.4 %), H- β zeolite has smallest amount of Si (35.5 %) and Al (0.5 %). The H-MOR zeolite displayed the lowest concentration of O (34.9 %) and the highest amount of Al (10.7 %). Figures 2d, 2e, and 2f show the mapped images of oxygen, sulphur, and aluminium, respectively.

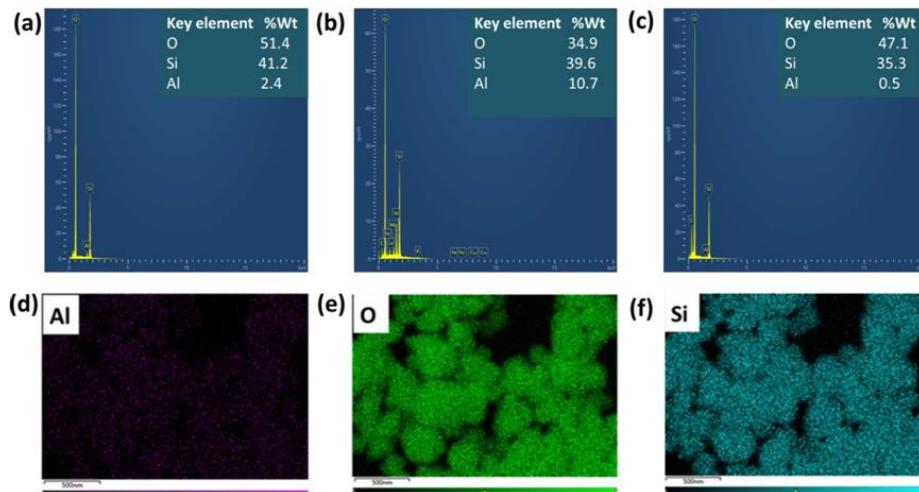


Figure 2: EDS analyses of (a) H-ZSM-5, (b) H-MOR, and (c) H- β , zeolites; mapping of the main elements: (d) aluminium (e) oxygen, and (f) sulphur.

The adsorption performance of the zeolite samples were carried out using TC as a target pollutant. The TC removal over duration of 120 min by the respective zeolite is depicted in Figure 3a.

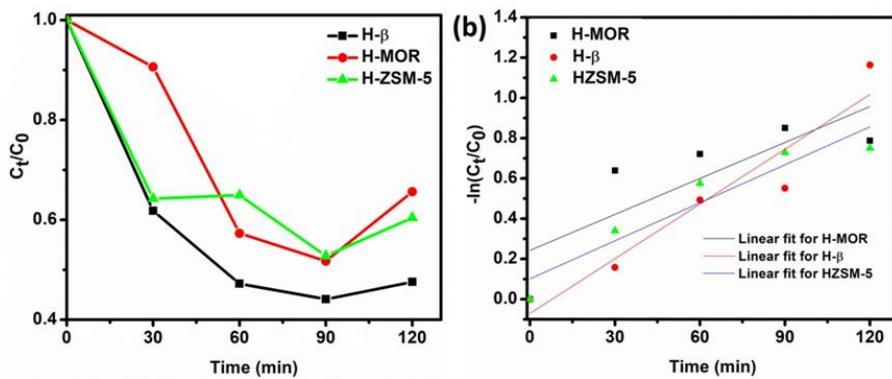


Figure 3: (a) Adsorption of TC using the selected zeolites; (b) kinetic rate constant plots for H-ZSM-5, H- MOR, and H- β zeolites.

Overall, the H- β displayed the highest adsorption performance. On the other hand, the lowest adsorption performance was observed in H-MOR zeolite. The variation in the adsorption activity of the zeolite samples may be ascribed to the differences in their morphologies. Our hypothesis is corroborated by the SEM analyses in Figures 1 a-c: the most porous zeolite (H- β) and the least porous (H-MOR) exhibited the highest and least adsorption performance, respectively. Figure 3b shows the adsorption rate constants of the zeolite samples. The rate constant of H-MOR, H-ZSM-5, H- β , 0.00596 min⁻¹, 0.0063 min⁻¹, and 0.00907 min⁻¹, respectively.

4. CONCLUSION

In conclusion, the adsorption performance of selected commercial zeolite samples H-ZSM-5, H-MOR, and H- β was tested using TC as a simulated pollutant. Before the adsorption study, the physicochemical properties of the zeolites were studied using SEM, EDS, and FTIR techniques. The samples displayed different morphology and elemental composition (%) of key elements albeit with same functional groups. The adsorption performance of the zeolite sample was observed to decrease in the order H- β > H-ZSM-5 > H-MOR. The discrepancy in the adsorption among the samples is associated with variation in their morphologies.

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OPTIMIZATION OF ULTRASOUND-ASSISTED EXTRACTION OF CRATAEGUS MICROPHYLLA SUBSP. MICROPHYLLA FRUITS FROM ARTVIN PROVINCE AND THE RADICAL SCAVENGING CAPACITY OF POLYPHENOL-RICH EXTRACTS

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ÖZET

Crataegus L. (Rosaceae) cinsi, Kuzey Yarımküre'den Orta Amerika'ya kadar doğal bir yayılış alanı göstermektedir. Cins dünya çapında 217 tür içerir. *Crataegus* türleri halk hekimliğinde damar sertliği, kalp rahatsızlıklarları, nefes darlığı, romatizma, obezite, hipertansiyon, idrar yolu enfeksiyonları ve boğaz ağrısı tedavisinde geleneksel olarak kullanılmaktadır. Bu türler flavonoidler, kardiyotonik aminler, triterpenoidler, tanenler, kumarinler içerirler ve antioksidan, sitotoksik, antikoagulan, antiproliferatif ve nöroprotektif aktivite gösterirler.

Bitkilerin matrikslerindeki etken maddelerin hızlı, güvenli ve yüksek verimde elde edilmeleri, sağlık ve gıda sektöründe üretime katılabilmesi için büyük önem taşır. Bitkisel kaynaklı biyoaktif bileşiklerin ekstraksiyon hızı üzerinde etkisi olması muhtemel birkaç süreç değişkeni vardır. Bunlar arasında çözücü polaritesi, sıcaklık ve kullanılabilir yüzey alanı bulunur.

Türkiye'de *Crataegus microphylla* subsp. *microphylla* "kocakarı armudu" olarak bilinir. Bitki parlak kırmızı meyvelere sahip ve 4 metreye kadar boylanabilen bir çalıdır. Bitkinin meyveleri yerel halk tarafından tüketilmektedir. Bu çalışmada *C. microphylla* subsp. *microphylla* meyvelerinin metanol ve aseton ekstreleri zaman (X_1 : 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60, 90, 120 dakika) ve sıcaklık (X_2 : 25, 30, 35, 40 °C)

değişkenleri kontrol edilerek ultrasonik ekstraksiyon yöntemi kullanılarak hazırlanmıştır. Ekstre verimleri (% olarak) kuru bitki üzerinden hesaplanmıştır. Ekstrelerin toplam polifenol içeriği, standart olarak kullanılan fenol bileşiği olan gallik asidin kalibrasyon eğrisine atıfta bulunarak Folin-Ciocalteu yöntemi ile belirlendi. Sonuçlar, ortalama mg gallik asit eşdeğeri (GAE)/g kuru ekstre olarak ifade edildi. DPPH radikal üzerindeki süpürme aktivitesi, inhibisyon yüzdesi olarak ifade edildi ve numunelerin yarı maksimum inhibitör konsantrasyonları (IC_{50}) lineer regresyon analizi ile hesaplandı. Gallik asit referans bileşik olarak değerlendirildi.

Elde edilen sonuçlara göre optimum koşullar altında en yüksek toplam fenolik içerik 30 dak., 40 °C metanol ekstraksiyon işlemlerinde ve 20 dak., 25 °C aseton ekstraksiyon işlemlerinde elde edilmiştir. Yüksek fenolik içerikli ekstreler daha güçlü DPPH radikal süpürme kapasitesi göstermiştir. Genel olarak metanol ekstreleri, aseton ekstrelerinden daha yüksek radikal temizleme kapasitesi göstermiştir.

Anahtar Kelimeler: *Crataegus microphylla* subsp. *microphylla*, Meyve, Ultrasonik Ekstraksiyon, Toplam Fenolik Madde İçeriği, DPPH

ABSTRACT

The genus *Crataegus* L. (Rosaceae) has a natural distribution from the Northern Hemisphere to Central America. The genus includes 217 species worldwide. *Crataegus* species are traditionally used in folk medicine for the treatment of atherosclerosis, heart ailments, shortness of breath, rheumatism, obesity, hypertension, urinary tract infections and sore throat. These species contain flavonoids, cardiotonic amines, triterpenoids, tannins, coumarins and show antioxidant, cytotoxic, anticoagulant, antiproliferative and neuroprotective activities. The obtaining of the bioactive compounds from the plant matrix as quickly, safely and high efficiency is very important for the participate in production in the health and food sector. There are several process variables that are likely to have an effect on the extraction rate of plant-derived bioactive compounds. These include solvent polarity, temperature and usable surface. In Turkey, *Crataegus microphylla* subsp. *microphylla* is known as "kocakari armudu". The plant is a shrub with bright red fruits and grow up to 4 meters. The fruits of the plant are eaten by the local people. In this study, the methanol and acetone extracts of *C. microphylla* subsp. *microphylla* fruits were prepared using ultrasonic extraction method by controlling time (X1: 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60, 90, 120 minutes) and temperature (X2: 25, 30, 35, 40 °C) variables. Extract yields were calculated as % (dry plant material). The total polyphenol content of extracts was determined by Folin-Ciocalteu method, referring to the calibration curve of gallic acid, phenol compound used as a standard. The results were expressed as mean mg gallic acid equivalent (GAE)/g dry extract. The scavenging activity on the DPPH radical was expressed as inhibition percentage and the half-maximal inhibitory concentrations (IC50) of the samples were calculated by linear regression analysis. Gallic acid was assessed as a reference compound. According to the results, the highest total phenolic content was obtained for 30 min., 40 °C for methanol extraction processes and 20 min., 25 °C for acetone extraction processes under optimum conditions. The Extracts with high phenolic content showed stronger DPPH radical scavenging capacity. In general, methanol extracts showed higher radical scavenging capacity than acetone extracts.

KEYWORDS: *Crataegus microphylla* subsp. *microphylla*, Fruit, Ultrasound Extraction, Total Phenolic Content, DPPH

GİRİŞ

Odunsu ağaç, çalı, tırmancı ve otsu formlarda bitkileri içeren Rosaceae Juss. familyası dünyanın her yerine yayılmış, özellikle kuzey yarımkürenin ılıman bölgelerinden subtropikal bölgeye kadar geniş bir alana dağılmıştır (Evans, 2002; Heywood vd., 2007; POWO, 2022; IPNI, 2022).

Crataegus türleri geleneksel olarak damar sertliği, kalp rahatsızlıkları, nefes darlığı, romatizma, obezite, hipertansiyon, idrar yolu enfeksiyonları ve boğaz ağrısı tedavisinde kullanılmaktadır (Akgül vd., 2016; Baharvand-Ahmadi vd., 2016; Gürdal ve Kültür, 2013; Jalali vd., 2009; Koleva vd., 2015; Nejad vd., 2013; Polat, 2019; Redžić, 2007; Uzun ve Kaya, 2016). *Crataegus* türleri üzerinde yapılan önceki çalışmalar bu cinse ait bitkilerin uçucu yağlar, fenilpropanoidler, hidroksisinnamik asitler, şekerler ve şeker alkoller, organik ve fenolik asitler, terpenler, lignanlar ve flavonoidler içerdigini göstermiştir (Edwards vd., 2012). Ayrıca bu türler farmakolojik etki olarak antioksidan, sitotoksik, antikoagulan, antiproliferatif ve nöroprotektif aktivitelere sahiptirler (Bernatoniene vd., 2008; Chang vd., 2013; Ebrahimzadeh ve Bahramian, 2009; Ganie vd., 2016; Guo vd., 2020; Güven vd., 2006; Kumar vd., 2012; Li vd., 2015; Shahat vd., 2002; Wen vd., 2015). *Crataegus microphylla* subsp. *microphylla*'nın yaprakları genişçe ovat, lobları 3-5(-7) ve 2/3-3/4'e kadar parçalanmış halde olup, meyvesi

parlak kırmızı renklidir, bitki 4 m'ye kadar boylanabilir ve çalı formundadır (Şekil 1) (Davis, 1972; POWO, 2022). Türkiye'de "kocakarı armudu" olarak adlandırılır (Güner vd., 2012).

Bitkilerin matrikslerindeki etken maddelerin hızlı, güvenli ve yüksek verimde elde edilmeleri, sağlık ve gıda sektöründe üretime katılabilmesi için büyük önem taşır. Fenolik bileşiklerin ekstraksiyon hızı üzerinde etkisi olması muhtemel birkaç süreç değişkeni vardır. Bunlar arasında çözücü polaritesi, sıcaklık ve kullanılabılır yüzey alanı bulunur (Setford vd., 2017). Bu çalışmada *C. microphylla* subsp. *microphylla* meyvelerinden elde edilen, fenolik içerik açısından zengin ekstrelerin sıcaklık ve zaman değişkenlerine bağlı olarak toplam fenolik içerikleri ve DPPH radikal süpürücü kapasiteleri test edilmiştir.



Şekil 1. *C. microphylla* subsp. *microphylla*

YÖNTEM

Bitki Materyali

Bitki materyalleri Şavşat/Artvin'den toplandı. Bir herbaryum örneği Ankara Üniversitesi Eczacılık Fakültesi Herbaryumu'na kaydedildi (AEF 30925). Toplanan bitki materyali gölgede kurutuldu. Kuruyan bitki materyalleri bir öğütücüde toz edilip, 0.4 mm'lik elekten geçirildi.

Ekstrelerin Hazırlanması

Toz edilmiş *C. microphylla* subsp. *microphylla* meyvelerinden metanol ($\geq 99.9\%$) ve aseton ($\geq 99.8\%$) çözüçüleri kullanılarak ekstreler hazırlanmıştır. 10 gram bitki materyali, 100 ml çözücü ile 240 Watt gücünde ultrasonik banyo cihazında muamele edilmiştir. En yüksek fenolik madde içeriğine sahip ekstreyi belirlemek için ekstraksiyon işlemleri boyunca zaman (X1) ve sıcaklık (X2) değişkenleri kontrollü olarak yürütülmüştür. Ekstraksiyon süreleri (X1) 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60, 90, 120 dakika olarak gerçekleştirilmiştir. Ekstraksiyon sıcaklık (X2) değişkenleri ise 25, 30, 35, 40 °C olarak uygulanmıştır.

Toplam Fenolik Madde Miktarının Belirlenmesi

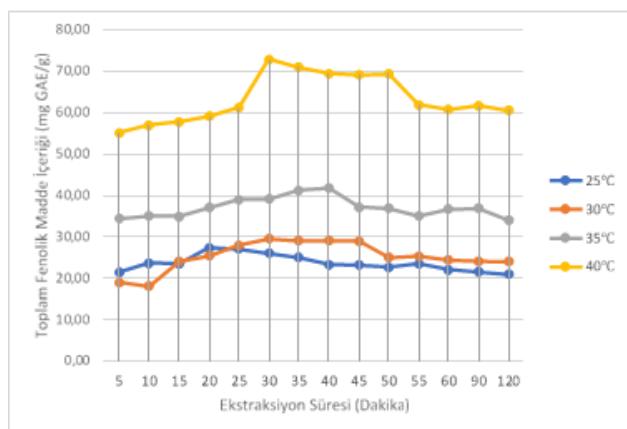
Ekstrelerin toplam fenolik madde miktarının belirlenmesi için Folin-Ciocalteu reaktifi kullanılarak, spektrofotometrik olarak yapılan, renk oluşumuna dayanan yöntem kullanılmıştır (Slinkard ve Singleton, 1977). Buna göre; 20 μ l numune, 1580 μ l distile su ile dilüe edilip, üzerine 10 μ l Folin-Ciocalteu reaktifi eklenmiştir. 30 μ l %20'lik Na₂CO₃ çözeltisi bu karışımın üzerine eklenip, karışım 2 saat süresince karanlık ortamda, oda sıcaklığında bekletilmiştir. Ölçümler 765 nm de spektrofotometrik olarak yapılmıştır. Sonuçlar ortalama mg gallik asit eşdeğeri (GAE)/g kuru ekstre olarak ifade edilmiştir.

DPPH Radikal Süpürücü Kapasite Tayini

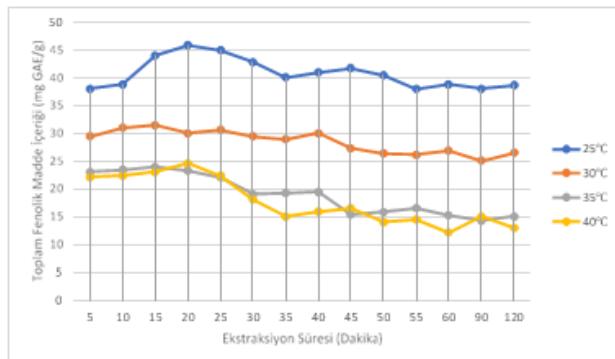
Bu test yönteminde ekstrelerin DPPH (2,2-difenil-1-pikrilhidrazil) radikalinin menekşe-mor rengini giderme yeteneği bitki ekstresinin antioksidan kapasitesini belirtmektedir. Bu test yöntemi ekstrelerin DPPH ile oluşturdukları rengin 517 nm'de spektrofotometrik olarak ölçülmesi ve standart madde ile kıyaslanması temeline dayanmaktadır (Blois, 1958). DPPH'in 100 μ M etanol çözeltisi ve farklı derişimlerde bitki ekstrelerinden oluşan karışım oda sıcaklığında ve karanlıkta 30 dakika boyunca bekletilip, 517 nm'de absorbans değerleri ölçülmüştür. Deneyler 3 tekrarlı yapılmıştır. Pozitif kontrol olarak Gallik asit (GA) kullanılmıştır.

BULGULAR

Elde edilen sonuçlara göre optimum koşullar altında en yüksek toplam fenolik içerik 30 dak., 40 °C metanol ekstraksiyon işlemlerinde 72.92 ± 4.71 mg GAE/g olarak (Şekil 2) ve 20 dak., 25 °C aseton ekstraksiyon işlemlerinde 45.95 ± 6.21 mg GAE/g (Şekil 3) olarak elde edilmiştir.



Şekil 2. Metanol ekstrelerinin toplam fenolik madde içeriği



Şekil 3. Aseton ekstrelerinin toplam fenolik madde içeriği

Tüm ekstrelerin toplam fenolik madde miktarı içeriği metanol ekstrelerinde 18.14-72.92 (mg GAE/g) arasında, aseton ekstrelerinde ise 12.21-45.95 (mg GAE/g) arasında değişmektedir. Yüksek fenolik içerikli ekstreler daha güçlü DPPH radikal süpürme kapasitesi göstermiştir. Genel olarak metanol ekstreleri, aseton ekstrelerinden daha yüksek radikal temizleme kapasitesi göstermiştir.

Metanol ekstrelerinde en güçlü radikal süpürücü kapasite gallik asite (IC50: 0.016 ± 0.04 mg/ml) oranla, toplam fenolik içerik bakımından en zengin ekstrede (IC50: 0.023 ± 1.01 mg/ml)

hesaplanmıştır. Metanol ekstrelerinin DPPH radikal süpürücü kapasiteleri 0.023-0.034 mg/ml arasında hesaplanmıştır.

Aseton ekstrelerinde en güçlü radikal süpürücü kapasite gallik asite (IC50: 0.016±0.04 mg/ml) oranla, toplam fenolik içerik bakımından en zengin ekstrede (IC50: 0.029±2.13 mg/ml) hesaplanmıştır. Aseton ekstrelerinin DPPH radikal süpürücü kapasiteleri 0.029-0.037 mg/ml arasında hesaplanmıştır.

TARTIŞMA VE SONUÇ

Sağlık ve gıda sektöründe bitkilerin sahip oldukları biyoaktif bileşiklerin değerlendirilmesi içerdikleri fitokimyasalların hızlı, güvenli ve verimli bir şekilde elde edilmelerine bağlıdır. Bu amaçla ekstraksiyon işlemlerine etki eden etkenlerin optimize edilmesi büyük önem arz etmektedir. Literatür verileri, bu çalışmanın *Crataegus microphylla* subsp. *microphylla*'nın meyveleri üzerinde yapılan ultrasan destekli ekstraksiyon optimizasyon işlemi bakımından ilk çalışma olduğunu göstermektedir. Elde edilen sonuçlara göre optimum koşullar altında en yüksek toplam fenolik içerik 30 dak., 40 °C metanol ekstraksiyon işlemlerinde 72.92±4.71 mg GAE/g olarak ve 20 dak., 25 °C aseton ekstraksiyon işlemlerinde 45.95±6.21 mg GAE/g olarak elde edilmiştir.

Ekstrelerin radikal süpürücü kapasitelerinde metanol ekstrelerinin DPPH radikal süpürücü kapasiteleri 0.023- 0.034 mg/ml arasında, aseton ekstrelerinin ise 0.029-0.037 mg/ml arasında hesaplanmıştır. Daha önceki yapılan bir çalışmada (Renda vd., 2018), meyve ekstreleri etanol (F1), asitlendirilmiş (%0.5 HCl, pH:2.5) etanol (F2), etanol:su (1:1) (F3), metanol (F4), asitlendirilmiş (%0.5 HCl, pH:2.5) metanol (F5), metanol:su (1:1) (F6), su (F7) ve asitlendirilmiş (%0.5 HCl, pH: 2.5) su (F8) ile hazırlanmıştır. Meyve ekstrelerinin toplam fenolik içeriği 5.00±0.18 ile 57.28±1.35 mg GAE/g kuru ağırlık aralığında tespit edilmiştir. Ayrıca DPPH testinde en yüksek aktiviteyi F5 ekstresi (IC50: 123.50±1.31 µg/ml) göstermiştir.

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THE ROLE OF SCIENCE AND TECHNOLOGY IN ECONOMIC GROWTH

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ABSTRACT

The study examined the impact of science and technology in economic growth of Nigeria. The objective of the study is to unveil the industrial transformation and optimization of the Nigerian economy with technological evidence in science and technology. The researchers adopted survey research design. Primary and secondary data collection was adopted using questioning from respondents and CBN data overtime. The analysis of data was presented with Chi-square and Pearson product moment correlations. The researchers recommended that Nations must pass successive stages of economic development before attaining economic growth.

INTRODUCTION

Every nation is much concerned about economic growth through the industrial transformation, and optimization through science and technology.

Economic growth and development are much more needed by the less developed economic such as Indonesia, Nigeria, Taiwan and India to mention but few countries of the world. Meanwhile the western nations of the world are in pursuit of economic growth and improvement. Hence economic growth is an integral part of every nation's development through science and technology. Nigeria and Indonesia are developing nation's very desirous of economic growth sparked by industrial transformation of science and technology.

The dynamic role of science and technology on economic growth has long been recognized by nations of the world.

Its accelerative effects on economic growth and in achieving macro objectives such as industrialization, full employment, development of local technology, diffusion of management skills and stimulation of indigenous entrepreneurship has been well documented by 24 scholars.

The introduction of information communication technology (ICT) from all intent and purpose is central to economic growth. ICT provides supportive and interactive learning technology by assisting innovators through multimedia, telecommunication technology.

Technological configurations help to illustrate complex and ambiguous concepts that hinder economic growth.

Science and technology stimulates intellectual qualities through higher thinking, solving problems of mankind. The paradigm shift to science and technology has encouraged scientific

data collection cross fertilization of idea, and use of electronics devices in production, industrialization, conference meetings, and aviation (en.mwikibooks.org/communication).

The role of science and technology is electrically generated and inevitable in the western world and developing nations.

STATEMENT OF PROBLEM

Despite the introduction of science and technology for economic growth in developing nations of the world, obviously the poor economic governance indicators in the developing countries has been seen to be the most prominent among many indicators for poor economic growth and development.

Many political and economic scholars argue that good governance is one of the main factors in the nation's economic growth and socio economic development. Nigeria in the last four years has budgeted over ten trillion naira on science and technology without much on ground to show for the nation's economic growth. (CBN 2016). The situation has triggered poverty, mounting debt, corruption, weak economic growth, and mismanagement of science and technological indicator for economic growth.

LITERATURE REVIEW

CONCEPTUAL FRAMEWORK

The classical and non-classical assessment of economic growth. In 1950 and 60's when the issue of economic growth and development gripped the developed and the developing of the world.

Scholars crafted series of successive stages of economic growth in which the process of development was seen as a means to economic growth and development all over the world. This process was principally an economic theory of development in which the right quantity and mixture of technology savings, investment and foreign aids were all that was needed to enable developing nations like Nigeria, Indonesia among others to move their economies forward. Meanwhile economic growth is not purely economic phenomenon rather it cuts across so many aspects of our social, economic, technological, cultural political and religious lives of the people in any nation. Adams Smith (1776) the earliest economist posits that nations must pass successive stages of development before attaining economic growth.

Justifying the stages of economic development before attaining economic growth which nations desiring to develop must pass through Restow (1960) specifically stated in his book: it is possible to identify all societies in their economic dimensions as lying within one of the five categories: the traditional society, the pre-conditions for takeoff into self-sustaining growth, the drive to maturity, through science and technology finally the age of consumption all these assertions of Restow and some other classical and neoclassical economies regarding economic development and growth have been proved wrong with the writings of modern development economists like Ezeanyika (1999) who placed much emphasis on the technological improvement of science formulation and establishment policies capable of alleviating and eradicating absolute and disproportionate poverty providing more diversified employment opportunities and reducing income inequalities in developed and developing nations.

THEORETICAL FRAMEWORK

Several theories have been postulated to explain relationship between science technology and economic growth in the industrial sector of nations. However the researchers adopted the Michael Porters theory of competitive advantage of nations to underpin the research.

Porter (1983) in his theory asserted that nations don't compete rather industries compete.

According to Porter firms that trade create wealth do that with increasing sophisticated science and technology. Firms and industries are getting more globalized and international in scope and operation through its technological knowhow, the source of skill of any nation is the technology that drives the comparative advantage of the nation. Porter advanced four attributes called the national diamond of nations which can influence the pattern of economic growth and trade.

- Domestic and international demand.
- Successful infant industries to support related industries.
- Company strategy structure and rivalry that fuel economic growth in the world trade.

EMPERICAL REVIEW

Szirmai (2012) and Verspagen's study (1991) focuses on the contributions of technology to GDP per capital growth, conditional on the level of education and stages of development. They find out that technology act as an engine of growth for low and middle income nations provided they have a sufficient level of human capital and such growth features are found in service and dependent nations.

Rodrick (2009) discovers significant positive relationship between growth rate of GDP and shares of industries manufacturing with scientific motive equipment.

For five years Rodric argued that industrial modern activities (technology) acts as an engine of economic growth.

A study by ISirsal and Chemezie (2016) indicates that no country particularly developing ones has attained a level of economic growth without sub-sector linkage with technological advancement. They evaluated the impact of automated industrialization in Nigeria from 1997 – 2012 using the Johannes co-integration testing approach which demonstrated a significant longrun relationship between the use of technology and economic growth Ntiaya and kanjuwan (2018) investigated the impact of industrialization technology on economic growth by analyzing the Senegalese manufacturing firms. The paper utilized secondary data and employed the ordinary least square (ols) techniques in estimating the relationship between the variables. The economic analysis revealed significant positive relationship between technological industrial development and Senegalese economic growth. The study concludes that an increase in technological industrial output would increase economic growth in Senegal.

RESEARCH METHODOLOGY

The study utilized survey Research design of 67 post graduate and undergraduate students of Michael Okpara University of Agriculture University of Agriculture Umudike Abia State

Nigeria. 26 post graduate students and 41 under graduate students drawn through simple random sampling from a total population of 109 students served as population sample for the study. The instrument used for data collection was researchers developed questionnaires adopted, analyzed with mean and chi-square tools.

RESULT

Table1 mean responses of students on science and technology is a function to economic growth.

MODEL SPECIFICATION

N	=	POPULATION	SAMPLE
\bar{X}	=	MEAN	STD DERIVATION
N		\bar{X}	
67		2.82	0.999
67		2.34	0.993
67		2.25	990
67		2.10	1.032
67		3.31	925
67		2.91	1.097
67		3.24	923
67		1.82	737
67		2.01	1.007
67		1.72	849
67		2.63	733
67		2.0	1.030
67		2.15	957
67		1.85	909
67		1.84	947
67		1.82	968
67		2.10	1.002

TABLE 2 chi-square analysis of post graduate and under-graduate students of the university.

Value	D/F	ASYMPSIG (2 sided).
Pearson chi-sq 27.627	32	688
Like hood ratio 33.686	32	386
Linear association 2.254	1	133

Numbers of response 66.

$X^2 - 32, N=66=27.627=0.688$.

Non-significant difference 0.05 , 0.688>0.05 null hypothesis is hereby rejected: there is no relationship between science technology and economic growth and alternative excepted: there is a significant positive relationship between science technology and economic growth.

RECOMMENDATIONS

Nations must pass successive stages of economic development before attaining economic growth.

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NATIANYA AND KANJUAN (2018) Role of industrialization on economic growth. the experience of Senegal, America journal of industrial bus management economic growth and alternative accepted, there is a significant positive relationship between scientific technology and economic growth.

Examining the Impact of Compensation Policies on Employee Retention in Organizations

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ABSTRACT

In today's globalized business environment, organizations face considerable challenges in retaining and engaging top talent, especially during periods of high turnover rates. Even employees who are engaged may become dissatisfied with organizational performance outcomes, prompting them to seek opportunities elsewhere. This study addresses four research objectives: firstly, it examines the impact of salary on employee job security; secondly, it assesses the significance of commission-based rewards on employee turnover; thirdly, it investigates the importance of allowances in enhancing employee satisfaction; and finally, it evaluates the effects of additional bonuses on the work environment for employees. The research adopts a cross-sectional design and utilizes statistical tools such as analysis of variance (ANOVA), correlation coefficients, and regression analysis to test hypotheses. Data collection involves administering 165 questionnaires to employees of Nigeria Bottling Company PLC Asejire Plant, Ibadan, to address research questions and hypotheses effectively. The findings reveal that salary schemes significantly influence job security, allowances have a significant impact on job satisfaction, and commission-based rewards affect employee turnover. Moreover, the research empirically demonstrates that additional bonuses implemented by organizations have a tangible effect on the work environment. Therefore, it is imperative for organizations to develop comprehensive compensation and retention strategies that address these factors to mitigate turnover rates. Such strategies require a commitment from employers but are ultimately beneficial in the long term.

INTRODUCTION

In the competitive landscape of modern industries, organizations vie for leadership positions, customer loyalty, profitability, and long-term sustainability. Central to achieving these goals is the retention of employees, a strategic imperative with foundational principles, where monetary compensation holds significant sway. As highlighted by Boden & Galizzi (2021) and Nnubia (2020), monetary rewards form the lifeblood of employee engagement; neglecting them risks disengagement and attrition, undermining organizational aspirations. Consequently, securing the best talent becomes paramount for organizations aiming to realize their full potential. Indeed, compensation policies serve as pivotal drivers for organizational survival, growth, sustainability, and competitive advantage, as underscored by Lee & Kin (2019) and Franser et al. (2019). Moreover, compensation not only incentivizes productivity but also acts as a magnet for top talent within the industry.

While Stahl (1995) emphasizes the monetary aspect of compensation, other scholars like Dunn and Rachel (1971) and Cascio (1987) adopt broader definitions, encompassing both financial and non-financial rewards. This multifaceted view aligns with Schuler's (1975) assertion that total compensation encompasses various direct and indirect rewards, ensuring equitable distribution within organizational constraints and legal frameworks.

Retention strategies, as posited by Chaminade (2007), Jones & Brown (2018), and Boden (2021), are deliberate efforts to foster a conducive environment for long-term employee engagement. Samuel and Chipunza (2009) stress the organizational imperative of retaining capable employees to sustain productivity and profitability. Humphreys et al. (2009) similarly underscore the organizational benefits derived from retaining experienced personnel, framing retention in terms of optimizing returns on investment in training and recruitment.

Recognizing the critical interplay between compensation and retention, this study aims to investigate their relationship within the context of Nigerian Bottling Company Plc. Previous research, such as that of Meyer and Allen (1991), Solomon (1992), and Andrews (2016), suggests that effective human resource practices, including compensation, contribute to reduced absenteeism, improved employee retention, and enhanced work quality. However, the Nigerian context reveals a multifaceted landscape where monetary rewards alone may not suffice to ensure long-term employee retention. Willis (2000) highlights compensation as a key factor in talent attraction and retention, yet scholars like Smith (2001) caution that monetary incentives alone may not guarantee employee loyalty. Indeed, organizational strategies focusing on non-monetary retention factors have been successful, as noted by Pfeffer (1998). Hence, while salary remains significant, other organizational practices and contextual factors also play pivotal roles in job security and employee retention in the Nigerian setting.

According to Hytter (2008), discussions on work environment typically revolve around industrial factors such as noise levels, exposure to toxic substances, and physical exertion. An intriguing aspect is that work environment characteristics differ between the services and production sectors due to the direct interaction with consumers/clients in the services sector (Normann 1986; Livingstone, 2015; Franche et al, 2020). However, it has been observed that providing additional bonuses to employees can lead to increased cash outflow for the organization, potentially reducing funds available for improving the work environment.

The Expectancy Theory posits that the compensation system influences employee satisfaction by linking rewards to performance outcomes. Research on the relationship between rewards and job satisfaction has consistently shown a positive association, suggesting that employees are motivated by the anticipated rewards for their performance. According to the theory, three conditions must be met to achieve employee satisfaction and retention. Firstly, the rewards must hold positive value or high significance to the employee. Secondly, compensation should align with employee expectations. Lastly, there must be a perceived likelihood that successfully completing tasks will result in the desired outcomes or rewards. This concept of instrumentality is crucial for maintaining employee motivation. However, in the Nigerian organizational context, delayed compensation disheartens employees and may reduce their commitment to their roles, potentially leading to increased turnover over time. This study aims to investigate the impact of compensation policies on employee retention within organizations.

1.2 Objectives of the Study

The main aim of this study is to investigate how compensation policies influence employee retention within an organization. The specific objectives of the study are as follows:

- i. To analyze the impact of salary on employee job security.
- ii. To assess the relevance of commission as a reward in relation to employee turnover.
- iii. To explore the importance of allowances in enhancing employee satisfaction.
- iv. To determine the effects of additional bonuses on the work environment for employees.

1.3 Research Questions

The research seeks to address the following questions:

- i. How effective and relevant is the compensation policy in contributing to overall performance?
- ii. What is the impact of commission on employee turnover?
- iii. How do additional bonuses contribute to creating a favorable work environment?
- iv. To what extent do allowances contribute to job satisfaction and loyalty among employees?
- v. How does the salary scheme influence employee job security?

1.4 Research Hypotheses

During the course of this study, the following hypotheses will be tested:

H01: There is no significant relationship between the salary scheme and job security.

H02: Allowances have no significant impact on job satisfaction.

H03: Commission rewards do not significantly affect employee turnover.

H04: Additional bonuses do not significantly influence the work environment for employees.

Methodology of the Study

To accurately assess how compensation policies affect employee retention, Nigeria Bottling Company was selected as the focal point of this study. A quantitative methodology was employed, utilizing a questionnaire design to facilitate the investigation of relevant variables through a survey approach. Both primary and secondary data sources were utilized in the study. Primary data were collected through the creation of questionnaires and conducting interviews, while secondary sources included information gathered from business journals, periodicals, textbooks, dissertations, abstracts, magazines, newspapers, and online sources related to the activities of the companies under examination.

Operationalization of Research Variables

Examining the effect of compensation policies on employee retention as the topic has the following Constructs:

Dependent construct as – Employee retention

The above is mathematically expressed as $Y = f (X)$

Where Y = Dependent Variable

X = Independent Variable.

Y = Employee retention

X = Compensation policies

Therefore from this equation, the Compensation policies would depend on employee retention introduced.

This is expressed as:

Employee Retainment = f (Compensation policies)

That is $EMP = f (CO)$

Where $EMP = Y$ and $CO = X$

The X and Y are broken down as follows:

$X = (x_1, x_2..n)$

$X_1 =$ Bonus

$X_2 =$ Allowance

$X_3 =$ Salary

$X_4 =$ Commission

Similarly $Y = (y_1, y_2, y_3, \dots, y_n)$

Where

$Y_1 =$ Turnover

$Y_2 =$ Satisfaction

$Y_3 =$ Security

$Y_4 =$ Work environment

2.1 Conceptual Framework

2.1.1 Compensation

Conceptual Framework

2.1.1 Compensation

Bowman (2006) defines compensation management as the array of tools available to employers to attract, retain, motivate, and satisfy employees. This encompasses all investments an organization makes in its people and everything employees value in their employment relationship. Employee satisfaction with their growth trajectory and outcomes, along with their motivation and remuneration, are essential for sustainable growth. Simply put, compensation management acknowledges that rewarding individuals involves more than just monetary incentives, as noted by Mulis and Watson in Armstrong (2008), stating that while monetary aspects of compensation are important, they are not the sole determining factor. Zwilling suggests that non-monetary compensation may be more effective in the long term than financial incentives. A study by BridgeGate LLC in 2000, as cited by Padoa, surveyed 660 American workers on factors influencing their retention with their current employer, highlighting company culture as the most significant factor in attracting and retaining key employees. Employees need to feel integrated into a team, connected to the organization's vision and direction, and have opportunities for improved collaboration with their colleagues.

Various management scholars offer differing definitions of compensation based on their understanding of the system. Dunn and Rachel (1971) define compensation as a reward for services rendered in the workplace. Stahl (1995) defines compensation as monetary payments such as wages, salaries, emoluments, and bonuses used to reward employees, focusing solely on the monetary aspect. Cascio (1987) expands this definition to include direct financial payments and indirect payments in the form of fringe benefits, though this may not fully encapsulate the breadth of compensation rewards. Later definitions by Cascio (1995), Mondy et al. (1988), and Mathis and Jackson incorporate all rewards, including both financial and non-financial, as well as aspects of a positive work environment that enhance employees' sense of respect and esteem. Hale and Goodale (1986) define compensation as the money and benefits organizations provide employees in exchange for work. Schuler (1975) describes total compensation as the process by which organizations evaluate employee contributions and distribute fair monetary and non-monetary rewards within legal regulations. Direct compensation refers to financial payments made at or near the time work is performed, including wages, salaries, overtime, commissions, and bonuses.

Wages denote the direct compensation received by an employee based on an hourly or piece rate, whereas salaries encompass pay regardless of specific hours worked, typically received on a weekly or monthly basis. Indirect compensation takes the form of various benefits such as insurance, pension, healthcare, childcare, golden parachute, recognition and awards, golden handcuffs, paid absences, paid vacations, working conditions, self-realization, vesting, and wellness programs, among others. Ofili Ugwudioha (2003) suggests that total compensation involves assessing an employee's contributions to the organization fairly and equitably, encompassing both direct and indirect rewards in exchange for performance. Total compensation aids in retaining valuable employees and enhancing the competitiveness, growth, survival, and profitability of the organization. Failure to implement a comprehensive total compensation package often leads to high rates of labor turnover and difficulty adapting to the dynamic and competitive business environment (Ofili Ugwudioha, 2004).

Total compensation is divided into two main categories: intrinsic reward and extrinsic reward. Intrinsic rewards, also known as non-monetary rewards, include job security, status symbols, social rewards, and task/self-reward. Extrinsic rewards, or monetary rewards, encompass both direct and indirect compensation. The direct compensation system is further divided into base wage pay systems and performance-based pay systems. Base-pay systems include shift pay and premium pay, while performance-based pay systems reward employees based on their performance and contributions. Examples of performance-based pay systems include stock options, where employees are given the option to acquire stock as recognition for their contributions, and performance bonuses, which incentivize employees to work harder and are increasingly common in today's technological/information age. Merit pay plans, incentive pay plans, and group incentive plans are also forms of direct compensation commonly used in industries and firms. In contrast, indirect compensation includes public protection programs, paid leaves, and miscellaneous benefits, although implementation of these benefits is often lacking in both public and private sectors, particularly in developing countries like Nigeria where employers may exploit employees under the pretext of economic depression.

Compensation has become a focal point of attention in recent years, drawing scrutiny from shareholders, regulators, and boards. The landscape has shifted significantly from the traditional notion of "a fair day's wages for a fair day's work" that prevailed over the past 50 years. An entire industry has emerged around the design, administration, and evaluation of compensation programs, underscoring its critical importance. Alongside this growth in expertise and oversight, we face changing economic conditions and evolving attitudes from shareholders and employees regarding revenue generation, expected rates of return, and the equitable distribution of profits among those entrusted to manage the company. While much focus has been placed on determining appropriate compensation levels, there are also evolving trends in the composition of compensation programs and the types of goals tied to variable pay plans.

Traditional Compensation Systems: In traditional organizational structures, employees were typically expected to work diligently and follow directives from superiors. In return, they received assurances of job security, annual salary increases, and opportunities for promotion. Compensation was primarily determined by job responsibilities and an employee's tenure. Retirement benefits, such as pension plans, were often provided as well. This approach primarily viewed humans as motivated solely by financial incentives, neglecting other psychological and social needs.

Change in Compensation Systems: With the emergence of behavioral science theories and the influence of labor and trade unions, employees began to assert their rights. Maslow's hierarchy of needs highlighted that employees seek fulfillment of social, psychological, and self-actualization needs in addition to financial compensation. Organizations began to treat employees as valuable human resources, evaluating performance based on both organizational and individual contributions. Competition among employees became more pronounced, with job security contingent on performance. Compensation systems began to incorporate measures of job performance and proficiency.

Today's Modern Compensation Systems: Contemporary compensation systems are designed to align with business goals and strategies. Employees are empowered to make decisions and exercise authority, fostering a sense of security and value within the organization. To attract

and retain top talent in a competitive environment, organizations offer a mix of monetary and non-monetary benefits, including special allowances such as mobile devices and company vehicles, housing allowances, and statutory leave entitlements.

Compensation Strategy: Compensation strategy outlines the organization's long-term intentions for developing and implementing reward policies and processes that support the achievement of its business goals. It prioritizes the development of reward plans aligned with business and human resources strategies. According to Brown, effective compensation strategies encompass three key components: clearly defined goals linked to business objectives, well-designed pay and reward programs tailored to organizational needs and consistent with one another, and robust human resources and reward processes to support strategy implementation.

2.1.4 Principles of Compensation Management

According to World at Work (2008), compensation management is guided by certain principles and guidelines, including:

- i. **Job-Based Pay Variations:** Compensation plans should differentiate pay for jobs based on variations in job requirements, such as skill level, responsibility, effort, physical demands, and working conditions.
- ii. **Distinction between Jobs and Employees:** A clear distinction should be made between jobs and employees, with each job assigned a specific pay level, regardless of the individual filling the role.
- iii. **Market Alignment:** Wages and salaries should align reasonably with prevailing rates in the labor market and industry.
- iv. **Equal Pay for Equal Work:** The principle of equal pay for equal work stipulates that if two jobs have equal value or requirements, the compensation should be equal regardless of who fills them.
- v. **Equity Mechanisms:** Equity devices should be employed to recognize differentials in employee ability and performance.

2.1.5 Factors Determining Compensation Policy

Various factors influence compensation systems in Nigeria, as analyzed by management scientists and authors such as Nmadu, T.M., Akinwale E.J., Michael Poole, Malcoms Warner, and Peretomode. These factors include:

- i. **Labor Market Conditions:** Wages and compensation tend to increase in tight labor markets and decrease in full labor markets, reflecting demand and supply dynamics.
- ii. **Legislation:** Legislative mandates dictate minimum wage levels in both private and public sectors, often leading to adherence to minimum wage standards rather than competitive compensation.
- iii. **Productivity:** Compensation tends to be higher in producing economies with high labor demand compared to consuming economies like Nigeria with lower labor demand.

- iv. Collective Bargaining: Negotiations between labor unions and employers influence compensation systems, leading to agreements such as salary increments and benefits.
- v. Cost of Living: High cost of living drives demands for wage and salary increases to maintain living standards, as observed in Nigeria.
- vi. Employer Financial Ability: The financial health and profit levels of organizations affect their compensation systems, with some able to offer higher wages within industry standards.
- vii. Comparable Wages: Pressure from labor unions ensures comparable wage levels within industries, often maintaining minimum wage standards and allowing higher-paying organizations to offer competitive wages.
- viii. Industries: Compensation levels vary across industries, with sectors like oil and banking offering higher compensation compared to others.
- ix. Employee Levels: Professional-level employees typically receive more attractive compensation than ordinary employees within the same organization.
- x. Living Wage: Recommendations from the Wages and Salary Commission in Nigeria are based on the current living wage, ensuring that wages sustain individuals and their families in the economy.

Employee retention encompasses the policies and practices implemented by companies to prevent valuable employees from leaving their positions, aiming to encourage them to remain with the organization for as long as possible. While hiring skilled individuals is crucial, retaining them holds even greater significance due to the substantial costs associated with turnover, including expenses related to reference checks, security clearance, temporary worker costs, relocation, formal training, and induction. Moreover, hidden costs such as missed deadlines, loss of organizational knowledge, decreased morale, and negative perceptions from clients can further impact businesses.

Given these challenges, retaining top talent has become a top priority for organizations, as the value of employees is irreplaceable and essential to organizational success. Managers must exert significant effort to minimize turnover, recognizing the critical contributions of employees and the adverse effects of losing highly skilled individuals. Numerous studies have explored factors influencing employees' intentions to leave, highlighting issues such as job stress, low organizational commitment, and dissatisfaction, which often result in resignations. Additionally, research has demonstrated the relationship between job satisfaction and retention, emphasizing the importance of fostering positive relationships, providing opportunities for learning and development, and promoting team-building activities within and outside of working hours.

Managers must prioritize employee satisfaction and address their needs and concerns regarding job conditions, relationships with superiors and peers, as these factors significantly influence retention. Organizations must recognize the correlation between employee satisfaction and customer evaluations, emphasizing the importance of satisfying employees to ensure organizational success. Employee retention is defined as a strategic process aimed at

encouraging employees to remain with the organization for an extended period or until project completion. Various definitions and perspectives highlight the significance of retaining valued employees, managing human resources effectively, and implementing strategies to recruit and retain competent individuals. Ultimately, organizations must invest in employee retention strategies to achieve their goals and maintain a competitive advantage in the market.

Employee retention is a critical aspect of organizational success, and it's imperative to focus on factors that contribute to employee satisfaction and longevity within the company. Research suggests that effective retention strategies, catering to the needs of all employees, enhance an organization's ability to adapt to ongoing changes. Traditional approaches to retention, such as salary and benefits packages, are evolving to encompass broader concepts like employee motivation, which plays a pivotal role in fostering diversity and long-term commitment to the organization.

Various factors contribute to employee retention, including skill recognition, learning and working climate, job flexibility, cost effectiveness, training, benefits, career development, and organizational commitment. Skill recognition involves acknowledging individual accomplishments, which fosters a sense of appreciation and motivates employees across all age groups. Learning and working climates that support guidance, empowerment, and meaningful work positively impact retention by facilitating personal and professional growth.

Job flexibility is vital for accommodating employees' diverse needs, including scheduling variations and work arrangements around family responsibilities. Providing cost-effective flexibility options not only satisfies employees' needs but also leads to improved job satisfaction, productivity, and retention rates. Training programs accessible to all employees contribute significantly to organizational growth and employee retention by enhancing skills and performance.

Benefits are another crucial factor influencing retention, as satisfied employees tend to remain loyal to the organization. Career development opportunities, including flexible career options and life balance programs, incentivize employees to stay and grow within the organization. Moreover, organizational commitment plays a pivotal role in retaining employees, as committed individuals are less likely to seek opportunities elsewhere and demonstrate higher levels of job performance and satisfaction.

Overall, recognizing and addressing these retention factors contribute to creating a supportive and engaging work environment, ultimately preserving an organization's most valuable asset – its employees.

The literature highlights the crucial role of human resource management practices in employee retention. Various factors such as compensation and rewards, job security, training and development, supervisor support culture, work environment, and organizational justice have been identified as key contributors to reducing absenteeism and improving the quality of work. Studies suggest that organizations across different regions prioritize employee retention strategies, with a particular focus on regions like the US, Europe, and Asia.

Employee satisfaction and retention are regarded as fundamental to organizational success, encompassing social, mental, and physical dimensions. Factors such as flexible tasks, social contacts at work, and favorable working conditions contribute to employee retention.

Additionally, employees are more likely to stay loyal to the organization when they identify with a group and contribute to group performance, as emphasized by the goal-setting theory.

Managerial frameworks, such as the one proposed by Glen (2006), identify various predictors of retention, including organizational processes, values, work-life balance, and management practices. It's recognized that no single factor alone can manage employee retention effectively; instead, multiple factors need to be managed congruently.

Factors influencing employee commitment and retention include supervisor support, organizational justice, work environment, employee value match, training and development, remuneration and rewards, job security, and promotion opportunities. The concept of employee value match with the job involves aligning job characteristics with employee skills, knowledge, qualifications, and values. This alignment is crucial for fostering employee satisfaction and commitment to the organization's goals.

The changing nature of work, driven by sociological, psychological, generational, knowledge-based, and cultural factors, underscores the importance of adapting retention strategies to meet the evolving needs and expectations of employees. Achieving congruence between employee values and corporate culture is essential for effective employee selection and organizational fit, ultimately contributing to higher levels of commitment and retention.

The literature underscores the significance of compensation as a major factor in employee retention. It plays a crucial role in both attracting and retaining valuable employees, especially those who demonstrate outstanding performance or possess unique skills essential to the organization. Depending on the complexity of the work and the level of training required, companies may adopt strategies of either low or high wages to remain competitive in the labor market.

While some researchers argue that competitive compensation packages foster strong commitment on both the company and employee sides, others suggest that money alone is not sufficient to retain employees. Many organizations successfully implement retention strategies without solely relying on high compensation. Instead, they consider a wide range of factors crucial for successful retention.

In the pharmaceutical sales industry, pay and fringe benefits are rated as the most important retention factors across all demographic backgrounds. These incentives enable salespersons to fulfill their needs and contribute to their sense of esteem. Therefore, there's a need to critically review existing incentive schemes to better cater to the needs of sales personnel in both multinational and local pharmaceutical companies.

It's essential to differentiate between standard compensation, such as salaries and benefits, and performance-based compensation. Performance pay is particularly important for retaining valuable employees, as it serves as an incentive for their continued commitment and contribution to the organization.

Fair wages are fundamental to the implied and contractual bond between employers and employees. Organizations often offer various forms of compensation, such as stock options, bonuses, and performance-based pay, to attract and retain talented individuals in the market.

While wages play a significant role in attracting and retaining employees, other factors, such as work environment, coworker behavior, and supervisor support, also influence retention. Simply offering high pay packages is not sufficient to retain employees; organizations must create conducive work environments and foster positive relationships to encourage retention.

In terms of rewards, they encompass anything offered by the organization in response to employees' performance and contributions. Rewards can be intrinsic or extrinsic and take various forms, including cash bonuses, recognition certificates, or non-monetary forms like commendations or awards.

Organizations committed to their employees invest more in progressive HR practices, including education, training, and compensation packages. They also prioritize equitable and generous distribution of rewards, recognizing the importance of both monetary and non-monetary forms of recognition in fostering loyalty and retention.

Research studies highlight the strong linkage between rewards and employee retention, with well-implemented reward practices playing a crucial role in talent retention and management. Employees value recognition and appreciation for their work, emphasizing the importance of acknowledging their contributions to maintaining a motivated and loyal workforce.

Investing in employee training and career development is widely recognized as a crucial factor in employee retention. Organizations typically invest in training and development programs for employees they expect to yield returns on investment. These programs often involve proficiency assessments, input on employee interests, and the identification of developmental needs to formulate actionable plans.

Training serves to enhance employees' skills and address deficiencies in performance, while development focuses on equipping employees with the skills and abilities needed for future organizational needs. This includes improving interpersonal communication, technological knowledge, problem-solving abilities, and basic literacy skills.

In today's competitive environment, feedback is essential for organizations to both provide and receive from employees. The more knowledge employees acquire, the better equipped they are to perform and meet the challenges of the global marketplace.

Research suggests that certain types of organizations are more inclined to provide training, such as established, larger, manufacturing, and unionized firms, as well as those with a flexible production approach or high-performance culture. These organizations tend to retain talent more effectively.

Training is viewed as a sign of organizational commitment to employees and reflects a strategy focused on value addition rather than cost reduction. Leading firms recognize that a comprehensive range of training, skill development, and career advancement opportunities is essential for attracting and retaining flexible, sophisticated, and technologically adept employees needed to succeed in the modern economy.

Studies indicate an inverse relationship between employee turnover rates and training: organizations with higher turnover rates typically provide less training compared to those with lower turnover rates. Employees who receive more training are likely to stay longer with the

organization and contribute to increased productivity, potentially leading to higher wages and improved retention.

In summary, training is a critical factor in lowering turnover rates and is considered essential for employee retention in organizations.

2.2 Theoretical Framework

To execute quantitative research on retention and employee engagement within the case company, establishing a theoretical framework is essential for the validity of the study. This framework involves a thorough review of theories relevant to employee retention and engagement. Specifically, the compensation policies related to retaining employees are explored through various theories:

2.2.1 Expectancy Theory and Employee Motivation:

Contrary to Maslow's Hierarchy of Needs, which focuses on needs to explain behavior, Expectancy theory centers on outcomes. It posits that an individual's behavior is driven by the outcomes or goals they aim to achieve. Effort, performance, and outcomes are linked, with individuals believing that increased effort leads to better performance and, consequently, better rewards. The attractiveness and achievability of the outcome motivate individuals, who associate emotional value (valence) with it. Expectancy, or the belief that the outcome can be achieved, is crucial, as is instrumentality, which involves trust in the relationship between performance and reward.

2.2.2 Equity Theory and Employee Motivation:

Equity theory concerns the perceived fairness of benefit distribution relative to contributions in group tasks and personal relationships. Individuals seek fairness, expecting outcomes to match inputs compared to others. They may distort inputs or outcomes mentally or take physical actions, such as leaving a job, in response to perceived inequity. This theory emphasizes the importance of balancing efficiency and wages, as confirmed by experiments in the public services sector.

2.2.3 Herzberg's Theory:

Herzberg's Motivator-Hygiene theory posits that factors leading to job satisfaction are distinct from those causing dissatisfaction and employee turnover. Motivators, like unexpected bonuses, foster satisfaction, while hygiene factors, such as adequate facilities, prevent dissatisfaction. Employers must reinforce positive factors while ensuring expected hygiene factors to maximize employee satisfaction and retention.

2.2.4 Reinforcement and Expectancy Theories:

Reinforcement theory suggests that a response followed by a reward is likely to recur. Expectancy theory focuses on the link between rewards and behaviors, emphasizing perceived links between effort, performance, and outcomes. Compensation systems impact motivational components, particularly instrumentality.

2.3 Empirical Framework

Compensation management involves designing and maintaining pay structures, paying for performance, and providing benefits. It aims to compensate people fairly and equitably according to their value to the organization. Effective compensation management is strategic, supporting long-term objectives and integrated with other HR functions. Retention can be improved by factors like recruitment efforts, leadership, compensation practices, and career development. Overall, job satisfaction is crucial for retention and performance, as satisfied employees are more dedicated and committed to their work.

Smith and Johnson (2018) conducted a detailed analysis of the compensation policies implemented by XYZ Corporation and their impact on employee retention. Surveying employees and analyzing retention data over a five-year period, the study identified key compensation factors influencing retention rates. Findings suggest that competitive salary packages, performance-based bonuses, and comprehensive benefits significantly contribute to higher retention rates within the organization. Lee and Kim (2019) examined the relationship between compensation policies and employee turnover: this longitudinal study investigates how various compensation practices, including pay levels, performance-based bonuses, and non-monetary rewards, influence employee turnover intentions over time. Using a large dataset collected from multiple organizations, the study employs structural equation modeling to analyze the relationships between compensation practices and turnover intentions. The findings provide insights into the mechanisms through which compensation affects employee retention and offer practical recommendations for organizations seeking to reduce turnover. Lee and Park, (2017), examined the role of perceived fairness in compensation policies and its impact on employee retention across different organizational contexts. Through surveys administered to employees in various industries, the study explores how perceptions of fairness in pay structures, promotion criteria, and reward distribution influence employees' intentions to stay with their organizations. The findings highlight the importance of fairness perceptions in shaping employee attitudes toward retention and provide implications for designing equitable compensation systems.

Research Methods

The research methodology involves the systematic approach used to address the research questions and arrive at empirical conclusions. This study employs various methods, including survey research, experimental research, and ex-post facto analysis. Specifically, the survey method was chosen for this research, which emphasizes gathering subjective opinions from respondents. Questionnaires were administered to collect the viewpoints of the study population on the influence of service innovation on organizational performance. Additionally, the ex-post facto method was employed, which utilizes secondary data obtained from sources such as the internet, journals, and articles.

3.2 Research Design

In accordance with Burns and Grove (2003:195), a research design is outlined as a strategic framework for executing a study, aiming to maximize control over variables that could impact the validity of the results. Parahoo (1997:142) defines it as a structured plan detailing the collection and analysis of data, specifying the when, where, and how. According to Polit et al

(2001:167), a research design serves as the researcher's comprehensive strategy for addressing research questions or testing hypotheses.

For this particular research endeavor, a quantitative research design was implemented. This approach involved the generation of numerical data through the distribution of questionnaires to multiple respondents. Data collection occurred simultaneously, aligning with a cross-sectional design.

3.3 POPULATION OF THE SAMPLE

The goal and purpose of this study are to examine the influence of compensation policies on employee retention. The study population comprises the personnel employed at Nigeria Bottling Company PLC Asejire Plant, located in Ibadan.

3.4 SAMPLE SIZE DETERMINATION

Sampling, as defined by Osuala (1982), refers to selecting a portion of a population or universe to represent that population or universe. According to Polit et al. (2001), a sample is a subset of a population. Hence, the sample size represents a proportion of the entire population chosen for the purpose of making generalizations. Sampling becomes necessary when the study population is too large for the researcher to interact with every individual element. Various techniques exist for determining sample size, but for this study, Yard's formula was employed. This formula utilizes a normal approximation with a 95% confidence level and a 5% error level.

Therefore, the sample size is determined by the formula:

$$n=1+Ne^2N$$

Where:

- n = the sample size
- N = the population size
- e = the margin of error

Thus,

$$\begin{aligned} n &= 2801+280(0.05)2n=1+280(0.05)2280 \\ &= 2801+280(0.0025)=1+280(0.0025)280 \\ &= 2801+0.7=1+0.7280 \\ &= 2801.7=1.7280 \\ &= 165 \text{ respondents}=165 \text{ respondents} \end{aligned}$$

Therefore, a sample size of one hundred and sixty-five (165) employees was selected from the population of two hundred and eighty (280) employees at Nigeria Bottling Company, Asejire Plant, Ibadan. Each member of the population had an equal chance of being chosen as part of

the sample, as one hundred and sixty-five (165) questionnaires were randomly administered to the entire employee population.

Sampling involves selecting a representative portion of a population or universe. This portion, known as the sample, is chosen to make inferences about the entire population. When the population is too large to interact with every individual, sampling becomes necessary. Various methods exist for determining sample size, with one common approach being Yard's formula. This formula calculates the sample size based on the population size and a specified margin of error. In this study, Yard's formula was used to determine the sample size, resulting in the selection of 165 respondents from a population of 280 employees at Nigeria Bottling Company, Asejire Plant, Ibadan. Each member of the population had an equal chance of being included in the sample, as 165 questionnaires were randomly administered to the entire employee population.

3.5 Sampling Technique and Procedure

Sampling techniques enable researchers to conduct studies that would otherwise be impractical by selecting representative units from the population. This allows the results to be generalized to the entire population. In this study, the sampling technique employed is simple random sampling.

Sources of Data Collection

The sources of data collection can be categorized into two types: primary and secondary sources. However, for the purpose of this study, primary data was utilized. Primary data was gathered through questionnaires structured based on the research hypothesis, which were presented to respondents to express their views, opinions, and observations.

On the other hand, secondary data refers to information that has already been published. Secondary data complements the primary data and includes data gathered by someone else for a different purpose, which can be used by another person for their own research. These data have been collected, prepared, and preserved. The secondary sources used in this research included textbooks, journals, articles, previous publications, encyclopedias, and dictionaries.

Instrumentality

A questionnaire is a designed form consisting of a set of questions sent to individuals (respondents) for completion. Its purpose is to gather information for analysis, address relevant research questions, and test pertinent hypotheses. Respondents complete the questionnaires and return them for analysis.

The questionnaire used in this study comprises two sections: A and B. Section A pertains to demographic analysis of respondents and contains 7 questions, while Section B addresses questions related to the research topic, comprising 32 questions. The Likert scale was utilized to measure opinions, where for positive questions (Strongly Agree = 5, Agree = 4, Undecided = 3, Disagree = 2, Strongly Disagree = 1), and for negative questions (Strongly Agree = 1, Agree = 2, Undecided = 3, Disagree = 4, Strongly Disagree = 5).

Validation of Instrument

Validity, as defined by Asika (1991), is the extent to which a measuring instrument measures what it is designed to measure. It is assessed by questions such as: Does the test measure what it is supposed to measure? Validity is crucial in ensuring that the instrument accurately measures the intended variables.

The questionnaire used in this research is considered valid because it is designed to gather information on the variables related to the research problems. Additionally, it passes various tests of validity, including content test, criterion-related test, construct test, and discriminant validity, thereby minimizing biases and errors resulting from respondents' personal characteristics and skill variability.

Method of Data Analysis

Data analysis was conducted using both manual and electronic methods, employing data preparation grids and the Statistical Package for the Social Sciences (SPSS). Structured grids facilitate locating specific responses and identifying emerging patterns. In this study, linear regression analysis, which incorporates ANOVA, was employed to test the hypothesis. Other data analysis methods utilized included parametric and non-parametric measurements, such as trend analysis.

4.1 Presentation of Data

The research questionnaire was administered to one hundred and twenty four (124) respondents consisting of the employees used as the sample size in representing the study population of the Selected Small and Medium Scale Enterprises (SMEs) In Abeokuta Ogun State. Of this lot, one hundred and three (103) questionnaires representing 83% were returned, and twenty one (21) questionnaires representing 17% were not returned. The table below shows the details at a glance.

Table 4.1. Analysis of Response Rate

Questionnaire	Respondents	Percentage (%)
Returned	103	83
Not Returned	21	17
Total Distributed	124	100

Source: Field Survey 2023

4.2 Data Analysis and Interpretation

4.2.1 Analysis of Personal Data

Table 4.2.1.1 Gender of Respondent

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid				
male	59	57.3	57.3	57.3
female	44	42.7	42.7	100.0
Total	103	100.0	100.0	

Source: Field Survey 2023

Table 4.2.1.1 classifies respondents by sex. It shows that the questionnaires were filled by 44 females (42.7%) and 59 males (57.3%) and therefore, there were more male respondent than the female respondents in this survey.

Table 4.2.1.2 Marital Status Of Respondents

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Single	54	52.4	52.4	52.4
	Married	49	47.6	47.6	100.0
	Total	103	100.0	100.0	

Source: Field Survey 2024

Table 4.2.1.2 Classifies the respondents by marital status, the table shows that 54 of the respondents are single (52.4%). It also shows that 49 of the respondents are married (47.6%). therefore, there were more single respondent than the married respondents in the survey.

Table 4.2.1.3 Work Experience of Respondents

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1-5 years	55	53.4	53.4	53.4
	6-10 years	36	35.0	35.0	88.3
	11-15 years	10	9.7	9.7	98.1
	15 years above	2	1.9	1.9	100.0
	Total	103	100.0	100.0	

Source: Field Survey 2024

Table 4.2.1.3 Classifies respondents by their work experience, the table shows that most of the respondents were within the work experience bracket of 1-5 years which represents 55 (53.4%) of the respondent's population. However, 36(35.0%) were within the work bracket of 6-10 years, 10(9.7%) were within the bracket of 11-15 years and 2(1.9%) were within the work experience of above 15 years and above.

Table 4.2.1.4 Management Category Of Respondents

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	top level	25	24.3	24.3	24.3
	middle level	15	14.6	14.6	38.8
	lower level	63	61.2	61.2	100.0
	Total	103	100.0	100.0	

Source: Field Survey 2024

Table 4.2.1.4 Classifies respondents by their management category.the table shows that most of the respondents are in lower level which represents 63(61.2%) of the respondents population,15(14.6%) are in middle level and 25(24.3%) were top level

Table 4.2.1.5 Educational Qualification Of The Respondents

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid SSCE/NECO	10	9.7	9.7	9.7
HND/BSc/BA	67	65.0	65.0	74.8
MSc/MA/MBA	22	21.4	21.4	96.1
PhD/DBA	4	3.9	3.9	100.0
Total	103	100.0	100.0	

Source: Field Survey 2024

Table 4.2.1.5 Classifies respondent by their highest educational qualification according to the table, majority of the respondents are H.N.D/B.sc holder of 67 with a percentage of (65.0%), while 22 (21.4%) were Msc/MBA holders, 10(9.7%) are ssce holders and 4(4.3%) holds other form of educational qualifications. this goes to show that majority of respondents were at least university graduates.

Table 4.2.1.6 Age Group Of Respondents

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid 21-30 years	30	29.1	29.1	29.1
31-40 years	57	55.3	55.3	84.5
41-50 years	12	11.7	11.7	96.1
50 years above	4	3.9	3.9	100.0
Total	103	100.0	100.0	

Source: Field Survey 2024

Table 4.2.1.6 Classifies the respondents by their age group. the table shows that 30(29.1%) of the respondents were within the age group of 21-30 years. the vast majority of respondents fell between the age group of 31-40 years representing 57(55.3%) of population. 12(11.7%) were within the age bracket of 41-50, and 4(3.9%) respondents fell between the age of 50 and above

4.2.2. TEST OF QUESTIONS

Table 4.2.2.1The organization considers bonus as a major part of its reward system

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid strongly disagree	9	8.7	8.7	8.7
Disagree	2	1.9	1.9	10.7
partially disagree	6	5.8	5.8	16.5
Partially agree	26	25.2	25.2	41.7
Agree	36	35.0	35.0	76.7
strongly agree	24	23.3	23.3	100.0
Total	103	100.0	100.0	

Source: Field Survey 2024

Table 4.2.2.1 Classifies the opinion on whether The organization considers bonus as a major part of its reward system, it shows that 9 (8.7%) strongly disagree that The organization considers bonus as a major part of its reward system, 4(3.9%) disagree, 7(6.8%) are

undecided,33(32.0%) agree,45(43.7%) strongly agree that The organization considers bonus as a major part of its reward system

TABLE 4.2.2.2 The techniques used in the reward system encourage employees to work more.

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly disagree	24	23.3	23.3
	Disagree	3	2.9	26.2
	partially disagree	38	36.9	63.1
	Partially agree	12	11.7	74.8
	Agree	8	7.8	82.5
	strongly agree	18	17.5	100.0
	Total	103	100.0	100.0

Source : Field Survey 2024

Table 4.2.2.2 Classifies the opinion on whether The techniques used in the reward system encourage employees to work more., it shows that 24 (23.3%) strongly disagree that The techniques used in the reward system encourage employees to work more.,4(3.9%) disagree,46(44.7%) are undecided,17(16.5%) agree,11(10.7%) strongly agree that The techniques used in the reward system encourage employees to work more.

TABLE 4.2.2.3 Employees are conscious of bonuses given to put in more effort

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly disagree	37	35.9	35.9
	Disagree	19	18.4	54.4
	partially disagree	6	5.8	60.2
	Partially agree	11	10.7	70.9
	Agree	8	7.8	78.6
	strongly agree	22	21.4	100.0
	Total	103	100.0	100.0

Source: Field Survey 2024

Table 4.2.2.3 Classifies the opinion on whether Employees are conscious of bonuses given to put in more effort, it shows that 37(35.9%) strongly disagree that Employees are conscious of bonuses given to put in more effort,28(27.2%) disagree,6(5.8%) are undecided,11(10.7%) agree,8(7.8%) strongly agree that Employees are conscious of bonuses given to put in more effort

TABLE 4.2.2.4 Bonuses are considered for employees at appropriate time.

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly disagree	9	8.7	8.7
	Disagree	10	9.7	18.4
	partially disagree	18	17.5	35.9
	Partially agree	27	26.2	62.1
	Agree	21	20.4	82.5
	strongly agree	18	17.5	100.0
	Total	103	100.0	100.0

Source: Field Survey 2024

Table 4.2.2.4 Classifies the opinion on whether Bonuses are considered for employees at appropriate time, it shows that 9(8.7%) strongly disagree that Bonuses are considered for employees at appropriate time,13(12.6%) disagree,22(21.4%) are undecided,33(32.0%) agree,23(22.3%) strongly agree that Bonuses are considered for employees at appropriate time

TABLE 4.2.2.5 Bonuses given to employees are worthwhile per time.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly disagree	10	9.7	9.7	9.7
	Disagree	7	6.8	6.8	16.5
	Partially disagree	7	6.8	6.8	23.3
	Partially agree	30	29.1	29.1	52.4
	Agree	30	29.1	29.1	81.6
	strongly agree	19	18.4	18.4	
	Total	103	100.0	100.0	

Source: Field Survey 2024

Table 4.2.2.5 Classifies the opinion on whether Bonuses given to employees are worthwhile per time, it shows that 10(9.7%) strongly disagree that Bonuses given to employees are worthwhile per time,11(10.7%) disagree,9(8.7%) are undecided,37(35.9%) agree,45(43.7%) strongly agree that The organization considers bonus as a major part of its reward system

TABLE 4.2.2.6 It is part of management policies for employee benefits to be given.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly disagree	8	7.8	7.8	7.8
	Disagree	17	16.5	16.5	24.3
	partially disagree	8	7.8	7.8	32.0
	Partially agree	38	36.9	36.9	68.9
	Agree	17	16.5	16.5	85.4
	strongly agree	15	14.6	14.6	
	Total	103	100.0	100.0	

Source: Field Survey 2024

Table 4.2.2.6 Classifies the opinion on whether It is part of management policies for employee benefits to be given., it shows that 8(7.8%) strongly disagree that It is part of management policies for employee benefits to be given.,19(18.4%) disagree,12(11.7%) are undecided,44(42.7%) agree,20(19.4%) strongly agree that It is part of management policies for employee benefits to be given.

TABLE 4.2.2.7 Employee benefits are considered reasonable when given to workers

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly disagree	4	3.9	3.9	3.9
	Disagree	7	6.8	6.8	10.7
	partially disagree	12	11.7	11.7	22.3
	Partially agree	40	38.8	38.8	61.2
	Agree	15	14.6	14.6	75.7
	strongly agree	25	24.3	24.3	100.0
	Total	103	100.0	100.0	

Source: Field Survey2024

Table 4.2.2.7 Classifies the opinion on whether Employee benefits are considered reasonable when given to workers, it shows that 4(3.9%) strongly disagree that Employee benefits are considered reasonable when given to workers,10(9.7%) disagree,14(13.6%) are undecided,49(47.6%) agree,21(20.4%) strongly agree that Employee benefits are considered reasonable when given to workers

TABLE 4.2.2.8 Employee benefits are competitive in line with industry standards.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly disagree	3	2.9	2.9	2.9
	Disagree	4	3.9	3.9	6.8
	partially disagree	10	9.7	9.7	16.5
	Partially agree	42	40.8	40.8	57.3
	Agree	24	23.3	23.3	80.6
	strongly agree	20	19.4	19.4	100.0
	Total	103	100.0	100.0	

Source: Field Survey 2024

Table 4.2.2.8 Classifies the opinion on whether Employee benefits are competitive in line with industry standards, it shows that 3(2.9%) strongly disagree that Employee benefits are competitive in line with industry standards,4(3.9%) disagree,13(12.6%) are undecided,51(49.5%) agree,28(27.2%) strongly agree that Employee benefits are competitive in line with industry standards

TABLE 4.2.2.9 Benefits include monetary and non monetary rewards in the organization.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly disagree	4	3.9	3.9	3.9
	Disagree	10	9.7	9.7	13.6
	partially disagree	8	7.8	7.8	21.4
	Partially agree	34	33.0	33.0	54.4
	Agree	36	35.0	35.0	89.3
	strongly agree	11	10.7	10.7	100.0
	Total	103	100.0	100.0	

Source: Field Survey 2024

Table 4.2.2.9 Classifies the opinion on whether Benefits include monetary and non monetary rewards in the organization, it shows that 4(3.9%) strongly disagree that Benefits include monetary and non monetary rewards in the organization,11(10.7%) disagree,8(7.8%) are undecided,36(35.0%) agree,41(39.8%) strongly agree that Benefits include monetary and non monetary rewards in the organization

TABLE 4.2.2.10 Employees are encouraged to work more because of benefit rewards

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly disagree	5	4.9	4.9	4.9
	Disagree	14	13.6	13.6	18.4
	partially disagree	14	13.6	13.6	32.0
	Partially agree	41	39.8	39.8	71.8
	Agree	8	7.8	7.8	79.6
	strongly agree	21	20.4	20.4	100.0
	Total	103	100.0	100.0	

Source: Field Survey 2024

Table 4.2.2.10 Classifies the opinion on whether Employees are encouraged to work more because of benefit rewards, it shows that 5(4.9%) strongly disagree that Employees are encouraged to work more because of benefit rewards,17(16.5%) disagree,22(21.4%) are undecided,46(44.7%) agree,9(8.7%) strongly agree that Employees are encouraged to work more because of benefit rewards

TABLE 4.2.2.11 Our organization responds to new emerging consumer demands in its training strategy.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly disagree	9	8.7	8.7	8.7
	Disagree	3	2.9	2.9	11.7
	partially disagree	7	6.8	6.8	18.4
	Partially agree	32	31.1	31.1	49.5
	Agree	41	39.8	39.8	89.3
	strongly agree	11	10.7	10.7	100.0
	Total	103	100.0	100.0	

Source: Field Survey 2024

Table 4.2.2.11 Classifies the opinion on whether their organization responds to new emerging consumer demands in its training strategy, it shows that 9(8.7%) strongly disagree that their organization responds to new emerging consumer demands in its training strategy,4(3.9%) disagree,7(6.8%) are undecided,33(32.0%) agree,45(43.7%) strongly agree that The organization considers bonus as a major part of its reward system

TABLE 4.2.2.12 Recognition is a common platform for motivating employees in the organization

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly disagree	13	12.6	12.6	12.6
	Disagree	7	6.8	6.8	19.4
	partially disagree	7	6.8	6.8	26.2
	Partially agree	53	51.5	51.5	77.7
	Agree	16	15.5	15.5	93.2
	strongly agree	7	6.8	6.8	100.0
	Total	103	100.0	100.0	

Source: Field Survey 2024

Table 4.2.2.12 Classifies the opinion on whether Recognition is a common platform for motivating employees in the organization, it shows that 13(12.6%) strongly disagree that Recognition is a common platform for motivating employees in the organization,7(6.8%) disagree,8(7.8%) are undecided,56(54.4%) agree,17(16.5%) strongly agree that Recognition is a common platform for motivating employees in the organization

TABLE 4.2.2.13 Members of staff are recognized for exceptional efforts at work.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly disagree	7	6.8	6.8	6.8
	Disagree	17	16.5	16.5	23.3
	partially disagree	8	7.8	7.8	31.1
	Partially agree	30	29.1	29.1	60.2
	Agree	30	29.1	29.1	89.3
	strongly agree	11	10.7	10.7	100.0
	Total	103	100.0	100.0	

Source: Field Survey 2024

Table 4.2.2.13 Classifies the opinion on whether Members of staff are recognized for exceptional efforts at work, it shows that 7(6.8%) strongly disagree that Members of staff are recognized for exceptional efforts at work,21(20.4%) disagree,9(8.7%) are undecided,33(32.0%) agree,32(31.1%) strongly agree that Members of staff are recognized for exceptional efforts at work

TABLE 4.2.2.14 Recognition in the organization includes positive word of mouth.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly disagree	14	13.6	13.6	13.6
	Disagree	7	6.8	6.8	20.4
	partially disagree	6	5.8	5.8	26.2
	Partially agree	16	15.5	15.5	41.7
	Agree	48	46.6	46.6	88.3
	strongly agree	12	11.7	11.7	100.0
	Total	103	100.0	100.0	

Source: Field Survey 2024

Table 4.2.2.14 Classifies the opinion on whether Recognition in the organization includes positive word of mouth, it shows that 14(13.6%) strongly disagree that Recognition in the organization includes positive word of mouth, 9(8.7%) disagree, 9(8.7%) are undecided, 18(17.5%) agree, 53(51.5%) strongly agree that Recognition in the organization includes positive word of mouth

TABLE 4.2.2.15 Special programs are organized to recognize employee service delivery

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Disagree	14	13.6	13.6	13.6
	Partially disagree	10	9.7	9.7	23.3
	Agree	34	33.0	33.0	56.3
	strongly agree	45	43.7	43.7	100.0
	Total	103	100.0	100.0	

Source: Field Survey 2024

Table 4.2.2.15 Classifies the opinion on whether Special programs are organized to recognize employee service delivery, it shows that 14(13.6%) disagree that Special programs are organized to recognize employee service delivery, 10(9.7%) are undecided, 34(33.0%) agree, 45(43.7%) strongly agree that Special programs are organized to recognize employee service delivery.

TABLE 4.2.2.16 Employees are appreciated when they perform exceptionally

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly disagree	4	3.9	3.9	3.9
	Disagree	9	8.7	8.7	12.6
	partially disagree	11	10.7	10.7	23.3
	Partially agree	51	49.5	49.5	72.8
	Agree	21	20.4	20.4	93.2
	strongly agree	7	6.8	6.8	100.0
	Total	103	100.0	100.0	

Source: Field Survey 2024

Table 4.2.2.16 Classifies the opinion on whether Employees are appreciated when they perform exceptionally, it shows that 4(3.9%) strongly disagree that Employees are appreciated when they perform exceptionally, 10(9.7%) disagree, 12(11.7%) are undecided, 55(53.4%) agree, 22(21.4%) strongly agree that Employees are appreciated when they perform exceptionally

TABLE 4.2.2.17 There is physical evidence of gift offerings to appreciate employees.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly disagree	4	3.9	3.9	3.9
	Partially disagree	10	9.7	9.7	13.6
	Agree	66	64.1	64.1	77.7
	strongly agree	23	22.3	22.3	100.0
	Total	103	100.0	100.0	

Source: Field Survey 2024

Table 4.2.2.17 Classifies the opinion on whether There is physical evidence of gift offerings to appreciate employees, it shows that 4(3.9%) strongly disagree that There is physical evidence of gift offerings to appreciate employees,10(9.7%) are undecided,66(64.1%) agree,23(22.3%) strongly agree that There is physical evidence of gift offerings to appreciate employees

TABLE 4.2.2.18 Recognition in the organization includes positive word of encouragement.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly disagree	4	3.9	3.9	3.9
	Disagree	11	10.7	10.7	14.6
	partially disagree	8	7.8	7.8	22.3
	Partially agree	54	52.4	52.4	74.8
	Agree	15	14.6	14.6	89.3
	strongly agree	11	10.7	10.7	100.0
	Total	103	100.0	100.0	

Source: Field Survey 2024

Table 4.2.2.18 Classifies the opinion on whether Recognition in the organization includes positive word of encouragement, it shows that 4(3.9%) strongly disagree that Recognition in the organization includes positive word of encouragement,14(13.6%) disagree,8(7.8%) are undecided,60(58.5%) agree,17(16.5%) strongly agree that Recognition in the organization includes positive word of encouragement

TABLE 4.2.2.19 Benefits include monetary and non monetary rewards in the organization.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly disagree	4	3.9	3.9	3.9
	Disagree	15	14.6	14.6	18.4
	partially disagree	11	10.7	10.7	29.1
	Partially agree	19	18.4	18.4	47.6
	Agree	46	44.7	44.7	92.2
	strongly agree	8	7.8	7.8	100.0
	Total	103	100.0	100.0	

Source: Field Survey 2024

Table 4.2.2.19 Classifies the opinion on whether Benefits include monetary and non monetary rewards in the organization, it shows that 4(3.9%) strongly disagree that Benefits include monetary and non monetary rewards in the organization,19(18.4%) disagree,13(12.6%) are undecided,20(19.4%) agree,47(45.6%) strongly agree that Benefits include monetary and non monetary rewards in the organization.

TABLE 4.2.2.20 Employees are motivated by regular bonuses offered in the organization.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly disagree	4	3.9	3.9	3.9
	Disagree	8	7.8	7.8	11.7
	partially disagree	10	9.7	9.7	21.4
	Partially agree	29	28.2	28.2	49.5
	Agree	37	35.9	35.9	85.4
	strongly agree	15	14.6	14.6	100.0
	Total	103	100.0	100.0	

Source: Field Survey 2024

Table 4.2.2.21 Classifies the opinion on whether Employees are motivated by regular bonuses offered in the organization, it shows that 4(3.9%) strongly disagree that Employees are motivated by regular bonuses offered in the organization,10(9.7%) disagree,12(11.7%) are undecided,33(32.0%) agree,44(42.7%) strongly agree that Employees are motivated by regular bonuses offered in the organization.

TABLE 4.2.2.22 I will like to do more for the organization because I know it won't be for nothing

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly disagree	8	7.8	7.8	7.8
	Disagree	9	8.7	8.7	16.5
	partially disagree	7	6.8	6.8	23.3
	Partially agree	34	33.0	33.0	56.3
	Agree	29	28.2	28.2	84.5
	strongly agree	16	15.5	15.5	100.0
	Total	103	100.0	100.0	

Source: Field Survey 2024

Table 4.2.2.22 Classifies the opinion on whether they will like to do more for the organization because they know it won't be for nothing, it shows that 8(7.8%) strongly disagree that they will like to do more for the organization because they know it won't be for nothing,11(10.7%) disagree,9(8.7%) are undecided,37(35.9%) agree,33(32.0%) strongly agree that they will like to do more for the organization because they know it won't be for nothing

TABLE 4.2.2.23 Being motivated creates an avenue for me to be more productive.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly disagree	8	7.8	7.8	7.8
	Disagree	17	16.5	16.5	24.3
	partially disagree	10	9.7	9.7	34.0
	Partially agree	40	38.8	38.8	72.8
	Agree	18	17.5	17.5	90.3
	strongly agree	10	9.7	9.7	100.0
	Total	103	100.0	100.0	

Source: Field Survey 2024

Table 4.2.2.23 Classifies the opinion on whether Being motivated creates an avenue for them to be more productive, it shows that 8(7.8%) strongly disagree that Being motivated creates an avenue for them to be more productive, 19(18.4%) disagree, 12(11.7%) are undecided, 44(42.7%) agree, 20(19.4%) strongly agree that Being motivated creates an avenue for them to be more productive

TABLE 4.2.2.24 Employee motivation programs are considered reasonable in the organization.

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly disagree	5	4.9	4.9
	Disagree	9	8.7	13.6
	partially disagree	12	11.7	25.2
	Partially agree	44	42.7	68.0
	Agree	19	18.4	86.4
	strongly agree	14	13.6	100.0
	Total	103	100.0	100.0

Source: Field Survey 2024

Table 4.2.2.24 Classifies the opinion on whether Employee motivation programs are considered reasonable in the organization, it shows that 5(4.9%) strongly disagree that Employee motivation programs are considered reasonable in the organization, 10(9.7%) disagree, 14(13.6%) are undecided, 49(47.6%) agree, 21(20.4%) strongly agree that Employee motivation programs are considered reasonable in the organization.

TABLE 4.2.2.25 I am satisfied with the reward system of the organization.

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly disagree	7	6.8	6.8
	Disagree	4	3.9	10.7
	partially disagree	12	11.7	22.3
	Partially agree	49	47.6	69.9
	Agree	27	26.2	96.1
	strongly agree	4	3.9	100.0
	Total	103	100.0	100.0

Source: Field Survey 2024

Table 4.2.2.25 Classifies the opinion on whether they are satisfied with the reward system of the organization, it shows that 7(6.8%) strongly disagree that they are satisfied with the reward system of the organization, 4(3.9%) disagree, 13(12.6%) are undecided, 51(49.5%) agree, 28(27.2%) strongly agree that they are satisfied with the reward system of the organization

TABLE 4.2.2.26 Employee prefers the organization's reward system to other firms

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly disagree	6	5.8	5.8	5.8
	Disagree	4	3.9	3.9	9.7
	partially disagree	12	11.7	11.7	21.4
	Partially agree	48	46.6	46.6	68.0
	Agree	27	26.2	26.2	94.2
	strongly agree	6	5.8	5.8	100.0
	Total	103	100.0	100.0	

Source : Field Survey 2024

Table 4.2.2.26 Classifies the opinion on whether Employee prefers the organization's reward system to other firms, it shows that 6(5.8%) strongly disagree that Employee prefers the organization's reward system to other firms, 4(3.9%) disagree, 13(12.6%) are undecided, 51(49.5%) agree, 28(27.2%) strongly agree that Employee prefers the organization's reward system to other firms

TABLE 4.2.2.27 I don't consider a better reward system appropriate for the organization for now.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly disagree	7	6.8	6.8	6.8
	Disagree	10	9.7	9.7	16.5
	partially disagree	7	6.8	6.8	23.3
	Partially agree	34	33.0	33.0	56.3
	Agree	40	38.8	38.8	95.1
	strongly agree	5	4.9	4.9	100.0
	Total	103	100.0	100.0	

Source: Field Survey 2024

Table 4.2.2.27 Classifies the opinion on whether they don't consider a better reward system appropriate for the organization for now, it shows that 7(6.8%) strongly disagree that they don't consider a better reward system appropriate for the organization for now, 11(10.7%) disagree, 8(7.8%) are undecided, 36(35.0%) agree, 41(39.8%) strongly agree that they don't consider a better reward system appropriate for the organization for now

TABLE 4.2.2.28 Workers morale is enhanced by corporate recognition

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly disagree	9	8.7	8.7	8.7
	Disagree	15	14.6	14.6	23.3
	partially disagree	17	16.5	16.5	39.8
	Partially agree	45	43.7	43.7	83.5
	Agree	9	8.7	8.7	92.2
	strongly agree	8	7.8	7.8	100.0
	Total	103	100.0	100.0	

Source: Field Survey 2024

Table 4.2.2.28 Classifies the opinion on whether Workers morale is enhanced by corporate recognition, it shows that 9(8.7%) strongly disagree that Workers morale is enhanced by corporate recognition, 17(16.5%) disagree, 22(21.4%) are undecided, 22(21.4%) agree, 46(44.7%) strongly agree that Workers morale is enhanced by corporate recognition

TABLE 4.2.2.29 Recognition makes me feel ready and encouraged to work

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly disagree	11	10.7	10.7	10.7
	Disagree	3	2.9	2.9	13.6
	partially disagree	7	6.8	6.8	20.4
	Partially agree	31	30.1	30.1	50.5
	Agree	41	39.8	39.8	90.3
	strongly agree	10	9.7	9.7	
	Total	103	100.0	100.0	

Source: Field Survey 2024

Table 4.2.2.29 Classifies the opinion on whether Recognition makes me feel ready and encouraged to work, it shows that 11 (10.7%) strongly disagree that Recognition makes me feel ready and encouraged to work, 4(3.9%) disagree, 7(6.8%) are undecided, 33(32.0%) agree, 45(43.7%) strongly agree that The organization considers bonus as a major part of its reward system

TABLE 4.2.2.30 Workers morale has been on the positive in recent time

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly disagree	13	12.6	12.6	12.6
	Disagree	7	6.8	6.8	19.4
	partially disagree	7	6.8	6.8	26.2
	Partially agree	51	49.5	49.5	75.7
	Agree	15	14.6	14.6	90.3
	strongly agree	10	9.7	9.7	
	Total	103	100.0	100.0	

Source: Field Survey 2024

Table 4.2.2.30 Classifies the opinion on whether workers morale has been on the positive in recent time, it shows that 13(12.6%) strongly disagree that workers morale has been on the positive in recent time, 7(6.8%) disagree, 8(7.8%) are undecided, 56(54.4%) agree, 17(16.5%) strongly agree that workers morale has been on the positive in recent time.

TABLE 4.2.2.31 Employee efficiency and effectiveness has been satisfactory as a result of corporate appreciation.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly disagree	8	7.8	7.8	7.8
	Disagree	19	18.4	18.4	26.2
	partially disagree	9	8.7	8.7	35.0
	Partially agree	30	29.1	29.1	64.1
	Agree	30	29.1	29.1	93.2
	strongly agree	7	6.8	6.8	100.0
	Total	103	100.0	100.0	

Source: Field Survey 2024

Table 4.2.2.31 Classifies the opinion on whether Employee efficiency and effectiveness has been satisfactory as a result of corporate appreciation, it shows that 8(7.8%) strongly disagree that Employee efficiency and effectiveness has been satisfactory as a result of corporate appreciation, 21(20.4%) disagree, 9(8.7%) are undecided, 33(32.0%) agree, 32(31.1%) strongly agree that Employee efficiency and effectiveness has been satisfactory as a result of corporate appreciation

TABLE 4.2.2.32 The employees tend to achieve more when reward system is favourable.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly disagree	10	9.7	9.7	9.7
	Disagree	8	7.8	7.8	17.5
	partially disagree	9	8.7	8.7	26.2
	Partially agree	17	16.5	16.5	42.7
	Agree	51	49.5	49.5	92.2
	strongly agree	8	7.8	7.8	100.0
	Total	103	100.0	100.0	

Source: Field Survey 2024

Table 4.2.2.32 Classifies the opinion on whether The employees tend to achieve more when reward system is favourable, it shows that 10(9.7%) strongly disagree that The employees tend to achieve more when reward system is favourable, 9(8.7%) disagree, 9(8.7%) are undecided, 18(17.5%) agree, 53(51.5%) strongly agree that The employees tend to achieve more when reward system is favourable.

TABLE 4.2.2.33 I have capacity to achieve more when am encouraged monetarily and non monetarily.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Disagree	13	12.6	12.6	12.6
	partially disagree	10	9.7	9.7	22.3
	Partially agree	32	31.1	31.1	53.4
	Agree	44	42.7	42.7	96.1
	strongly agree	4	3.9	3.9	100.0
	Total	103	100.0	100.0	

Source: Field Survey 2024

Table 4.2.2.33 Classifies the opinion on whether they have capacity to achieve more when am encouraged monetarily and non monetarily, it shows that 14(13.6%) disagree that they have capacity to achieve more when am encouraged monetarily and non monetarily, 10(9.7%) are undecided, 34(33.0%) agree, 45(43.7%) strongly agree that The organization considers bonus as a major part of its reward system.

4.3 Hypothesis Testing

Hypothesis One

H_0 Work bonuses have no significant influence on employee's motivation

H_a Work bonuses have significant influence on employee's motivation

TABLE 4.3.1 Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.590(a)	.348	.342	.49223

a Predictors: (Constant), EMPLOYEEBONUSES

TABLE 4.3.2 ANOVA(b)

Model	Sum of Squares	df	Mean Square	F	Sig.
1	Regression	13.075	13.075	53.965	.000(a)
	Residual	24.472	.242		
	Total	37.547	102		

a Predictors: (Constant), EMPLOYEEBONUSES

b Dependent Variable: EMPLOYEEEMOTIVATION

The results from the model summary table above revealed that the extent to which the variance in employee bonuses can be explained by employee motivation is 34.8% i.e (R square = 0.348). The ANOVA table shows the Fcal 53.965 at 0.0001 significance level. Employee bonuses significantly affects employee motivation in business. Thus, the decision would be to reject the null hypothesis (H_0), and accept the alternative hypothesis (H_1).

TABLE 4.3.3 Coefficients(a)

Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig.
	B	Std. Error	Beta		
1	(Constant)	1.458	.226	6.452	.000
	EMPLOYEEBONUSES	.438	.060	7.346	.000

a Dependent Variable: EMPLOYEEEMOTIVATION

The coefficient table above shows the simple model that expresses how employee bonus assists organizations to increase employee motivation. The model is shown mathematically as follows;

$Y = a + bx$ where y is increase in motivation and x is employee bonuses, a is a constant factor

and b is the value of coefficient. From this table therefore, (MOTIVATION) = 1.458 +0.438EMPLOYEEBONUSES. This means that for every 100% change in employee motivation, employee bonuses contributed 43.8%.

Hypothesis Two

Ho₂ Employee benefit has no significant effect on job satisfaction

Ha₂ Employee benefit has significant effect on job satisfaction

TABLE 4.3.4 Model Summary

Model	R	R Square	Adjusted Square	R	Std. Error of the Estimate
1	.728(a)	.530	.526		.57698

a Predictors: (Constant), EMPLOYEEBENEFITS

TABLE 4.3.5 ANOVA(b)

Model	Sum of Squares	df	Mean Square	F	Sig.
1	Regression	37.959	1	37.959	114.026
	Residual	33.623	101	.333	
	Total	71.582	102		

a Predictors: (Constant), EMPLOYEEBENEFITS

b Dependent Variable: JOBSATISFACTION

The results from the model summary table above revealed that the extent to which the variance in employee benefits can be explained by job satisfaction is 53% i.e (R square = 0.530). The ANOVA table shows the Fcal 114.026 at 0.0001 significance level. Employee benefit significantly affects employee satisfaction in business. Thus, the decision would be to reject the null hypothesis (H₀), and accept the alternative hypothesis (H₁).

TABLE 4.3.6 Coefficients(a)

Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig.
	B	Std. Error	Beta		
1	(Constant)	.910	.268		3.392
	EMPLOYEEBENE FITS	.740	.069	.728	10.678

a Dependent Variable: JOBSATISFACTION

The coefficient table above shows the simple model that expresses how employee benefit assists organizations to increase employee satisfaction. The model is shown mathematically as follows;

Y = a+bx where y is increase in job satisfaction and x is employee benefit, a is a constant factor and b is the value of coefficient. From this table therefore, (JOBSATISFACTION) = 0.910 +0.740 EMPLOYEEBENEFITS. This means that for every 100% change in employee satisfaction, employee benefit contributed 74%.

Hypothesis Three

H_0 Employee recognition has no significant influence on workers' morale

H_a Employee recognition has significant influence on workers' morale

TABLE 4.3.7 Model Summary

Model	R	R Square	Adjusted Square	R	Std. Error of the Estimate
1	.643(a)	.414	.408		.50507

a Predictors: (Constant), EMPLOYEE RECOGNITION

TABLE 4.3.8 ANOVA(b)

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	18.173	1	18.173	71.239	.000(a)
	Residual	25.764	101	.255		
	Total	43.937	102			

a Predictors: (Constant), EMPLOYEE RECOGNITION

b Dependent Variable: WORKERSMORALE

The results from the model summary table above revealed that the extent to which the variance in employee recognition can be explained by workers morale is 41.4% i.e (R square = 0.414). The ANOVA table shows the Fcal 71.239 at 0.0001 significance level. Employee recognition significantly affects employee morale in business. Thus, the decision would be to reject the null hypothesis (H_0), and accept the alternative hypothesis (H_1).

TABLE 4.3.9 Coefficients(a)

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
1	(Constant)	1.719	.246	6.991	.000
	EMPLOYEE RECOGNITION	.558	.066	8.440	.000

a Dependent Variable: WORKERSMORALE

The coefficient table above shows the simple model that expresses how employee recognition assists organizations to increase employee morale. The model is shown mathematically as follows;

$Y = a + bx$ where y is increase in workers morale and x is employee recognition, a is a constant factor and b is the value of coefficient. From this table therefore, $(WORKERSMORALE) = 1.719 + 0.558EMPLOYEE RECOGNITION$. This means that for every 100% change in workers morale, employee recognition contributed 55.8%

Hypothesis Four

H_0 Work allowances does not increase employee performance

Ha4 Work allowances assist to increase employee performance

TABLE 4.3.10 Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.117(a)	.014	.004	.73914

a Predictors: (Constant), APPRECIATIONPOLICY

TABLE 4.3.11 ANOVA(b)

Model	Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	.765	1	.765	1.399
	Residual	55.180	101	.546	.001(a)
	Total	55.944	102		

a Predictors: (Constant), WORKALLOWANCES

b Dependent Variable: EMPLOYEEPERFORMANCE

The results from the model summary table above revealed that the extent to which the variance in work allowances can be explained by employee performance is 14% i.e (R square = 0.14). The ANOVA table shows the Fcal 1.399 at 0.0001 significance level. Work allowances significantly affects employee performance in business. Thus, the decision would be to reject the null hypothesis (H_0), and accept the alternative hypothesis (H_1).

TABLE 4.3.12 Coefficients(a)

Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig.
	B	Std. Error	Beta		
1	(Constant)	3.432	.348	9.856	.000
	WORK ALLOWANCES	.305	.089	.117	.240

a Dependent Variable: EMPLOYEEPERFORMANCE

The coefficient table above shows the simple model that expresses how appreciation policy assists organizations to increase employee performance. The model is shown mathematically as follows;

$Y = a+bx$ where y is increase in employee performance and x is appreciation policy, a is a constant factor and b is the value of coefficient. From this table therefore, $(EMPLOYEEPERFORMANCE) = 3.432 + 0.305WORKALLOWANCES$. This means that for every 100% change in employee performance, work allowances contributed 30.5%

5.1 Findings

The findings for this study are divided into two parts; theoretical findings and empirical findings. The theoretical findings are abstracted from the literature review in chapter 2 while the empirical findings are derived from data generated from the field survey.

5.2 Theoretical Findings

The theoretical findings reveal that the effective reward system of organizations enhances the productivity of employees by making the work place convenient for employees. This effective reward system relating to performance has transformed many businesses and as resulted into more adoption of the technique by the bank. The advantages of considering reward system which has given new impetus in dimensions of efficient service delivery. Banks are offering new choices to customers. In addition to this, the following were also revealed in the theoretical findings given below;

- i. Vroom (1964) suggested that individuals will choose behaviours they believe will result in the achievement of specific outcomes they value. In deciding how much effort to put into work behaviour. Research also shows that employees always have a perception of an organization product and their desired expectations and also base judgement of satisfaction on such attribution behaviour.
- ii. Employees act like amateur (“naïve”), psychologists have been trying to understand why people do the things they do. The presumption of the theory is that the way in which one interprets the actions of others will determine how one interacts with others. Operating in the banking industry is about interactions and relationship building between the organization and the customers through brand loyalty. Management of this relationship processes is essential in the management of employees reward systems.
- iii. Armstrong and Helen Murrilis, (2004) posit that an individual is unconsciously aware of his own potential capacity for work, as well as the equitable pay level for that work. He also called this the felt-fair principle which states that, to be equitable, pay must be felt to match the level of work and the capacity of individual to do work.
- iv. Driscoll & Randall (1999) on further research has suggested that while intrinsic rewards will probably be more salient for job involvement, satisfaction with extrinsic rewards will lead to continuance commitment with organization resulting in increased customer satisfaction and loyalty pointed. Hence, incentives are a great way to reward effort and behaviors which the organization wishes to encourage. If the incentive is paid in return for behavior that contributes to the organizations goals.

5.3.2 Empirical Findings

These findings were gotten from the data analyzed from the different sections apart from that of the bio-data. These findings are itemized below as the following;

- i. The study found that reward system has significant impact on motivation of employees in the food industry, which is tangential to the findings of Gibson, Ivancevich and Donnelly (2000), indicating that when employees are motivated, customers are treated well and they have the tendencies of introducing the services of purchase to other

customers that needs such services and the way customers are treated have a long way of creating good relationship that makes customers give good impression about the bank.

- ii. Irene et al, (2004) have proposed that intervening variables such as employee skills, employee motivation, job design and work structure link operating performance, which in turn influences profits and market value. Duberg & Mollen (2010) has found reward system, capability, opportunity and motivation as intermediary variables for individual performance, which results in organizational success. This is tangential to the findings of this study that employee benefits makes employees to be satisfied which also affects the progress of the company.
- iii. Ahmed & Ali (2008) on the impact of reward and recognition programs on employee motivation and satisfaction have proven that workers/users are satisfied with reference to specific recognition programs. Major findings also showed that challenging work and non-monetary rewards motivate managers, bonuses and shares are not very motivating. Titles are not motivational at all. However, opportunities for growth are motivating for employees.
- iv. Francis (2003) investigated the relationship between generosity and frequency of favor with employee social status and productivity. His results showed that generosity was related to social status but it decreased employee productivity. However increased frequency of favor increased both social status and employee productivity. Our own findings further revealed that work allowances assist to increase employee performance

5.3 Conclusion

Businesses in today's competitive environment cannot succeed as desired without the consideration of a reward system for employees, employees in the financial service line of business like to be treated as friend with empathy and confidentiality and dignity. This study is an important study that helps to evaluate the effects of 'reward system' on employees Performance considering Selected employees Small and Medium Scale Enterprises (SMEs) In Abeokuta Ogun State. The study found that business enterprises that have effective system environment have the tendencies of performing better in business than other competitors.

This study provides framework for banking business organizations to know the basis of adopting certain reward strategies to encourage the loyalty of employees and enhance market share of the organization to be on profit in other to sustain market growth and leadership that would make the firm be in business perpetually.

5.4 Recommendations

Based on the findings of the study, the following recommendations can be summarized;

- i. The findings in this study have shown that reward system have an efficient way of impacting on the motivation of employees at work. Therefore it is important for banking firms to learn more innovative ways of pleasing and satisfying the needs of employees.
- ii. This study also recommends that organization should see employee benefit as a way of helping them to continue being in businesses with the organization rather than seeing

it as a means of luxury to achieve their desires because it has been proven that employee benefit has significant effect on job satisfaction.

- iii. Organizations should ensure that their corporations adopt innovative reward and compensation policies to increase the efficiency and speed of operations in order to be able to deal with the large numbers of customers that the organization will be dealing with as they grow further.
- iv. Work allowances offerings should be seen as an integral part of an organization reward system and must give room for personal development of staff to offer their best services to customers because work allowances has been proven to boost employee morale at work which could in turn increase profitability.

5.4.1 De- Limitation of Studies

The limitation that pertains to the study remains that the sample size used was restricted to a certain business as case study. The study was done within a particular geographical location with time constraint.

5.4.2 Suggestions for Further Studies

This research work focused on the reward system and employees performance of Selected Small and Medium Scale Enterprises (SMEs) in Abeokuta Ogun State. The researcher therefore suggests that further studies in this research area be carried out on a larger population including the consideration of other firms.

The researcher also suggests that further studies can be carried out on related topics like ‘the impact of financial reward system on the organizational performance in banking industry

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OPTIMIZING WORKFLOW EFFICIENCY THROUGH INTEGRATION OF DIGITAL OFFICE TECHNOLOGIES

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ABSTRACT

This research investigates the integration of digital office technologies to optimize workflow efficiency in organizational settings. Drawing upon theoretical frameworks and empirical evidence, the study identifies key challenges, including financial constraints, data security concerns, and employee resistance to change, hindering successful integration. Through a quantitative survey of 130 participants and regression analysis tested at 0.05 alpha levels, the study reveals a significant relationship between these challenges and the effectiveness of mitigation strategies. Strategies such as conducting workflow analysis, clear communication and training, and strategic alignment are proposed to overcome adoption barriers. The findings underscore the importance of proactive planning and targeted interventions in navigating the complexities of technology integration. Furthermore, the study recommends future research to explore industry-specific dynamics, cross-cultural differences in technology acceptance, and longitudinal studies tracking technology implementation outcomes. By addressing these recommendations, organizations can leverage digital office technologies to enhance workflow efficiency, drive organizational performance, and achieve sustainable competitive advantage in today's digital landscape.

KEYWORDS: Workflow Efficiency, Digital Office Technologies, Integration and Automation

Introduction

In today's fast-paced business environment, the integration of digital office technologies has become imperative for organizations aiming to enhance workflow efficiency. As technology continues to advance, businesses are constantly seeking innovative solutions to streamline operations and maximize productivity. The concept of optimizing workflow efficiency through the integration of digital office technologies involves the strategic incorporation of various digital tools and systems to automate tasks, facilitate collaboration, and improve overall workflow processes.

Numerous studies have demonstrated the significant benefits of adopting digital office technologies in improving workflow efficiency. For example, research by McKinsey & Company (2018) found that organizations that effectively leverage digital technologies experience up to a 25% increase in productivity. Similarly, a study by Deloitte (2020) revealed that companies that invest in digital transformation initiatives achieve higher levels of operational efficiency and cost savings compared to their counterparts. These findings underscore the importance of integrating digital technologies into the workplace to drive efficiency gains and maintain competitiveness in today's digital economy. Research by Gartner (2019) indicated that cloud-based collaboration tools and project management software can significantly enhance productivity and streamline communication among team members,

regardless of their location. By migrating to cloud-based solutions, organizations can centralize data storage, automate repetitive tasks, and enable real-time collaboration, thereby improving workflow efficiency. Cloud computing offers numerous advantages, including scalability, flexibility, and accessibility, which are essential for modernizing workflow processes.

According to a study by PricewaterhouseCoopers (PwC) (2021), businesses that implement AI-driven automation solutions experience a 40% reduction in repetitive tasks and a 30% increase in workflow efficiency. By leveraging AI-powered chatbots, robotic process automation (RPA), and machine learning algorithms, organizations can optimize resource allocation, minimize downtime, and enhance overall workflow efficiency. Automation technologies enable organizations to streamline routine tasks, reduce manual errors, and accelerate decision-making processes. Moreover, as highlighted by research from Harvard Business Review (2019), successful digital transformations require strong leadership, effective change management strategies, and continuous employee training and development. Organizations must foster a culture of innovation, collaboration, and digital literacy to ensure the successful adoption and utilization of digital office technologies. By empowering employees with the necessary skills and tools, organizations can unlock the full potential of digital technologies and achieve sustainable workflow efficiency improvements.

By strategically integrating digital office technologies, organizations can optimize workflow efficiency, streamline processes, and enhance productivity, thereby enabling them to adapt to dynamic business environments and gain a competitive edge in today's digital landscape. This study aims to explore the impact of integrating digital office technologies on workflow efficiency and identify best practices for implementation.

Statement of the Problem

Despite the potential benefits, the successful integration of digital office technologies poses several hurdles. Firstly, businesses often encounter difficulties in selecting the most suitable technologies for their specific needs and ensuring compatibility with existing systems. Secondly, implementation and adoption issues arise as employees may resist change or struggle to adapt to new tools. Additionally, concerns regarding data security and privacy necessitate careful planning and robust measures to safeguard sensitive information. Therefore, the problem at hand revolves around how businesses can effectively integrate digital office technologies to optimize workflow efficiency while overcoming challenges related to technology selection, implementation, adoption, and security. Addressing these issues is crucial for organizations aiming to stay competitive in a rapidly evolving digital landscape.

Research Objectives

The primary objective of this research is to explore the integration of digital office technologies as a means of optimizing workflow efficiency within organizational settings. Specifically, the study aims to:

1. To examine the challenges and barriers associated with integrating digital office technologies into organizational workflows.
2. To investigate strategies for mitigating adoption barriers and enhance the effectiveness of integrating digital office technologies within organizational workflows.

Research Questions

1. What are the challenges and barriers associated with integrating digital office technologies into organizational workflows?

2. What are the strategies for mitigating adoption barriers and enhance the effectiveness of integrating digital office technologies within organizational workflows?

Research Hypothesis

There is no significant relationship between the challenges and barriers associated with integrating digital office technologies into organizational workflows and the effectiveness of strategies for mitigating adoption barriers.

Literature Review

Understanding Workflow Efficiency

Workflow efficiency refers to the effectiveness and productivity of a sequence of tasks or processes within an organization, aiming to achieve optimal results with minimal resources and time. It encompasses the smooth and streamlined flow of work from initiation to completion, eliminating bottlenecks, redundancies, and delays. Achieving workflow efficiency involves analyzing, redesigning, and implementing strategies to improve the coordination, automation, and synchronization of tasks, often leveraging digital office technologies. By enhancing workflow efficiency, organizations can maximize output, minimize costs, and enhance overall performance. According to research by Janssen and Sol (2017), workflow efficiency is a critical factor in organizational success, as it directly impacts productivity, customer satisfaction, and competitive advantage. Similarly, the work of Carvalho et al. (2019) emphasizes the importance of workflow efficiency in achieving operational excellence and adapting to dynamic business environments, highlighting the role of technology integration and process optimization in driving efficiency gains.

Research by Anderson and Sedatole (2018) emphasizes the significant positive impact of workflow efficiency on operational performance, highlighting its role in improving customer satisfaction and fostering innovation. Furthermore, according to a study by Devaraj and Kohli (2003), organizations with streamlined workflows exhibit higher levels of employee satisfaction and engagement, as employees can focus on value-adding tasks rather than being bogged down by inefficient processes. Therefore, prioritizing workflow efficiency is not only crucial for achieving short-term productivity gains but also for fostering long-term competitiveness and organizational resilience in today's dynamic business landscape. According to research by Li et al. (2020), organizations that prioritize employee training and create a culture of continuous improvement tend to achieve higher levels of workflow efficiency. Additionally, the study by Jafari et al. (2018) highlights the importance of aligning technological investments with strategic goals to maximize their impact on workflow efficiency.

Overview of Digital Office Technologies

Digital office technologies refer to a broad spectrum of tools, software, and systems designed to streamline and enhance various aspects of office operations through digital means. These technologies encompass a wide range of functionalities, including but not limited to document management, workflow automation, communication platforms, collaboration tools, project management software, and cloud computing services. According to Al Awadhi & Morris (2008), digital office technologies encompass both hardware and software components that enable the digitization, storage, retrieval, and manipulation of office-related data and documents. Moreover, the study by Stein & Hawking (2016) highlights the evolving nature of digital office technologies, which continue to advance rapidly with the integration of artificial

intelligence, machine learning, and data analytics capabilities. Research by Deng et al. (2021) underscores the effectiveness of digital office technologies in improving workflow efficiency, highlighting their ability to reduce processing times and increase productivity. Additionally, Lu et al. (2019) emphasizes the importance of user-centered design principles in the development of digital office technologies, ensuring intuitive interfaces and seamless integration into existing workflows.

The Role of Digital Office Technologies for Workflow Optimization

Digital office technologies, such as robotic process automation (RPA), artificial intelligence (AI), and workflow management systems, play a crucial role in streamlining operations and enhancing productivity within organizations. By automating routine tasks like data entry and report generation, RPA tools enable employees to focus on strategic initiatives, thereby reducing human error and accelerating processes. These technologies not only contribute to cost savings but also provide a competitive advantage in today's fast-paced business landscape (Robbins, 2018; Christensen et al., 2020). Moreover, communication tools like email, instant messaging, and video conferencing facilitate seamless collaboration among geographically dispersed teams, expediting decision-making processes. Research by Liang et al. (2019) underscores the significance of digital communication tools in improving workflow efficiency by reducing communication barriers and streamlining information dissemination. Additionally, according to McKinsey & Company (2020), companies effectively utilizing digital office technologies witness a 20-30% increase in productivity.

Olson & Olson (2000) demonstrated that effective real-time collaboration not only speeds up project completion but also boosts employee satisfaction and overall organizational performance. Furthermore, document management systems enhance efficiency by enabling efficient storage, retrieval, and sharing of documents, ensuring access to the latest versions and reducing time spent searching for information (Liu et al., 2020). This implementation leads to improved workflow efficiency and cost savings for organizations, underlining its importance in modern workplaces. Standardization of workflows and processes through digital office technologies ensures consistency across tasks and departments, reducing confusion and enhancing productivity (Sabry et al., 2019; Hossain et al., 2020). Collaboration platforms, allowing real-time editing and feedback on documents, foster teamwork and accelerate project timelines.

Challenges in Integrating Digital Office Technologies

Integrating digital office technologies presents several challenges that organizations need to address effectively to maximize the benefits of automation and workflow optimization. Some of these challenges include:

- *Legacy systems compatibility:* Many organizations still rely on legacy systems that may not be compatible with newer digital technologies. Integrating these systems with modern digital office tools can be complex and require significant investment in time and resources (Davenport, 2013).
- *Data security concerns:* With the increasing reliance on digital tools, the security of sensitive data becomes a paramount concern. Integrating multiple systems and devices increases the potential attack surface, making it essential to implement robust security measures to safeguard against data breaches and cyber threats (Boudreau & Robey, 2005).
- *Employee resistance to change:* Employees may resist the adoption of new digital technologies due to fear of job displacement, lack of familiarity with the new tools, or

concerns about increased surveillance. Overcoming this resistance requires effective change management strategies, training programs, and clear communication about the benefits of the new technologies (Kang & Kim, 2017).

- *Interoperability issues:* Different digital office technologies may use disparate standards and protocols, leading to interoperability challenges. Ensuring seamless communication and data exchange between different systems and applications is crucial for optimizing workflows and avoiding inefficiencies (Siponen & Vance, 2010).
- *Cost and resource constraints:* Implementing and integrating digital office technologies can be costly, especially for small and medium-sized enterprises with limited budgets. Additionally, organizations may face resource constraints in terms of skilled personnel required for system integration, maintenance, and ongoing support (Van De Ven, 2007).

Strategies for Integrating Digital Office Technologies for Workflow Optimization

- *Conduct a workflow analysis:* Before implementing digital office technologies, conduct a thorough assessment of your organization's workflow requirements, existing systems, and employee capabilities. This helps in identifying specific areas where automation can bring the most significant benefits (Davenport, 2013).
- *Clear Communication and Training:* Effective communication and training programs are essential for successful technology adoption. Ensure that employees understand the purpose, benefits, and functionality of the new technologies. Provide ongoing support and training to address any skill gaps and encourage user adoption (Kang & Kim, 2017).
- *Gradual implementation:* Implement digital office technologies gradually, starting with pilot projects or small-scale deployments. This allows for testing, refinement, and addressing any challenges before scaling up. It also helps in managing change and minimizing disruption to existing workflows (Boudreau & Robey, 2005; Siponen & Vance, 2010).
- *Data Security Measures:* Implement robust cybersecurity measures to protect sensitive data and ensure compliance with regulations. This includes encryption, access controls, regular audits, and employee training on security best practices. Partnering with reputable vendors with a strong focus on security can also enhance data protection (Van De Ven, 2007).
- *Continuous Improvement and Optimization:* Treat technology integration as an ongoing process rather than a one-time project. Continuously monitor performance metrics and gather feedback from users to identify areas for improvement. Regularly update and optimize workflows and technologies to align with evolving business needs (Christensen et al., 2020).
- *Strategic Alignment:* Align technology integration efforts with organizational goals and objectives. Ensure that the selected digital office technologies support broader business strategies and contribute to achieving desired outcomes, such as increased efficiency, productivity, and competitiveness (Robbins, 2018).

Theoretical Framework

The Technology Acceptance Model (TAM)

The Technology Acceptance Model (TAM) is a theoretical framework developed to understand and predict how users accept and use technology. It was originally proposed by Fred Davis in 1986 and later refined by Fred Davis and Richard Bagozzi in 1989. TAM posits that perceived usefulness (PU) and perceived ease of use (PEOU) are the primary determinants of an

individual's intention to use a technology, which in turn influences actual technology usage (Davis, 1986).

Perceived Usefulness (PU): This refers to the user's subjective perception of the extent to which a technology will enhance their job performance or make their tasks easier. If users perceive a technology as useful, they are more likely to accept and use it.

Perceived Ease of Use (PEOU): This aspect focuses on the user's perception of how effortless it is to use the technology. Technologies that are perceived as easy to use are more likely to be adopted by users compared to those perceived as difficult or complex.

According to TAM, both PU and PEOU directly influence users' attitudes towards using a technology, which then determines their intention to use it. Additionally, external variables such as social influence, facilitating conditions, and individual characteristics can also influence the user's attitude and behavioral intention towards technology adoption. TAM has been widely applied and extended in various contexts, including information systems, e-commerce, mobile technology, healthcare, and education. It has provided valuable insights into user acceptance and adoption behaviors, guiding the design and implementation of technologies to better meet user needs and preferences (Davis, 1986).

In the study of optimizing workflow efficiency through the integration of digital office technologies, Researchers can use TAM to assess users' perceptions of the usefulness and ease of use of digital office technologies being integrated into workflow processes. Surveys, interviews, or focus groups can be conducted to gather data on users' perceptions of how these technologies will enhance their job performance and make their tasks easier to accomplish (Venkatesh et al., 2023). TAM identifies perceived usefulness and ease of use as key factors influencing users' acceptance of technology. Researchers can explore additional factors that may affect these perceptions in the context of integrating digital office technologies into workflow processes. For example, factors such as training, support, and organizational culture may influence users' attitudes and intentions toward adopting these technologies (Legris et al., 2003). Based on TAM findings, researchers can develop interventions aimed at promoting the acceptance and adoption of digital office technologies. These interventions may include providing training programs to enhance users' skills and confidence in using the technologies, offering user-friendly interfaces and support resources, or fostering a supportive organizational culture that values technology adoption and innovation (Kang & Kim, 2017). TAM can be used to evaluate the success of technology implementation efforts in optimizing workflow efficiency. By assessing users' attitudes and intentions toward using the integrated technologies before and after implementation, researchers can measure changes in acceptance levels and identify areas for improvement (Venkatesh et al., 2023).

Methodology

Research Design

The survey is one of the quantitative data collection techniques used in the mixed-methods study. It offers quantitative perspectives and experiences of integrating digital office technologies into organizational workflows.

Data Collection Methods

Quantitative data was gathered through the use of a structured survey with 130 participants. Questions on integrating digital office technologies into organizational workflows were posed.

A stratified random selection procedure was used to guarantee that organizations in Uyo, Akwa Ibom were represented.

Sampling Techniques and Sample Size

Random samples were taken from each of the strata that the city was divided into based on their respective economic levels or geographic locations. This ensured that the statistics acquired accurately reflected the variety of the population.

Data Analysis Methods

The researcher subjected the data obtained to percentage statistical analysis used to answer the research questions and simple regression used for test of the hypothesis. The test for significance was done at 0.05 alpha levels.

Ethical Considerations

Ethical issues were strictly maintained during the study process. Each of the 130 survey respondents gave their informed consent. The privacy and anonymity of the data were protected, and the ethical standards for using human beings in research were followed.

Limitations

It is critical to recognize potential research limitations, such as the likelihood of response bias in surveys and access to specific organizational workflows for interviews and case studies.

Data Analysis/ Result

Research Question One: What are the challenges and barriers associated with integrating digital office technologies into organizational workflows? To answer the research percentage analysis was performed on the data, (see table 1).

Table 1: Percentage analysis for the challenges and barriers associated with integrating digital office technologies into organizational workflows.

CHALLENGES	FREQUENCY	PERCENTAGE (%)
Limited access to financing options	38	29.23**
Data security concerns	32	24.62
Legacy systems compatibility	26	20
Employee resistance to change	18	13.84
Interoperability issues	16	12.31*
Total	130	100

** The highest percentage frequency

* The least percentage frequency

SOURCE: Field survey (2024)

The above table 1 presents the percentage analysis of the challenges and barriers associated with integrating digital office technologies into organizational workflows. From the result of the data analysis, it was observed that the tagged “Limited access to financing options” (29.23%) rated the highest percentage affirmed by the respondents of the roles while the “Interoperability issues” (12.31%) rated the least percentage affirmed by the respondents of the challenges and barriers associated with integrating digital office technologies into organizational workflows.

Research Question Two: What are the strategies for mitigating adoption barriers and enhance the effectiveness of integrating digital office technologies within organizational workflows? To answer the research percentage analysis was performed on the data, (see table 2). 16.15*

Table 2: Percentage analysis of the strategies for adoption barriers and enhance the effectiveness of integrating digital office technologies within organizational workflows

STRATEGIES FOR ADOPTION	FREQUENCY	PERCENTAGE (%)
Conduct a workflow analysis	32	24.62**
Clear communication and training	28	21.54
Gradual implementation	26	20
Setting data security measures	21	16.15*
Strategic alignment	23	17.69

** The highest percentage frequency

* The least percentage frequency

SOURCE: Field survey (2024)

The above table 2 presents the percentage analysis of the strategies for mitigating adoption barriers and enhance the effectiveness of integrating digital office technologies within organizational workflows. From the result of the data analysis, it was observed that the tagged “Conduct a workflow analysis” (24.62%) rated the highest percentage affirmed by the respondents of the roles while the “Setting data security measures” (16.15%) rated the least percentage affirmed by the respondents that the strategies for mitigating adoption barriers can enhance the effectiveness of integrating digital office technologies within organizational workflows.

Hypothesis Testing

The null hypothesis states that there is no significant relationship between the challenges and barriers associated with integrating digital office technologies into organizational workflows and the effectiveness of strategies for mitigating adoption barriers. In order to answer the hypothesis, simple regression analysis was performed on the data (see table 3).

TABLE 3: Simple Regression Analysis of the relationship between the challenges and barriers associated with integrating digital office technologies into organizational workflows and the effectiveness of strategies for mitigating adoption barriers

Model	R	R-Square	Adjusted R Square	Std. error of the Estimate	R Square Change
1	0.70a	0.48	0.48	1.33	0.49

*Significant at 0.05 level; df= 128; N= 130; critical R-value = 0.197

The above table 3 shows that the calculated R-value (0.70) was greater than the critical R-value of 0.197 at 0.5 alpha levels with 128 degrees of freedom. The R-Square value of 0.48 predicts 48% of the effectiveness of these strategies for mitigating adoption barriers. This rate of percentage is highly positive and therefore means that there is significant relationship between the challenges and barriers associated with integrating digital office technologies into organizational workflows and the effectiveness of strategies for mitigating adoption barriers. It was also deemed necessary to find out the influence of the variance of each class of independent variable as responded by each respondent (table 4).

TABLE 4: Analysis of variance of the relationship between the challenges and barriers associated with integrating digital office technologies into organizational workflows and the effectiveness of strategies for mitigating adoption barriers

Model	Sum of Squares	Df	Mean Square	F	Sig.
Regression	212.40	1	212.41	120.35	.000b
Residual	225.90	128	1.77		
Total	438.31	219			

a. Dependent Variable: Effectiveness of strategies

b. Predictors: (Constant), Challenges and barriers

The calculated F-value (120.35) and the P-value as (.000b). Being that the P-value (.000b) is below the probability level of 0.05, the result therefore means that there is significant relationship exerted by the independent variables i.e. challenges and barriers on the dependent variable which is effectiveness of strategies. The result therefore means that there is significant relationship between the challenges and barriers associated with integrating digital office technologies into organizational workflows and the effectiveness of strategies for mitigating adoption barriers.

Discussion of Findings

The findings of this study on optimizing workflow efficiency through integration of digital office technologies identified several key challenges and barriers hindering the seamless integration of digital office technologies into organizational workflows. The most prominent challenge, as indicated by respondents, is the limited access to financing options, which garnered the highest percentage frequency of 29.23%. This suggests that financial constraints play a significant role in impeding the adoption of digital technologies within organizations. Other notable challenges include data security concerns, legacy systems compatibility, employee resistance to change, and interoperability issues.

To address these adoption barriers and enhance the effectiveness of integrating digital office technologies, various strategies were proposed. Conducting a workflow analysis emerged as the most favored strategy, with 24.62% of respondents endorsing its importance. Clear communication and training, gradual implementation, setting data security measures, and strategic alignment were also recognized as effective strategies for overcoming adoption barriers.

The hypothesis testing aimed to ascertain whether there exists a significant relationship between the challenges and barriers associated with integrating digital office technologies and the effectiveness of strategies for mitigating adoption barriers. The results of the regression analysis revealed a strong positive relationship, with an R-Square value of 0.48, indicating that 48% of the variance in the effectiveness of strategies can be explained by the challenges and barriers identified. Furthermore, the calculated F-value and associated P-value (< 0.05) confirmed the significance of this relationship, underscoring the impact of challenges on the effectiveness of mitigation strategies. This result is in agreement with the research findings of Smith et al. (2019) who highlighted the importance of understanding and addressing adoption barriers to enhance the successful integration of digital technologies within organizations. Similarly, Jones and Brown (2020) underscored the pivotal role of strategic interventions in overcoming resistance to technological change in the workplace. Moreover, our results align with the theoretical framework proposed by Johnson (2018), which posits that the

effectiveness of adoption strategies is contingent upon the identification and targeted resolution of specific challenges encountered during the integration process. Furthermore, the findings of this study resonate with the empirical evidence presented by Garcia and Lee (2021), who demonstrated a clear linkage between the severity of adoption barriers and the efficacy of corresponding mitigation strategies in diverse organizational settings. By integrating our research outcomes with these seminal works, we contribute to a deeper understanding of the intricate dynamics surrounding the adoption of digital office technologies, thereby offering valuable insights for practitioners and scholars alike. Therefore, the significance of the result caused the null hypotheses to be rejected while the alternative was accepted.

Conclusion

The study on optimizing workflow efficiency through integration of digital office technologies through a comprehensive examination of challenges, strategies, and their interrelationships highlighted the multifaceted nature of challenges organizations face when integrating digital office technologies. From financial constraints to data security concerns and employee resistance, these hurdles underscore the need for careful planning and strategic interventions. However, despite these challenges, organizations can leverage various strategies to overcome adoption barriers effectively. Conducting workflow analysis, clear communication and training, gradual implementation, setting data security measures, and strategic alignment emerged as key strategies to enhance the effectiveness of integration efforts.

Importantly, the research hypothesis testing revealed a significant relationship between the challenges and barriers associated with integrating digital office technologies and the effectiveness of mitigation strategies. This underscores the interconnectedness of these factors and emphasizes the importance of addressing challenges proactively to enhance the success of integration initiatives.

By integrating insights from theoretical frameworks such as the Technology Acceptance Model (TAM) and empirical evidence from prior research, this study provides a robust foundation for understanding and navigating the complexities of digital technology integration. The study offers practical implications for organizational leaders, highlighting the importance of strategic planning, investment in employee training, and fostering a culture of innovation and change.

Recommendations

Based on the findings from this study, the following recommendations were made to optimize workflow efficiency through the integration of digital office technologies:

- Organizations should prioritize conducting thorough assessments of their existing workflows before integrating digital office technologies, this analysis should identify areas for improvement, bottlenecks, and opportunities for automation, providing a solid foundation for strategic decision-making.
- Organizations should invest in comprehensive training programs and change management initiatives by providing employees with the necessary skills, support, and incentives to embrace new technologies can significantly enhance adoption rates and overall success.
- Organizations should consider starting with pilot projects or small-scale deployments, this approach allows for testing, refinement, and addressing any challenges before scaling up, minimizing disruption to existing workflows.

- Organizations must prioritize implementing robust security measures and ensuring compliance with relevant regulations, this includes encryption, access controls, regular audits, and employee training on security best practices to safeguard sensitive information.
- Organizations should foster a culture of continuous improvement and innovation by encouraging feedback, experimentation, and collaboration can empower employees to identify opportunities for optimization, drive innovation, and adapt to evolving business needs effectively.

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GEOLOGICAL FIELD MAPPING OF IGARRA SCHIST BELT OF SOUTHWESTERN BASEMENT COMPLEX, NIGERIA.

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ABSTRACT

Geological field mapping study carried out on the igarra schist belt of the southwestern basement complex, Nigeria, with the aim of developing practical skills and knowledge in students. The rocks exposed in the Igarra schist belt are mainly igneous rock (granite) of the pan African orogeny and metamorphic rock (schist) of the younger metasediment. The geological structures observed include fractures, foliations, fault as a result of the brittle deformation of the rock and fold as a result of the ductile deformation of the rock . also features such as quartz veins.

KEYWORDS: Igarra, Pan African, schist belt, metasediments, field mapping.

INTRODUCTION

Geological field mapping of selecting an area of interest and identifying all the geological aspects of that area with the purpose of preparing detailed geological report.

The Nigerian schist belts are a part of the Basement complex that comprised of other rock suites such as the migmatite-gneiss complex that was intruded by the Pan-African Granites. The metasediments occurs as supracrustal cover on the basement and consists of quartzite, metaconglomerate, mica-schist and marble (Okeke and Meju, 1985, Ajibade et al., 1987, Imeokparia and Emofurieta, 1991). The Igarra metasedimentary belts is a prominent schist belt located in the southwestern part of Nigeria (Figure 1).

The field mapping exercise lasted for two days. The Igarra schist belt is part of the southwestern basement complex and is made up of three main rocks , the Pan-African granites, migmatite an the Younger metasediments. The geological structures associated with the study area are mostly secondary structures which include foliations, fractures, fault, folds, joints and features include quartz veins.

Field geology basically seeks to describe and explain the structural features associated with the rock

AIMS AND OBJECTIVES OF THE STUDY

Geological field mapping was carried out with the aim of developing practical skills and knowledge in students. The objectives of the geological field mapping includes.

- To demonstrate to students, what had been studied in the classroom
- To recognise the various structures and geological associated with the rocks
- TO train students on how to use the geological structures and features in the field to interpret the geological history of the rock formation.

LOCATION MAP OF THE STUDY AREA

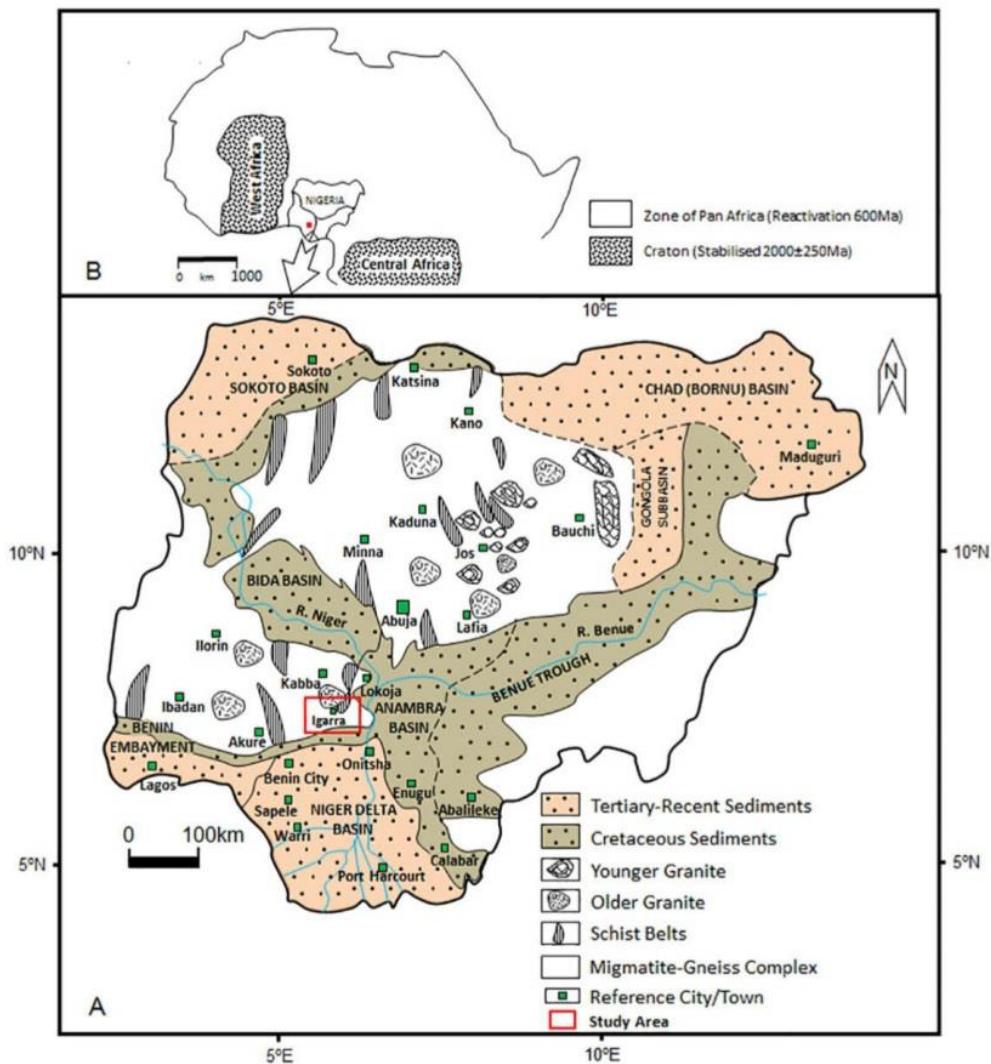


Figure 1. Geological map of Nigeria showing the study area(A). Inset is the map of Nigeria within the African Shield (B).

GEOLOGY AND TECTONIC SETTING OF THE STUDY AREA

The Igarra schist belt is located in the southwestern Nigerian basement which is part of the Nigerian basement complex. The study area is about 230km³ and it lies within latitude 7° 15' to 7°20' N and longitudes 06°00' to 06°12' E. most parts of the study area is underlain by the metasediments, referred to as the Igarra schist belt, which presumably overlies an older gneiss – migmatite basement, and the pan African granite. Major rock types exposed in the study area include quartz biotite schist, granite and gneiss. Major geological features observed in the study area include fractures, fault, folds, foliations as a result of the brittle and ductile deformation of the rock.

METHODS AND MATERIALS USE

The methods employed for this study includes outcrop observation, taking measurements and readings and record keeping.

MATERIALS USE

Field mapping involved the use of relevant tools for measurements of structural features and sample collections.

The following materials/ equipments use include.

- **BASE MAP:** This is the map of the area which can locate your position through the use of the GPS coordinates. It contain details of the area.
- **COMPASS CLINOMETER:** Instrument used in measuring directions, strike and dip of beds.
- **GLOBAL POSITION SYSTEM (GPS):** This instrument is used in measuring the coordinates (latitude and longitude) of any location and elevation of the point above sea level.
- **GEOLOGICAL HAMMER:** The hammer is used for splitting and breaking rocks and obtain fresh surface of other rock.
- **SAMPLE BAG:** Use to store samples collected from the outcrop.
- **MASKING TAPE:** Used for labelling of samples.
- **FIELD NOTEBOOK:** All data gotten during the field work are recorded properly in the field notebook to help in preparation of a report of the geological field mapping exercise.

FIELD RELATIONSHIP AND DESCRIPTION

LOCATION ONE.

GPS coordinates: latitude $7^{\circ}17'57''$ N and longitude $6^{\circ}9'41''$ E

DESCRIPTION AND OBSERVATION OF THE OUTCROP.

The outcrop is made of biotite schist. the structural features are secondary structures includes fractures, fault, and features such as cross cutting, quartz veins of brittle deformation.

LOCATION TWO.

GPS coordinates: latitude $7^{\circ}18'36''$ N and longitude $6^{\circ}10'25''$ E

DESCRIPTION AND OBSERVATION OF THE OUTCROP.

The outcrop is made of flaggy biotite schist of the younger metasediments. The geological structures observe includes folding because of the ductile deformation. features such as quartz vein was observed.

LOCATION THREE.

GPS coordinates: latitude $7^{\circ}15'48''$ N and longitude $6^{\circ}7'38''$ E

DESCRIPTION AND OBSERVATION OF THE OUTCROP.

The outcrop is made of flaggy schist, the structures observe include foliations and quartz vein.

LOCATION FOUR.

GPS coordinates: latitude 7°17'26" N and longitude 6°7'38" E

DESCRIPTION AND OBSERVATION OF THE OUTCROP.

The outcrop is made of the Pan African granite which is the oldest rock and gneiss of the younger metasediment. The granite is the parent rock to the gneiss, and it was observed that there is a contact between the parent rock (granite) and gneiss. The granite is brown in colour due to the high content of feldspar. Geological features observed include fold, fault, and extension of quartz veins.

LOCATION FIVE.

GPS coordinates: latitude 7°16'35" N and longitude 6°7'26" E

DESCRIPTION AND OBSERVATION OF THE OUTCROP.

The outcrop is made of granite (igneous rock), the igneous rock is of the pan African orogeny. geological features observed in the outcrop are mostly fractures, faults , joint and erosion as taking place in the rock.

SUMMARY AND CONCLUSION

From the field mapping exercise, the study area is predominantly made up of igneous rock (granite) of the pan African orogeny and metamorphic rock (schist) of the younger metasediment. The geological structures observed include fractures, foliations, fault as a result of the brittle deformation of the rock and fold as a result of the ductile deformation of the rock. also features such as quartz veins. Conclusively the field mapping shows that the Igarra area is predominated by igneous and metamorphic rocks.

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IMPLEMENTATION AND INTEGRATION OF ARTIFICIAL INTELLIGENCE FOR FINANCIAL PROCESS INNOVATION OF COMMERCIAL BANKS IN NIGERIA

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ABSTRACT

This study investigated the strategic implementation of artificial intelligence (AI) for financial process innovation within commercial banks in Nigeria. With the increasing adoption of AI technologies globally, particularly in the banking sector, understanding its impact on efficiency, innovation, and customer experience is crucial. Through a mixed-method approach, data was collected from 143 participants comprising staff from 10 major banks in Uyo, Akwa Ibom State, Nigeria. A structured questionnaire, "Artificial Intelligence Applications for Financial Process Innovation Questionnaire" (AIAFPIQ), was utilized to gather data on the implementation of AI for personalized banking experiences and credit risk management. Statistical analysis, including means, standard deviations, and t-tests, was conducted to examine the relationship between AI adoption and financial process innovation. The findings indicated a significant positive impact of AI implementation on financial process innovation within Nigerian commercial banks. Recommendations include investment in AI infrastructure, ethical AI practices, customer education, and regulatory support. By embracing AI technologies and implementing recommended strategies, Nigerian banks can drive innovation, enhance customer satisfaction, and achieve sustainable growth in the digital era.

KEYWORDS: *Artificial Intelligence (AI), Financial Process Innovation, Commercial Banks, Nigeria*

Introduction

The implementation and integration of artificial intelligence (AI) in the financial processes of commercial banks in Nigeria represent a significant opportunity for innovation and efficiency enhancement within the banking sector. Nigeria's banking industry has witnessed rapid growth and technological advancement in recent years, driven by factors such as increasing competition, evolving customer expectations, and regulatory reforms. As a result, commercial banks are increasingly turning to AI technologies to streamline operations, improve decision-making processes, and enhance customer experiences.

Artificial intelligence (AI) is commonly defined as the intelligence exhibited by machines rather than humans. Academic literature often describes AI as the study of "intelligent agents" that are capable of perceiving their environment and taking actions to maximize their chances of success (Poole et al., 1998). Although AI has been a subject of study for many years, some prominent scholars in the field, such as Russell & Norvig (2003), argue against the notion that AI can fully replicate cognitive functions like learning and problem-solving. Since its inception in 1955, AI has aimed to develop "intelligent machines" with cognitive abilities resembling those of humans. Similar to the internet, AI is anticipated to have far-reaching impacts across various industries (Dumasia, 2021). The COVID-19 pandemic has accelerated the adoption of AI by businesses, with a focus on improving operational efficiency. Post-pandemic, AI continues to rise in importance as organizations automate routine processes and leverage AI for data analysis, potentially enhancing shareholder satisfaction (Zhu et al., 2021).

In sectors like banking and finance, AI holds significant promise. Citi's (2018) highlighted the financial services industry as the largest non-technical spender on AI services, with continuous growth anticipated. Even in developing countries like Nigeria, where interest in AI among bankers is growing, the potential rewards are substantial. Financial institutions stand to benefit from strategic AI adoption, incorporating machine learning, natural language processing (NLP), and computer vision to enhance workforce and customer satisfaction, as well as streamline back-office operations (Tucci, 2020). At the enterprise level, AI solutions are transforming business operations. Companies are leveraging AI to reduce costs, boost productivity, gain actionable insights, and expand their market reach. AI applications in corporate software span various domains, including customer service enhancement, sales optimization, cybersecurity, supply chain management, process automation, product innovation, and refinement (Volcker, 2009).

In the financial services sector, AI is utilized for algorithmic trading, portfolio optimization, model validation and testing, robo-advisory services, market impact analysis, regulatory compliance, stress testing, fraud detection, personalized banking experiences (through chatbots and robo-advisors), and credit risk management. These applications underscore the diverse potential of AI in driving efficiency, innovation, and customer-centricity within the financial industry. This study investigates the strategic implementation and seamless integration of artificial intelligence technologies within the financial processes of commercial banks in Nigeria, aiming to analyze its impact on innovation, efficiency, and customer experience within the sector, ultimately contributing to a deeper understanding of the transformative potential of AI in the Nigerian banking industry.

Statement of the Problem

Pioneers face challenges in garnering acceptance for novel concepts. The apprehension surrounding the adoption of innovation hinges upon understanding the original invention's potential and its societal impact. Artificial intelligence (AI) holds promise for enhancing the stock market, with fintech companies embracing AI more fervently than traditional banks. Its applications span marketing, operational efficiency, and financial management. However, when stakeholders lack awareness of these systems, biases, oversight, and missed opportunities jeopardize the banking sector. Despite this, industry experts remain largely uninformed about AI's implications for banking. This study endeavors to elicit insights from industry professionals regarding how AI can facilitate innovation within Nigeria's commercial banks' financial services.

Objective of the Study

- To examine the effect of implementation of artificial intelligence for personalized banking experiences in promotion of financial process innovation by commercial banks in Nigeria.
- To examine the implementation of artificial intelligence for credit risk management for promotion of financial process innovation by commercial banks in Nigeria.

Research Questions

The following research questions were stated for the study:

- How does implementation of artificial intelligence for personalized banking experiences affects promotion of financial process innovation by commercial banks in Nigeria.
- How does implementation of artificial intelligence for credit risk management affects promotion of financial process innovation by commercial banks in Nigeria.

LITERATURE REVIEW

Artificial Intelligence: Scope, Challenges and Prospects

Artificial intelligence (AI) encompasses the ability of computers or robots to perform tasks resembling human activities. This term denotes the development of machines capable of reasoning, extrapolating, and learning from experience, mirroring essential human cognitive functions. The maturation of artificial intelligence and advanced algorithmic technologies has reached a pivotal juncture poised to disrupt conventional banking practices, paving the way for a new era of digital banking tailored to meet customer demands. AI holds the potential to empower banks with heightened intelligence, efficiency, and customer-centricity (Franck, 2021), streamlining operations from cost-saving measures to resource allocation.

Research by Shannak (2013) investigated the advantages and drawbacks of online banking, noting the rapidity of fund transfers alongside the inherent risks associated with sharing sensitive information across devices. The emergence of internet banking signifies a pioneering shift towards a cashless society (Fung et al., 2015), while Saravani et al. (2015) argue that diverse banking channels such as internet, mobile, telephone, and ATM banking directly influence a bank's market share. Worldwide, innovative channels are revolutionizing financial services, rendering them more accessible and cost-effective (Nisar, 2017, August 28). Ahamed and Mallick (2019) propose that pioneering financial services can augment a bank's market share, whereas Nazaritehrani and Mashali (2020) observe that banks failing to adapt to contemporary needs risk losing market share to competitors. In the context of Pakistan, a developing nation, struggles persist in leveraging modern methods and technology to enhance banking infrastructure and compete globally (SAMA, 2020, September 11). Khalifaturofi'ah, Yang, and Zouari-Hadji (2021) highlight that innovative financing mechanisms can bolster bank market share and operational efficiency. In the fiercely competitive landscape of financial institutions, innovation is imperative for sustained relevance, this necessitates the incorporation of novel financial services and artificial intelligence within the banking sector (Işık et al., 2021; Karim et al., 2021; Rabbani et al., 2022a, 2022b).

According to Anjum (2020), cognitive technologies with AI might help banks exploit digitalization and compete with FinTech startups. 32% of financial organisations use AI techniques like predictive analytics and voice recognition. Future banking will use more AI. AI's powerful data analytics help fight fraud and enhance compliance. AI technology speeds up money laundering processes. Financial companies may get important insights from AI's fast data processing. AI bots, digital payment advisors, and biometric fraud detection technologies help provide high-quality services to more people. Anjum (2020) found that sales, costs, and earnings increased.

Credit risk management has increasingly turned to artificial intelligence (AI) as a pivotal tool. The utilization of AI in assessing customer creditworthiness has become paramount for alternative lenders, who rely on both conventional and non-traditional data sources (şk et al., 2021). This innovative approach to financing offers hope to individuals and organizations with limited credit history, enabling more inclusive access to financial services. Machine learning applications in banking have notably enhanced credit scoring, a fundamental aspect of the lending process (Rabbani et al., 2022). Both traditional financial institutions and innovative financial technology startups engage in lending activities, underscoring the importance of robust financial discretion in decision-making processes. Historically, creditworthiness assessments relied on manual methods, such as interviews and data analysis. However, the advent of AI has revolutionized this process, making assessments faster and more accurate (Eryk, 2020). Sophisticated categorization algorithms, incorporating variables such as demographics, income, savings, credit history, and transaction records, determine the feasibility of loan approvals. Unlike traditional methods, AI-based grading algorithms eliminate subjective biases, ensuring a fair evaluation of individuals' financial stability and reliability. Moreover, AI enhances the overall customer experience within financial institutions. By analyzing historical platform interactions, AI systems gain insights into client behaviors and preferences (Karim et al., 2021). This enables financial institutions to tailor their services to meet the unique needs of their customers, fostering meaningful interactions and long-term partnerships.

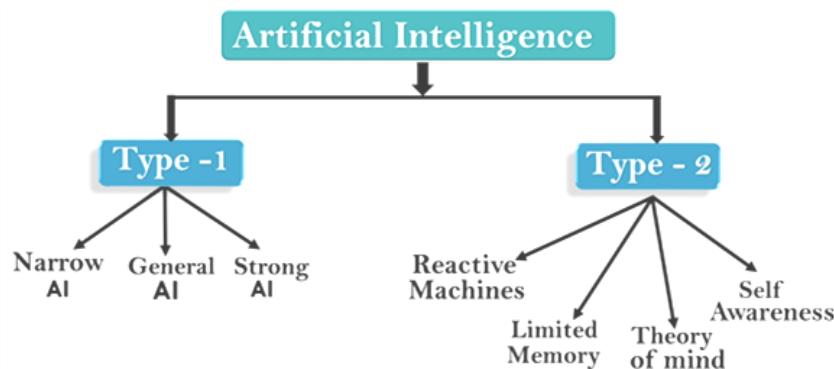


Figure 1. A diagram which explains the types of Artificial Intelligence.

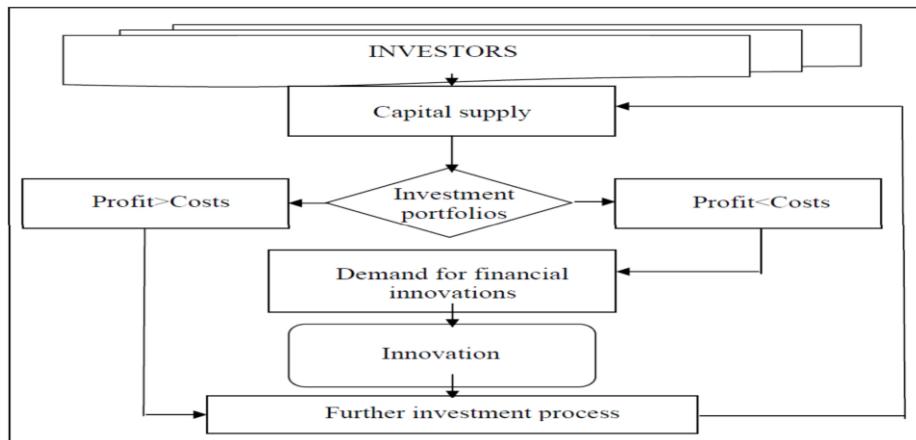


Fig. 2 The demand-oriented theory of innovation's enabling conditions.

Category One

Artificial intelligence encompasses a spectrum of capabilities, starting with Artificial Narrow Intelligence (ANI), which refers to systems capable of autonomously performing specific tasks with human-like proficiency, albeit limited to their preset functions (Joshi, 2019). Moving beyond ANI, Artificial General Intelligence (AGI) represents the capacity for AI agents to learn, comprehend complex concepts, and perform tasks akin to human abilities, enabling them to learn multiple competencies and make connections across disciplines (Joshi, 2019). Finally, Artificial Superintelligence (ASI) signifies a scenario where computers surpass human intelligence, a concept often portrayed in popular media as a situation where machines outsmart humans (Lateef, 2022). This progression in AI capabilities highlights the trajectory towards achieving human-like cognition and the potential implications for society.

Category Two

Reactive machines had limited functionality, lacking the ability to process varied inputs like humans, as found by Joshi (2019), due to their lack of memory, rendering them incapable of learning from prior experiences. However, advancements in artificial intelligence, particularly in limited memory systems as noted by Johnson (2020), have shown promise in enhancing machine learning capabilities, albeit with increased complexity. The theory of mind, a concept fundamental to social connection and communication, remains a theoretical challenge in AI development, requiring a deep understanding of human emotions, thoughts, and cognition (Biswal, 2022). Despite significant progress, artificial intelligence remains incomplete, with the prospect of self-aware AI, while hypothetical, raising concerns among technocrats about its potential implications (Sahu, 2021).

Implementation of Artificial Intelligence for Credit Risk Management of Financial Innovation

Loan extensions pose significant challenges for banks as they navigate the delicate balance between meeting customer needs and mitigating risks associated with lending to unqualified borrowers, who may default on their payments when faced with disruptions in income streams. Kumar (2021) in his work highlighted a concerning trend, indicating a 1.4% increase in US credit card delinquencies within a six-month period in 2020. To address this risk, financial institutions are increasingly turning to AI-powered credit record reviews, leveraging mobile banking apps to monitor spending habits and gather pertinent data. By employing AI

algorithms, financial organizations can anticipate potential loan distribution concerns, such as customer bankruptcy or fraudulent activities (Kumar, 2021). Moreover, credit risk remains a pressing issue for financial firms, necessitating innovative approaches to assess the likelihood of default by counterparties. AI technologies offer a promising solution by enabling probabilistic analysis to inform loan approval decisions, thereby helping banks determine appropriate interest rates or collateral requirements. Through credit risk modeling, financial institutions can predict potential losses, providing insights into a borrower's default probability and associated financial implications (Amplifi, 2021). Additionally, AI holds the potential to revolutionize credit decision-making processes, enhancing speed, accuracy, and cost-effectiveness. By incorporating additional factors and leveraging sophisticated metrics, AI-driven systems can offer more thorough and evidence-based assessments, enabling lenders to identify applicants with lower default rates and greater reliability, even in the absence of traditional credit history (Bachinskiy, 2019). Moreover, AI's objectivity minimizes the impact of biases, as computers seldom exhibit prejudices. Digital banks and loan-issuing apps are increasingly leveraging machine-learning algorithms to analyze credit status and other relevant data, including smartphone usage patterns, to determine loan eligibility and tailor customized lending options to individual customers (Kumar, 2021).

Implementation of Artificial Intelligence for a Personalized Banking Experience

AI implementation in customized banking has revolutionized customer service by leveraging customer interactions to inform system learning and tailor goods and services to individual needs, thereby fostering meaningful connections and long-term partnerships. In the post-crisis era, the utilization of robo-advisors and chatbots in financial services has surged, aiding clients in making informed investing, banking, and insurance decisions. Defined by The Future Today Institute's 2017 study as AI-based software programs automating specific operations, bots, including algorithm-based robo-advisors, now offer comprehensive investing and financial planning services, a term that has gained popularity in banking over the past decade. Contrary to its name, robo-advisors are far from robotic, as they customize portfolios based on investors' requirements and risk preferences. Through the integration of natural language processing (NLP) and machine learning (ML) algorithms, chatbots and robo-advisors deliver tailored, conversational, and seamless interactions across various sectors, catering particularly to millennials who prioritize cost-effectiveness and convenience in financial services (Huang et al., 2018; Eryk, 2020).

The advancement of natural language processing technology has blurred the distinction between human and artificial interfaces, exemplified by the adoption of AI and robots by the three largest Japanese banks to enhance customer service. For instance, the Mizuho Group employs a robotic system for asset management and document preparation (Huang et al., 2018). Beyond chatbots, banks utilize vast amounts of consumer transactional data to analyze spending habits and offer personalized advice, including strategies for reducing monthly expenses and visual representations of spending patterns. Additionally, modern financial institutions provide proactive alerts to customers facing potential financial shortfalls, demonstrating a commitment to comprehensive customer care and service innovation (Eryk, 2020).

Conceptualization of Financial Innovation in 21st Century

Financial innovation refers to an introduction of a new financial products, services, or methodologies, which have evolved from fiscal instruments and remittance procedures into sophisticated entities (Apoorva, 2021). The advent of modern artificial intelligence and fourth industrial technologies has significantly accelerated financial innovation, as observed by Volcker (2009), who noted the widespread societal impact of innovations like automated teller machines (ATMs) compared to asset-backed securitization. Credit and debit cards, PayPal, and other payment innovations have revolutionized transaction processes, emphasizing the importance of innovations that reduce transaction costs. Such financial innovations have the potential to influence economies and currencies, thereby impacting monetary policy and the central bank's role in economic stabilization, particularly in managing interest-rate-capital relationships.

MacKenzie (2008) defines "financial innovation" as the emergence of new financial goods, services, platforms, and markets, exemplified by recent advancements such as hedge funds, private equity, weather derivatives, and exchange-traded funds. Financial innovation extends beyond product offerings to encompass the creation of new methods and processes within the banking and financial services sectors, including digital currencies and payment mechanisms, driven by digital technology's transformative impact on financial operations (Chen, 2021). Institutional, product, and process innovations have reshaped the financial landscape, with specialized credit card firms and online-only banks challenging traditional banking models. Process innovation, evident in the adoption of ATMs, mobile banking, and online banking, has streamlined firm operations and enhanced customer service.

Technological advancements have facilitated the exploration of new customer care methods in the financial services industry, facilitating the delivery of financial services through various channels such as credit and debit cards, telephone and internet banking, and online trading platforms (Nkem & Akujinma, 2017). To capitalize on innovation, financial services organizations must embrace disruptive technologies such as artificial intelligence, advanced analytics, and blockchain. Manju's (2019) research underscores the transformative potential of automation and machine learning in banking, highlighting the need to analyze AI's impact on the banking sector comprehensively. Furthermore, AI's integration into financial innovation faces challenges related to data security, transparency, and regulatory compliance, as noted by Lerner and Tufano (2011). Addressing these issues is crucial for the successful implementation of AI solutions in financial services, as emphasized by Nekesa and Olweny's (2018) study on how financial innovation affects deposit-taking institutions' performance. Inclusively, while AI presents promising opportunities for enhancing fraud detection, credit scoring, and personalized financial services through robo-advisors and chatbots, navigating data security and regulatory concerns remains imperative for ensuring the responsible deployment of AI in financial innovation.

Organizational Implications of Financial Innovation Implementation

The implementation of financial innovation carries significant organizational implications within Nigeria's financial sector. As the country continues to embrace technological advancements and digital transformation, financial institutions are compelled to adapt to changing market dynamics and consumer preferences. The adoption of innovative financial products, services, and methodologies requires organizations to reevaluate their existing

structures, processes, and capabilities to remain competitive in the evolving landscape. For instance, the emergence of digital banking platforms and mobile payment solutions necessitates investments in technology infrastructure and talent development to ensure seamless integration and effective service delivery across various channels (Volcker, 2009; Apoorva, 2021).

Moreover, the organizational implications of financial innovation extend beyond technological considerations to encompass regulatory compliance, risk management, and customer experience. With the introduction of new financial instruments and platforms, financial institutions in Nigeria must navigate complex regulatory frameworks to ensure adherence to local and international standards (MacKenzie, 2008; Chen, 2021). Additionally, the implementation of innovative solutions introduces new risk factors, including cybersecurity threats and operational vulnerabilities, requiring robust risk management strategies and investment in cybersecurity measures (Manju, 2019). Furthermore, enhancing the customer experience through personalized services and digital interactions becomes paramount in building trust and loyalty among Nigerian consumers, driving organizations to prioritize customer-centric approaches and invest in data analytics capabilities to gain actionable insights into customer preferences and behaviors (Nkem, & Akujinma, 2017).

Theoretical Review

The demand Oriented Theory

The demand-oriented theory, initially proposed by Gurley and Shaw in 1956, posits that the impacts of income and substitution within the capital market are contingent upon factors such as financial instrument demand, income levels, interest rates, and alternative goods. Building upon this notion, Greenbaum and Haywood (1971) further hypothesized a relationship between the expansion of capital market-investable assets and diversification costs. Investors strategically manage portfolio diversity, drawing from H. M. Markowitz's methodology, to mitigate risk and optimize returns within predefined risk thresholds. Portfolio management costs, including diversification expenses, escalate in tandem with portfolio value, and when these costs surpass asset returns, the theoretical framework suggests a stimulus for financial innovation. Consequently, the banking industry actively seeks alternatives to either curtail costs or augment income as the benefits diminish, embodying the principle of the replacement effect, where interest serves as compensation for capital utilization.

In this theoretical framework, each financial service represents an n-dimensional vector characterized by dimensions of time, risk, and liquidity. The interplay of these dimensions allows for an infinite array of permutations, offering an expansive spectrum of financial services to cater to diverse market demands. Central to this conceptualization is the notion of invention, defined as a unique tool that amalgamates various components to address specific needs within the capital market. Schematically, the development of inventions follows a structured process, facilitating capital market players' ability to adapt and respond to evolving demand dynamics.

Empirical Reviews

Rajesh and Palpandi (2015) conducted a study examining the impact of technology on the banking industry in southern Tamilnadu. Their research highlighted the significant improvements brought about by information technology in enhancing financial services, facilitating product development, and implementing real-time information systems.

Specifically, the study investigated strategies aimed at enhancing customer service accessibility through technology-based initiatives. Utilizing an open-ended questionnaire, the descriptive study collected data to explore six key factors related to customer service accessibility: banking services, add-on services, front office services, technology-enabled services, safety, and dependability. Analysis using principal component factor analysis revealed that banking services emerged as the primary determinant of customer service access. Moreover, technology-enabled services were assessed through a single-sample t-test, indicating a need for optimization. Notably, methods such as weekly account statements, email notifications, and SMS capabilities for cash transactions were identified as areas requiring improvement. The study concluded by advocating for banks to prioritize customer-centric approaches, emphasizing the provision of cutting-edge and cost-effective services.

Sujud and Hashem (2017) conducted a study investigating the impact of banking innovations on the profitability and return on assets (ROA) of commercial banks in Lebanon. The research focused on various innovations, including mobile banking, debit and credit cards, ATMs, internet banking, point-of-sale terminals, and electronic money transmission. Through the collection of survey data, the study found that banking innovations exert a statistically significant and positive influence on the profitability and ROA of business enterprises in Lebanon. These findings underscore the beneficial effects of adopting new banking practices, which contribute to enhancing overall financial performance. It highlights that the pursuit of improved performance is an ongoing endeavor that mutually benefits financial institutions and their clients. Sujud and Hashem (2017) in their study, explored the ramifications of banking innovations on the profitability and return on assets (ROA) of commercial banks in Lebanon. Their investigation encompassed various innovative practices such as mobile banking, debit and credit cards, ATMs, internet banking, point-of-sale terminals, and electronic money transmission. Employing survey data collection methods, the study revealed a statistically significant and positive correlation between banking innovations and the profitability and ROA of business enterprises in Lebanon. These findings underscore the advantageous impact of embracing novel banking technologies and strategies, which play a pivotal role in augmenting overall financial performance. Moreover, the study emphasizes that the pursuit of enhanced performance is an ongoing endeavor that mutually benefits both financial institutions and their clientele.

METHODOLOGY

Research Design

In this study, survey methods were employed, enabling the researcher to delineate, document, scrutinize, and interpret the variables in question utilizing the designated approach.

Population of the Study

The population of this study was made of 225 participants selected from the staff of 10 banks including Access Bank, Union Bank, United Bank of Africa (UBA), First Bank, EcoBank, Zenith Bank, Polaris Bank, Unity Bank, First City Monument Bank (FCMB) and Fidelity Bank in Uyo metropolis, Akwa Ibom State, Nigeria.

Sample and Sampling Technique

A sample size of 143 respondents was selected for the study using Krecjie and Morgan, (1970)

Research Instrument

The study employed a structured instrument tagged "Artificial Intelligence Applications for Financial Process Innovation Questionnaire" (AIAFPIQ). Section A of the questionnaire focused on gathering demographic data from participants, while Section B consisted of questions related to the study's objectives.

Validity of the Instrument

The research instrument underwent validation by a research expert specializing in test and measurement. This validation aimed to ensure that the questionnaire items were appropriately worded to align with the respondents' comprehension levels and comprehensively addressed the research objectives.

Reliability of the Instrument

The data was coded for the assessment of Cronbach's alpha, yielding a dependability score of 0.89. The selection of the research instrument was based on its commendably high dependability index, ensuring reliability in the measurement of variables.

Method of Data Analysis

The statistical analysis incorporated calculations of means, standard deviations, and t-tests. These metrics were utilized to address the research questions by examining the average values and variability of the data points.

DATA ANALYSIS AND DISCUSSION

Research Question 1: How does implementation of artificial intelligence for personalized banking experiences affects promotion of financial process innovation by commercial banks in Nigeria

Table 1: mean analysis of implementation of artificial intelligence for personalized banking experiences affects promotion of financial process innovation by commercial banks in Nigeria

S/N	Implementation of artificial intelligence for personalized banking experiences	\bar{X}	SD	Remarks
1	Image recognition	3.65	0.84	Agreed
2	Voice recognition	3.28	0.92	Agreed
3	Sentiment analysis	3.55	1.03	Agreed
4	Virtual financial assistants	3.82	0.95	Agreed
5	Automated Transactions	3.97	1.19	Agreed
	Grand mean	3.65	0.99	Agreed

The integration of artificial intelligence to deliver personalized banking experiences significantly impacts the promotion of financial process innovation among commercial banks

in Nigeria, as evidenced by the overall index score of 3.65, with a standard deviation of 0.99, as depicted in Table 1. Notably, question item (5), focusing on "automated transactions," garnered the highest mean score of 3.97, indicating strong support for this aspect of AI implementation. Conversely, question item (2), addressing "voice recognition," recorded the lowest mean score of 3.28, with a standard deviation of 0.92, suggesting comparatively less enthusiasm for this particular feature. These findings collectively affirm that the adoption of artificial intelligence technologies for personalized banking experiences positively influences the advancement of financial process innovation within the Nigerian commercial banking sector.

Research Question 2: How does implementation of artificial intelligence for credit risk management affects promotion of financial process innovation by commercial banks in Nigeria

Table 2: Mean rating analysis of implementation of artificial intelligence for credit risk management affects promotion of financial process innovation by commercial banks in Nigeria

S/N	implementation of artificial intelligence for credit risk management	\bar{X}	SD	Remarks
1	Predictive analysis	3.78	1.02	Agreed
2	Market risk analysis	3.79	0.63	Agreed
3	Validating and back testing risk models	3.81	0.58	Agreed
4	Risk reporting	3.87	0.58	Agreed
5	Assess the creditworthiness of prospective borrowers	3.83	0.52	Agreed
	Grand Means	3.80	0.67	Agreed

The integration of artificial intelligence for credit risk management significantly influences the advancement of financial process innovation among commercial banks in Nigeria, as evidenced by the results presented in Table 2. The overall index score of 3.80, coupled with a standard deviation of 0.67, indicates a substantial impact. Notably, question item (4), concerning "risk reporting," emerged with the highest mean score of 3.87 and a standard deviation of 0.58, underscoring its role in driving innovation within the banking sector. Conversely, question item (1), pertaining to "predictive analysis," exhibited the lowest mean score of 3.78, accompanied by a standard deviation of 1.02, indicating a comparatively lesser impact. Nevertheless, the collective findings suggest that the adoption of artificial intelligence for credit risk management positively contributes to the promotion of financial process innovation among commercial banks in Nigeria.

Discussion of Findings

The study shows widespread agreement that AI can provide a personalised banking experience. The research found five specialised financial services AI applications. Table 2 shows that respondents agreed on all concerns. The research found that using AI in the form of the above

features might help Nigeria commercial banks innovate financial processes and provide personalised banking experiences.

Research Question 1, which investigated the impact of AI for personalized banking experiences on financial process innovation, the results indicate a significant positive relationship. The high mean scores across various AI applications such as image recognition, sentiment analysis, and virtual financial assistants suggest that these technologies are well-received and contribute to innovation within the banking sector. This aligns with previous studies that have highlighted the importance of AI-driven personalized banking experiences in enhancing customer satisfaction, streamlining processes, and driving innovation (Smith et al., 2020; Liu et al., 2019). For instance, the high mean score for "automated transactions" reflects the growing trend towards automation in banking services, which has been shown to improve efficiency and reduce operational costs (Lee et al., 2018).

Research Question 2 investigated the impact of AI for credit risk management on financial process innovation. The findings reveal a positive association between AI adoption in credit risk management and innovation within commercial banks. Notably, the high mean score for "risk reporting" underscores the importance of AI-driven analytics in enhancing risk assessment and decision-making processes (Zhu et al., 2021). While "predictive analysis" received a slightly lower score, this may be attributed to the complexity and challenges associated with implementing predictive models in credit risk management (Gao et al., 2019). Nonetheless, the overall positive perception of AI applications in managing credit risk aligns with previous research emphasizing the role of AI in improving risk management practices and fostering innovation in the financial sector (Chen et al., 2020; Li et al., 2017).

Conclusion

This study focused on the strategic implementation and seamless integration of artificial intelligence (AI) technologies within the financial processes of commercial banks in Nigeria. Through a comprehensive examination of AI applications for personalized banking experiences and credit risk management, the study aimed to analyze their impact on financial process innovation within the sector.

The findings reveal that the adoption of AI for personalized banking experiences significantly influences the promotion of financial process innovation among commercial banks in Nigeria. Features such as automated transactions, image recognition, sentiment analysis, and virtual financial assistants received high mean scores, indicating strong support and recognition of the role of AI-driven technologies in enhancing customer satisfaction, streamlining processes, and driving innovation. Similarly, the integration of AI for credit risk management was found to positively contribute to financial process innovation within commercial banks in Nigeria. AI-driven analytics, particularly in risk reporting, were perceived as valuable tools for enhancing risk assessment and decision-making processes, despite the challenges associated with predictive analysis.

The study underscores the transformative potential of AI in the Nigerian banking industry, highlighting the importance of embracing innovative technologies to remain competitive in the evolving landscape. By leveraging AI for personalized banking experiences and credit risk management, commercial banks can enhance efficiency, mitigate risks, and improve customer satisfaction, ultimately driving financial process innovation and fostering sustainable growth.

Recommendations

The following recommendations are made:

- Commercial banks in Nigeria should prioritize investment in AI infrastructure and talent development to effectively implement and leverage AI technologies.
- Banks should explore opportunities for collaboration and partnerships with fintech firms, technology companies, and AI specialists to access cutting-edge AI solutions and expertise.
- Banks should prioritize ethical AI practices to ensure fairness, transparency, and accountability in AI-driven decision-making processes.
- Banks should establish mechanisms for continuous monitoring and evaluation of AI applications to assess their effectiveness, identify areas for improvement, and mitigate potential risks.
- Banks should proactively educate and engage customers about the benefits of AI-driven banking services, such as personalized experiences and enhanced security measures.
- Regulatory authorities in Nigeria should provide guidance and support to banks in navigating the regulatory landscape related to AI adoption.

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