

- EDUCATION
- RESEARCH
- DEVELOPMENT



**ICTBJ
2023**

Nazrul University
2nd International Conference

TECHNOLOGY BUSINESS JUSTICE

Towards Smart Bangladesh
05-06 June 2023



JATIYA KABI KAZI NAZRUL ISLAM UNIVERSITY
Trishal, Mymensingh, Bangladesh

Co-organizer





2nd International Conference on
Technology, Business, and Justice towards Smart Bangladesh
ICTBJ-2023

Editor-in-Chief
Professor Dr. Soumitra Sekhar

Editors
Prof. Dr. Tushar Kanti Saha
Prof. Dr. Md. Tariqul Islam



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Trishal, Mymensingh-2224, Bangladesh

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Welcome Message from CONVENOR

Warm Greetings!

As a convenor, it is my immense pleasure to invite all researchers and distinguish guests to the International Conference on Technology, Business, and Justice towards Digital Bangladesh (ICTBJ-2023), which will be held on June 5-6, 2023 at Jatiya Kabi Kazi Nazrul Islam University, Trishal, Mymensingh, Bangladesh. Keeping peace with our government motto of Smart Bangladesh by 2041, this conference aims to bring together academics, researchers, practitioners, policymakers, and stakeholders from various fields to discuss and share their insights, experiences, and solutions on how to leverage our technology, business, and justice for achieving a Smart Bangladesh. Jatiya Kabi Kazi Nazrul Islam University also aims to build smart campus with the mottos of education, research, and development as desired by our Honorable Vice Chancellor, Professor Dr. Soumitra Sekhar.

The conference will feature inaugural session, keynote talks, paper presentations, and networking sessions on topics such as AI, Machine learning, Medical informatics, Environmental science, Blockchain, Cryptocurrency, e-commerce, Cybersecurity, Social justice, Human rights, Innovation, Entrepreneurship, and more.

Finally, I would like to thank our Honorable Vice Chancellor, Professor Dr. Soumitra Sekhar, Registrar, all committee and sub-committee members, deans, keynote speakers, session chairs, authors, reviewers, sponsors, co-organizer (iDEA, Bangladesh) and others who have helped us to make the conference successful.

Professor Dr. Tushar Kanti Saha
Convenor
ICTBJ-2023 Committee
Jatiya Kabi Kazi Nazrul Islam University
Trishal, Mymensingh, Bangladesh



Message from the CHIEF GUEST

It gives me immense pleasure to extend my heartfelt greetings to the International Conference on Technology, Business, and Justice towards Smart Bangladesh (ICTBJ), taking place on 5-6 June 2023. As the Minister responsible for fostering the development of education, I am delighted to witness the convergence of intellect and expertise in this prestigious gathering.

Our world is witnessing an unprecedented era of digital transformation, where breakthroughs in artificial intelligence, blockchain, cybersecurity, and the Internet of Things have profound implications for businesses, governments, and individuals alike. As we navigate the uncharted territories of this digital landscape, it is imperative that we ensure our legal frameworks are sufficiently robust and adaptable to safeguard the rights and interests of all stakeholders, while fostering an environment conducive to innovation, entrepreneurship, and sustainable economic growth.

I am confident that the ICTBJ-2023 serves as a platform to explore the multifaceted dimensions of emerging technologies, their impact on business models, and the legal implications that must be considered. Through insightful discussions, thought-provoking panels, and rigorous academic research, we will delve into topics ranging from data privacy and intellectual property rights to digital ethics, regulatory frameworks, and the evolving landscape of international trade.

I welcome the esteemed researchers and practitioners to embrace the insights shared, extract key learnings, and identify actionable strategies that can be implemented to propel Bangladesh forward on its smart journey. Let these proceedings be a source of inspiration, guiding us as we navigate the challenges and opportunities that lie ahead.

I wish the conference and Jatiya Kabi Kazi Nazrul Islam University a glorious success.

Joy Bangla, Joy Bangabandhu
Bangladesh Live Forever

Mohibul Hassan Chowdhury, MP
Deputy Minister
Ministry of Education
Government of the People's Republic of Bangladesh



Message from CHIEF PATRON

It is with great pleasure and honor that I extend my warmest greetings to the esteemed researchers and participants as Jatiya Kabi Kazi Nazrul Islam University (JKKNIU) hosts the momentous occasion of the International Conference on Technology, Business, and Law towards Smart Bangladesh (ICTBJ). This conference serves as a pivotal platform for stakeholders from academia, industry, and legal spheres to converge, exchange ideas, and forge partnerships that transcend boundaries.

At JKKNIU, we recognize and nurture the synergies among education, research, and development. Education provides the foundation for research and development, research informs evidence-based practices in education and drives innovation for development. Today, technology, without any doubt, has emerged as a powerful catalyst for inclusive growth, and sustainable development.

Furthermore, the intersection of technology, business, and justice plays a pivotal role in nurturing an environment conducive to progress. As we embrace the digital age, it becomes essential to establish robust legal frameworks that safeguard individual rights, protect intellectual property, and foster a fair and transparent business ecosystem. Through the judicious application of justice, we can cultivate an environment that promotes innovation, upholds ethical standards, and facilitates the responsible use of technology for the betterment of society.

I encourage each participant to seize this invaluable opportunity to engage in fruitful dialogue, share expertise, and gain invaluable insights from luminaries and experts in their respective fields. Embrace the spirit of collaboration, for it is through collective efforts that we can steer the course towards a future where technology, business, and law coexist harmoniously, driving progress, inclusivity, and building a smart Bangladesh.

May this conference be a catalyst for transformative ideas, enduring partnerships, and enlightened perspectives. Let us set new benchmarks in the realms of technology, business, and law, propelling our nations towards a brighter and more equitable future.

I congratulate the guests from home and abroad, who participated in this conference. I cannot thank the members of the conference organizing committee enough. They have worked hard and have been paying attention for a long time to make this conference a success. It is a matter of pride for our Nazrul University.

Joy Bangla, Joy Bangabandhu

Professor Dr. Soumitra Sekhar
Vice Chancellor
Jatiya Kabi Kazi Nazrul Islam University
Trishal, Mymensingh, Bangladesh



**Message from
DEAN
Faculty of Science and Engineering**

Dear participants and respected researchers,

Welcome to the first International Conference on Technology, Business and Justice (ICTBJ-2023) and welcome to our Jatiya Kabi Nazrul Islam University.

As the Dean of the Faculty of Science and Engineering, it is my great pleasure to be able to welcome you to this international conference. I appreciate the participation of attendees coming from home and abroad. In this occasion, I would like to give my sincere gratitude to the Chief Patron of this conference honorable Vice-Chancellor of our university Prof. Dr. Soumitra Sekhar and my respected colleagues for their sincere team efforts in organizing this conference successfully. I would like to express my gratefulness to the keynote speakers and the reviewers for their insightful speeches and valuable feedback.

The objectives of the conference are to obtain and extend the knowledge of recent issues, opinions, and bright ideas about Electrical Engineering, Computer Science Engineering, Environmental Science and Engineering, Statistics, Business and Law. The research and development in these fields are of great importance for now and in the future to fulfil the vision of our honorable Prime Minister Sheikh Hasina towards Smart Bangladesh.

I do hope that this conference not only be a valuable forum for the researchers to share their excellent research and thoughts but also helpful to develop interpersonal skills. I strongly infer that it will raise the awareness of the scientific community to motivate our young researchers and take the country one step ahead towards Smart Bangladesh.

Finally, I would like to congratulate all the participants, respected researchers, students and the organizing committee to make this conference meaningful. I wish you all the success and may you feel enjoy, happy and comfortable. Stay safe and healthy.

Prof. Dr. Uzzal Kumar Prodhan
Dean, Faculty of Science and Engineering
Jatiya Kabi Nazrul Islam University
Trishal, Mymensingh, Bangladesh



**Message from
DEAN
Faculty of Business Administration**

It gives me immense pleasure to learn that Jatiya Kabi Kazi Nazrul Islam University is hosting "International Conference on Technology, Business, and Justice Towards Smart Bangladesh (ICTBJ-2023)" on 5-6 June 2023, the first of its kind in the history of the university. On this very occasion, the conference committee is going to publish an abstract book accommodating the selected abstracts of the authors participating the conference.

It is interesting to note that the conference will cover science, business, and law discipline simultaneously. It will be great to have an array of scholars from different fields to share their ideas, views, and critical thinking which will definitely add value to the contemporary literature on these fields.

On this auspicious occasion, I take this opportunity to extend my sincerest thanks and gratitude to our honorable Vice Chancellor Professor Dr. Soumitra Sekhar for taking such an exemplary step for the university. It is very much in line with his dream of focusing on education, research, and development towards a smart Bangladesh. It will give a nice opportunity to the scholars to exchange their views and ideas through interaction and cross-examination. It will be of great value to the young teachers, researchers, and students home and abroad. It will give international exposure to the university as well.

Finally, I want to thank all whose efforts have made this mammoth task happen. Hope this will be a perpetual event for the university in the coming days. I wish a grand success of the conference.

Joy Bangla

Joy Bangabandhu

Professor Dr. Md. Riad Hassan
Dean, Faculty of Business Administration
Jatiya Kabi Kazi Nazrul Islam University
Trishal, Mymensingh, Bangladesh



Message from REGISTRAR

After joining of our present Vice Chancellor Professor Dr Soumitra Sekhar, Jatiya Kabi Kazi Nazrul Islam University has turned into a research atmosphere. As because he has taken a motto with three important words like Education, Research and Development. To satisfy Education, he has published a planned academic calendar with the help of all faculties and departments. Through this academic calendar class, mid-term and semester final examinations have been implemented very cautiously. That's why there is no any session jam now. Development work is going on very smoothly now. Twenty four numbers of development package of the projects are running in the campus. Besides of above these, research is the most important one. A university is mainly stands for research and academic institution. To attain academic excellence research play an important role for the students as well as the nation. National and international seminar/conference is an initiative for making linkage between different institution of different countries. Our Jatiya Kabi Nazrul Islam University has started international conference/seminar from last year i.e, 2022. That was based on humanities, social science and fine arts. To maintain consecutive sequence, this year i.e, 2023 is also organized same type international conference/seminar on technology, business and justice. Two-day long international conference will be held on 5-6 June 2023. As far I know there have already submitted more than one hundred articles of different disciplines for different countries. Eminent researchers, scientists, educationist and faculties of different institutions of different countries to present and participate in discussion session. As a member of Nazrul University family I feel proud for taking part to organize such an international conference. I deeply pray for the grand success of the conference as before.

Dr. Md. Humayun Kabir
Registrar
Jatiya Kabi Kazi Nazrul Islam University
Trishal, Mymensingh, Bangladesh



Summary of Keynote Speech

Artificial Intelligence-Based Computer-Aided Diagnosis

Dr. Syoji Kobashi

The rapid advancement of artificial intelligence (AI) and machine learning (ML) has revolutionized computer-aided diagnosis (CAD), particularly in the field of medical imaging. By seamlessly integrating AI/ML, image processing techniques, and statistical analysis, CAD systems have become essential tools for radiologists in the interpretation and analysis of medical images, including ultrasound, X-ray radiographs, CT, and MRI. These sophisticated CAD systems automatically detect lesions, quantify disease progression, and even predict diseases outcome. Several CAD systems have been successfully commercialized and used in hospitals. The talk aims to provide a comprehensive understanding of the fundamental principles underlying CAD for medical images, while also highlighting speaker's studies involving AI/ML-based CAD approaches.

Brief Bio

Syoji Kobashi received BE in 1995, an ME in 1997, and a Doctor of Engineering in 2000, all from Himeji Institute of Technology. He was an assistant professor at Himeji Institute of Technology (2000-2004), an associate professor (2005-2016), and currently a professor (2016-Present), University of Hyogo. He has served as the manager of the advanced medical engineering research center (2016-2021), and, the director of the advanced medical engineering research institute, at the University of Hyogo. And, he was a guest associate professor at Osaka University, WPI immunology frontier research center (2010-2016), and was a visiting scholar at the University of Pennsylvania (2011-2012), and a specially appointed director, National Cerebral and Cardiovascular Center (2021-Present). His research interests include medical image understanding and artificial intelligence. He received 16 international awards, including Lifetime Achievement Award (WAC, 2016), Franklin V. Taylor Memorial Award (IEEE-SMCS, 2009). He has been serving as Program Chair of WAC2022, and many others. Moreover, he is an editor-at-large of the Intelligent Automation & Soft Computing journal, editor-in-chief of the International Journal of Biomedical Soft Computing and Human Sciences, associate vice president of organization and planning of IEEE SMCS, etc. He is a senior member of IEEE.



Summary of Keynote Speech

Digitalizing Business for Smart Bangladesh

Dr. Binod Krishna Shrestha

Businesses around the world are in rapid turbulence in a competitive market because of the booming use of digital technology and artificial intelligence, disruption in society through fast changes in customers' needs and aspirations, and distribution and supply chains due to changing geo-political situations. In order to survive in these situations, business organizations have been adopting digitalizing and digital automation in customer services, supply chain, operation, human resource management and financial management and so on. In addition, rampant corruption, imbalanced wealth distributions and the need for the conservation of the environment and culture have also stimulated the further uses of digital technology in the payment of tax, tender bidding, catering to small farmers and producers to integrate them into the supply chain. In this context, businesses need to be updated with smart technology to be competitive in every field such as resource mobilization through the backward supply chain, internal business processing, forward distribution channels to reach customers at their doorsteps and collecting feedback for redesigning the business model through continuous innovation. Failure to adopt digital technology, artificial intelligence, blockchain technology, cloud computing etc. will affect the business sustainability and growth. Businesses in Bangladesh like in many emerging countries have been increasingly adopting this technology for their survival and existence in this competitive business world. The quicker the adoption, the better it is for businesses, which will contribute to making smart Bangladesh. However, the adoption of this technology needs empirical research from customers' and management standpoints across different business sectors. Although the use of smartphones and the internet has been widespread, intentions to adopt this technology for purchase and consumption purposes and corresponding influential factors need to be explored by university research to educate business students and managers. Similarly, the adoption of technology in supply chain actors and internal business managers and associated factors need to be explored from different perspectives. This conference will highlight these issues to draw implications for encouraging the use of digital technology and the latest development.

Brief Bio

Dr. Binod Krishna Shrestha is a professor of entrepreneurship and marketing at Kathmandu University School of Management in Nepal. He has thirty-three years of experience in training, education, research and consulting in entrepreneurship and management development in different countries. He has PhD in marketing (Nepal), a Master's in development of small enterprises (Germany) and an MBA (Nepal). He has served the university in different positions such as senate member, director, associate dean and associate controller of examination. He has dozens of research publications in strategic management, entrepreneurship, marketing and business ethics in different international journals. He also carried out field-based action research in different areas of Nepal for micro and small enterprise development.



Summary of Keynote Speech

A Roadmap towards Smart Bangladesh: Exploring Malaysia's Path to Smart Cities Aspiration

Dr. Hartini Saripan

This keynote speech explores the journey of Malaysia in transforming its cities into smart cities and the legal implications associated with this transformation. It incorporates the defining concepts of smart cities and their significance in the contemporary world, emphasizing elements such as data-driven decision-making, IoT integration, sustainable infrastructure, and citizen engagement. It then provides an overview of Malaysia's progress in developing smart cities, highlighting successful examples and initiatives in cities like Cyberjaya, Putrajaya, and Iskandar Malaysia. The sharing further delves into the legal challenges and opportunities presented by smart cities in Malaysia, addressing issues such as data privacy and security, regulatory frameworks, intellectual property rights, governance and ethics, and citizen rights and social equity. Drawing parallels between Malaysia's experiences and the potential for smart city development in Bangladesh, the speaker offers insights on lessons learned and best practices that can be applied. It emphasizes the importance of collaboration between government, industry, academia, and civil society in shaping smart cities and ensuring alignment with legal, ethical, and human rights principles. The speech concludes by underscoring the transformative potential of smart cities in driving sustainable development, economic growth, and social inclusion, and calls for continued research, innovation, and collaboration in Bangladesh's journey towards becoming a smart nation.

Brief Bio

Hartini Saripan is an Associate Professor at the Faculty of Law, Universiti Teknologi MARA, Shah Alam, Malaysia where she has been serving for 20 years. She is currently the Dean of the Faculty of Law. She obtained her PhD in Law from UiTM. She researched electronic commerce and digital signature legislation in cyber law. Later, she specialised in robotic law and AI. Cyber Security Malaysia and the National Centre for Governance, Integrity, and Anti-Corruption hired her as the primary consultant and researcher on Law and Technology, Privacy, Ethics, and Integrity. Furthermore, her research has been funded by several national grants including the Fundamental Research Grant Scheme (FRGS) and Niche Research Grant Scheme (NRGS). She is interested in legal education, industry-driven curriculum, and future graduate models, notably in the post-pandemic age, in addition to her research and consultancy work. She has experience of working as an invited speaker and panellist at institutions in Turkey, Russia, Indonesia, and India on this relevant issue. Moreover, she has authored many flagship and indexed journal papers.



**2nd International Conference on
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ICTBJ-2023**

**Programme Schedule
Day One: Monday, 5 June 2023
Inaugural Session
Venue: Central Library, 2nd Floor**

09:30 am Presenters and Participants take seats
09:45 am Guests take seats
10:00 am Welcome Address and Introduction to the Conference
Prof. Dr. Tushar Kanti Saha
Convenor, ICTBJ-2023

Address by the Special Guests

10:07 am **Dr. Md. Humayun Kabir**
Registrar, JKKNIU
10:10 am **Mr. Md. Altaf Hossain**
Project Director, iDEA, ICT Division
10:13 am **Professor Dr. Md. Riad Hassan**
Dean, Faculty of Business Administration
10:16 am **Prof. Dr. Uzzal Kumar Prodhan**
Dean, Faculty of Science and Engineering
10:19 am **Prof. Dr. Durgadas Bhattacharjee**
Former Vice Chancellor, National University, Bangladesh

Address by the Guests of Honour

10:25 am **Dr. Syoji Kobashi**
University of Hyogo, Japan
10:30 am **Dr. Binod Krishna Shrestha**
Kathmandu University, Nepal
10:35 am **Dr. Hartini Saripan**
UiTM, Malaysia

Address by the Chief Guest

10:40 am **Mr. Mohibul Hassan Chowdhury, MP**
Deputy Minister, Ministry of Education
Government of the People's Republic of Bangladesh

Address by the Chair

10:50 am **Professor Dr. Soumitra Sekhar**
Vice Chancellor
Jatiya Kabi Kazi Nazrul Islam University

Photography & Refreshments: 11:00 am - 11:30 am



SCIENCE SESSIONS

Day One, Monday, 5 June 2023

Keynote Talk: Artificial Intelligence-Based Computer-Aided Diagnosis

Speaker: Dr. Syoji Kobashi, University of Hyogo, Japan

Chair: Prof. Dr. Uzzal Kumar Prodhan, Dean, Faculty of Science & Engineering, JKKNUI

Time: 11:30 am – 12:20 pm; **Venue:** Administrative Building, Conference Room

Parallel Sessions One: 12:30 pm - 01:20 pm

Theme: Machine Learning

Venue: Science Building, Room No. 417

Session Chair: Prof. Dr. Sajjad Waheed, Dept. of Information and Communication Technology, MBSTU

Paper ID	Title
S-16	Cooperative Spectrum Sensing in Full-duplex Based CR-IoT Using Convolutional Neural Network
S-18	Fracture Recognition from Pelvic X-Ray Images Using Deep Convolutional Neural Networks (DCNN)
S-67	Patient Allocating Management Tool for Infectious Disease Based on Data Mining with Machine Learning Algorithms: Study Case Covid-19

Theme: Artificial Intelligence

Venue: Science Building, Room No. 505

Session Chair: Prof. Dr. A. H. M. Kamal, Department of Computer Science and Engineering, JKKNUI

Paper ID	Title
S-12	Comparative Study of NLP and Fuzzy Logic for Text Summarization
S-61	An IoT-based Intelligent Security System Through Visualizing Human Faces for Access Control Using Raspberry Pi
S-33	A Hyper-tuned Vision Transformer Model with Explainable AI for Eye Disease Detection and Classification from Retinal Images

Lunch and Prayer Break: 01:20 pm - 02:30 pm

Parallel Sessions Two: 02:30 pm - 03:30 pm

Theme: Artificial Intelligence/Internet Application

Venue: Science Building, Room No. 417

Session Chair: Prof. Dr. Sajjad Waheed, Dept. of Information and Communication Technology, MBSTU

Paper ID	Title
S-3	BanglaDigitNet: Bangla Handwritten Digit Recognition Using Convolutional Neural Network
S-25	Unlocking Potential: The Impact of ICT on Female Education and Employment in Bangladesh
SO-2	Real-Time BCI Scheme to Assisting Disabled Persons Using Motor Imagery EEG Signal Classification



Theme: Machine Learning

Venue: Science Building, Room No. 505

Session Chair : Prof. Dr. Uzzal Kumar Prodhyan, Dept. of Computer Science and Engineering, JKKNIU

Paper ID	Title
S-29	Enhancing Lung Cancer Diagnosis Using a Hybrid VGG-16 and Vision Transformer Model
S-56	Speaker Independent Bangla Isolated Speech Recognition Using Deep Neural Network
S-63	Efficient Techniques for Moving Object Detection Using Deep Learning

Parallel Sessions Three: 03:45 pm - 04:45 pm

Theme: Machine Learning

Venue: Science Building, Room No. 417

Session Chair: Prof. Dr. Sajjad Waheed, Dept. of Information and Communication Technology, MBSTU

Paper ID	Title
S-8	Prospective Methodology of Hand Gesture Image Processing for Human-Computer Interaction Systems
S-39	Ontology-based Spatio-temporal Data Mining Approach for Health Care in Bangladesh
S-55	A Study on Machine Learning Algorithms with Different Encoding Techniques for Identifying the Right One for Patients' Big Data

Theme: Communication

Venue: Science Building, Room No. 505

Session Chair: Prof. Dr. Mst Jannatul Ferdous, Department of Computer Science and Engineering, JKKNIU

Paper ID	Title
S-6	Child Drowning Prevention: GPS and LoRa Based Emergency Alert System
S-51	A Hexagonal Low Loss PCF with Five Ring of Air Hole Exhibiting Near-Zero Ultra-Flattened Dispersion for Broadband Optical Communication
S-64	Mobile Phone Controlled Robots Using DTMF Technology: An Innovative Approach for Efficient and Versatile Control

Prayer and Tea Break: 04:45 pm - 05:15 pm

Parallel Session Four: 05:15 pm - 06:15 pm

Theme: Microwave Antenna

Venue: Science Building, Room No. 417

Session Chair: Prof. Dr. Md. Sujan Ali, Department of Computer Science and Engineering, JKKNIU

Paper ID	Title
S-60	Antenna-based Detection of the Breast Cancer: A Feasibility Study
SO-5	Millimeter Wave C-Slotted Microstrip Patch Antenna for 5G Communication
SO-6	Design of Rectangular Microstrip Patch Antenna for Detecting Brain Tumor



Theme: Internet Application

Venue: Science Building, Room No. 505

Session Chair: Prof. Dr. Md. Mijanur Rahman, Department of Computer Science and Engineering, JKKNIU

Paper ID	Title
S-4	A Survey on Electronic Healthcare Systems in Bangladesh: Current Consequences and Future Prospects
S-9	Optimizing Last-mile Delivery of A Company: A Vehicle Routing Solution
S-48	GPS Tracker for Field Staffs Through Application and Authority Monitoring System in Web

Day Two, Tuesday, 6 June 2023

Parallel Sessions Five: 12:00 pm - 01:00 pm

Theme: Environmental Pollution

Venue: Science Building, Room No. 417

Session Chair: Prof. Dr. Syed Samsuddin Ahmed, Dept. of Geology & Mining, University of Rajshahi

Paper ID	Title
S-28	Evaluation of Human Risk of Polycyclic Aromatic Hydrocarbons Produced as a Processes Contaminant
S-65	Isolation and Characterization of Entomopathogenic Bacteria (EPB) from Bangladesh Soils
S-202	An Analytical Approach to Evaluate Particulate Matter Concentrations in Outdoor Workplace Environments of Dinajpur Municipality in Bangladesh.

Theme: Waste Management and Green Technology.

Venue: Science Building, Room No. 505

Session Chair: Prof. Dr. Subrota Kumar Saha, Department of Geology & Mining, University of Dhaka

Paper ID	Title
S-19	Comparison of Alternative Freight Routes from Turkiye to Europe under the Green Deal
S-200	Assessment of Health Care Waste Generation and Management Status in Selected Institutions of Dinajpur City in Bangladesh.
SO-7	Solid Waste Management Practices in Mymensingh City Corporation Areas, North-central Bangladesh

Lunch and Prayer Break: 01:00 pm - 02:00 pm

Parallel Sessions Six: 02:00 pm - 03:00 pm

Theme: Water Quality and Biodiversity

Venue: Science Building, Room No. 417

Session Chair: Prof. Dr. Subrota Kumar Saha, Department of Geology & Mining, University of Dhaka

Paper ID	Title
S-37	Floral Biodiversity Depletion in the Bakkhali River Estuary, Cox's Bazar, Chattogram
S-41	Seawater Quality Analysis of the Coastal Regions of the Sundarban Mangrove Forest of Bangladesh
S-42	Assessment of Surface Water Quality in Karnaphuli Estuary



Theme: Public Health

Venue: Science Building, Room No. 505

Session Chair: Prof. Dr. M. Kamruj Jaman Bhuiyan, Dept. of Agricultural and Applied Statistics, BAU

Paper ID	Title
S-13	Solid Fuel Use in the Household Elevates Blood Pressure of Reproductive-aged Married Women in Bangladesh
S-21	Exploring the Factors that Influence Contraceptive Use in Mymensingh Division, Bangladesh: A Cross-Sectional Study
S-70	Women's Decision-Making Power and Its Association with Contraceptive Use in Bangladesh: Evidence from a Cross-Sectional Survey

Tea Break: 03:00 pm - 03:15 pm

Parallel Sessions Seven: 03:15 pm - 04:15 pm

Theme: Public Health

Venue: Science Building, Room No. 417

Session Chair: Prof. Dr. M. Kamruj Jaman Bhuiyan, Dept. of Agricultural and Applied Statistics, BAU

Paper ID	Title
S-7	Availability and Readiness of Healthcare Facilities and Their Effects on Antenatal Care Services Uptake in Bangladesh: Evidence from Household and Health Facility Level Surveys
S-20	Factors Affecting the Cost of Antenatal Care in Bangladesh: A Cross-sectional Study in Mymensingh Division
S-30	The Prevalence of Self-reported Mental Disorders (Depression and Anxiety) and Its Association with Socio-demographic Factors among the Adolescents Aged 15 to 21 in Bangladesh

Closing and Award-giving Ceremony: 04:30 pm - 06:00 pm



B U S I N E S S S E S S I O N S

Day One, Monday, 5 June 2023

Parallel Sessions One: 12:30 pm - 01:20 pm

Theme: Sustainability for Business and Society

Venue: Faculty of Business Administration, Room No. 501

Session Chair: Dr. Md. Reiazul Haque, University of Manchester, UK

Paper ID	Title
B-06	Sustainable Strategy and Socially Responsible Human Resource Management in Predicting the Sustainable Performance
B-55	Sustainability Performance and Decision Usefulness of Sustainability Disclosures: Moderating Effect of Corporate Governance Quality
B-63	The Impact of Corporate Social Responsibility on Cost of Debt: An Empirical Study of Political Institutional Setting

Theme: Financial Innovation in a Changing World

Venue: Faculty of Business Administration, Room No. 502

Session Chair: Dr. Abdul Karium Masud, Associate Prof., Noakhali Science and Technology University

Paper ID	Title
B-01	Fintech Credit Using CBDC: Transformation of Lending Market in Asia Pacific
B-05	Blockchain-based KYC Framework for Banks: A Study on Bangladesh
BO-2	The Financial Technology (FinTech) in Bangladesh: A Journey towards Complete Financial Inclusion

Lunch and Prayer Break: 01:20 pm - 02:30 pm

Parallel Sessions Two: 02:30 pm - 03:30 pm

Theme: Technology in Banking and Auditing

Venue: Faculty of Business Administration, Room No. 501

Session Chair: Dr. Md. Alamgir Hossain, Associate Professor, HSTU

Paper ID	Title
B-11	Role of Technology on Depositors' Bank Selection Decision
B-57	Technological Transformation in Audit: An Evidence from Auditing Practice in Bangladesh
BO-1	Regulatory Technology (Regtech) Landscape of Bangladesh: Policies and Practices

Theme: Leadership and Entrepreneurship

Venue: Faculty of Business Administration, Room No. 502

Session Chair: Prof. Dr. Razu Ahmed, Department of Accounting & Information Systems, JKKNLU

Paper ID	Title
B-04	The Influence of Subordinates' Strength-based Leadership on Creative Process Engagement in A Moderated Mediation Mechanism
B-51	Effects of Business Environment on Social Entrepreneurship
B-61	Impact of Technology and Social Capital on Women Entrepreneurship Development in Bangladesh



Parallel Sessions Three: 03:45 pm - 04:45 pm

Theme: Corporate Governance and Auditing

Venue: Faculty of Business Administration, Room No. 501

Session Chair: Dr. Md. Reiazul Haque, University of Manchester, UK

Paper ID	Title
B-16	Influence of Corporate Governance on Firm Value: Evidence from Bangladeshi Manufacturing Industry
B-47	The Impact of Document Verification System on Audit Fees in Banks: An Empirical Study in Bangladesh
B-48	Determinants of Corporate Governance and Its Effect on Credit Risk: A Study on Commercial Banks in Bangladesh

Theme: Financial Management and Stock Market

Venue: Faculty of Business Administration, Room No. 502

Session Chair: Prof. Dr. S. M. Sohrab Uddin, Department of Finance, University of Chittagong

Paper ID	Title
B-17	Impact of Demographic Variables on Investor's Risk Tolerance: Empirical Study from Bangladesh
B-28	The Impact of Interest-Free Islamic Microfinance on the Wellbeing of the Borrowers in Bangladesh: A Qualitative Investigation
B-44	Impact of Dividend Policy on Stock Price: A Study on Pharmaceutical and Chemical Companies Listed in DSE

Prayer and Tea Break: 04:45 pm - 05:15 pm

Parallel Sessions Four: 05:15 pm - 06:15 pm

Theme: Digital Financial Services and Online Food Delivery System

Venue: Faculty of Business Administration, Room No. 501

Session Chair: Prof. Dr. S. M. Sohrab Uddin, Department of Finance, University of Chittagong

Paper ID	Title
B-25	Enablers and Inhibitors of Mobile Financial Services (MFS) in an Emerging Economy: A Dual Factor Theory Perspective
B-26	Determining the Factors Affecting the Usage of the Online Food Delivery App of Pathao Food in Bangladesh: The Moderating Effect of Post Covid-19 Impact
B-33	Level of Acceptance of Mobile Banking at Rajshahi City in Bangladesh

Theme: Affordability and Access to Healthcare Services

Venue: Faculty of Business Administration, Room No. 502

Session Chair: Prof. Dr. Md. Riad Hassan, Department of Accounting & Information Systems, JKKNIU

Paper ID	Title
B-20	Exploring the Cost and Accessibility of Delivery Healthcare Services in Mymensingh Division, Bangladesh
B-49	An Empirical Study on Patients' Satisfaction with Community Clinics Healthcare Services: Based on Exploratory Factor Analysis
BO-4	Exploring the Impact of E-Business Deals on Cost and Client Service in the Healthcare Industry of Bangladesh



Day Two, Tuesday, 6 June 2023

Keynote Talk: Digitalizing Businesses for Smart Bangladesh

Speaker: Prof. Dr. Binod Krishna Shrestha, University of Kathmandu, Nepal

Chair: Prof. Dr. Md. Riad Hassan, Dean, Faculty of Business Administration, JKKNIU

Time: 11:00 am – 11:50 am; **Venue:** Administrative Building, Conference Room

Parallel Sessions Five: 12:00 pm - 01:00 pm

Theme: Organizational Development in Business and Education

Venue: Faculty of Business Administration, Room No. 502

Session Chair: Prof. Dr. Shakhawat Hossain Sarkar, Dept. of Accounting & Information Systems, JKKNIU

Paper ID	Title
B-35	Analysis of Trade of Fertilizer Products of the BIMSTEC Member Countries
B-36	Influences of theater practices in higher educational institute: A comparative study with Maturity-Immaturity Model of Chris Argyris on theatre activist and non-theatre activist students
B-45	Factors Affecting Organizational Climate at Tertiary-Level Educational Institutions: An Empirical Study on Private University Teachers in Bangladesh

Lunch and Prayer Break: 01:00 pm - 02:00 pm

Parallel Sessions Six: 02:00 pm - 03:00 pm

Theme: Technology and Media in Marketing

Venue: Faculty of Business Administration, Room No. 502

Session Chair: Prof. Dr. Mollah Aminul Islam, Department of Accounting & Information Systems, JKKNIU

Paper ID	Title
B-02	Creating Ethical Tech Savvy Business for Smart Bangladesh
B-14	The Role of Digital Advertisement and Influencer Marketing on Brand Equity
B-32	Nexus between Swift Guanxi and Purchase Decision in Livestreaming

Tea Break: 03:00 pm - 03:15 pm

Closing and Award-giving Ceremony: 04:30 pm - 06:00 pm



L A W S E S S I O N S

Day One, Monday, 5 June 2023

Parallel Sessions One: 12:30 pm - 01:20 pm

Theme: Law and Society in Bangladesh: Exploring Critical Issues for a Safer, Inclusive, and Transparent Future

Venue: Administrative Building, Conference Room

Session Chair: Prof. Dr. Nakib Muhammad Nasrullah, Department of Law, University of Dhaka

Paper ID	Title
L-9	Road To Safety: Legal Ways to Address the Key Behavioural Risk Factors Behind Road Crashes in Bangladesh
L-18	Are Child Actors Workers in Bangladesh? A Critical Legal Analysis
L-37	Knowledge, Practice and Response of Right to Information (RTI) Act: A Study at Jatiya Kabi Kazi Nazrul Islam University, Bangladesh

Lunch and Prayer Break: 01:20 pm - 02:30 pm

Parallel Sessions Two: 02:30 pm - 03:30 pm

Theme: Constitutional Dynamics: Exploring Awareness, Equity, and Freedom of Expression in Bangladesh

Venue: Administrative Building, Conference Room

Session Chair: Prof. Dr. Md. Anisur Rahman, Department of Law, University of Rajshahi

Paper ID	Title
L-20	Awareness about the Constitution of Bangladesh: An Empirical Study on the Secondary and Tertiary Level Students in Mymensingh District
L-35	Law and Economics of Positive Discrimination Under Constitution: Bangladesh Context
L-43	Meme Culture in Bangladesh: "My Right Ends Where Yours Begin," From Freedom of Expression to Undesirable Consequences in Digital Age.

Parallel Sessions Three: 03:45 pm - 04:45 pm

Theme: Navigating Economic Practices, Patent issues in Public Health, and Cybersecurity in Bangladesh

Venue: Administrative Building, Conference Room

Session Chair: Prof. Dr. Nakib Muhammad Nasrullah, Department of Law, University of Dhaka

Paper ID	Title
L-4	The Unsupervised Business Practices Through Online Market Platforms Causing Barriers to Sustainable Economic Growth: Need for Legal Reforms
L-22	Pharmaceutical Patents under the TRIPS Agreement and Its Potential to Protect Public Health during Pandemic in Bangladesh
L-27	Combating Cybercrime in The Financial Sector: A Study on Problems, Preventions, and Cyber Laws of Bangladesh

Prayer and Tea Break: 04:45 pm - 05:15 pm



Parallel Sessions Four: 05:15 pm - 06:15 pm

Theme: Empowering Women: Legal Perspectives on Trafficking, Rights, Technology, and Social Norms in Bangladesh

Venue: Administrative Building, Conference Room

Session Chair: Professor Dr. Md. Anisur Rahman, Department of Law, University of Rajshahi

Paper ID	Title
L-6	Laws Relating to Women Trafficking in Bangladesh: A Comparative Study with SAARC Countries
L-29	Protecting Women's Rights: "The Role of Alternative Dispute Resolution in Bangladesh"
L-36	Technology Facilitated Violence Against Women in Bangladesh
L-41	Misconception of Dowers: An Evil Exercise Which Leads to an Unethical Burden to a Man

Day Two, Tuesday, 6 June 2023

Keynote Talk: A Roadmap towards Smart Bangladesh: Exploring Malaysia's Path to Smart Cities Aspiration

Speaker: Dr. Hartini Saripan, Universiti Teknologi MARA, Malaysia

Chair: Prof. Dr. SM Masum Billah, Dean, Faculty of Law, Jagannath University

Time: 10:00 am – 10:50 am; **Venue:** Administrative Building, Conference Room

Parallel Sessions Five: 12:00 pm - 01:00 pm

Theme: Safeguarding Nature and Advancing Legal Technology: Exploring Environmental Laws, AI, and Ecocide in Bangladesh

Venue: Administrative Building, Conference Room

Session Chair: Prof. Dr. SM Masum Billah, Dean, Faculty of Law, Jagannath University

Paper ID	Title
L-08	A Study on The Effectiveness of Environmental Laws in Bangladesh in Protecting the Country's Natural Resources
L-25	Ecocide Laws: A New tool to Environmental Justice
L-07	Role Of Artificial Intelligence in Law and Legal Technology
L-33	Using Artificial Intelligence (AI) to enhance smooth legal operations: Potentials and Challenges

Lunch and Prayer Break: 01:00 pm - 02:00 pm

Parallel Sessions Six: 02:00 pm - 03:00 pm

Theme: Examining the Complexities of Bangladesh's Digital Security Act and Its Impact on Expression and Privacy

Venue: Administrative Building, Conference Room

Session Chair: Dr. Md. Raziur Rahman, Dean, Faculty of Law, BSMRSTU, Gopalganj

Paper ID	Title
L-14	Freedom of Expression and the Digital Security Act, 2018: Achievements and Complexities in Smart Bangladesh
L-28	Controlling Online Content: How the Digital Security Act 2018 Limits Freedom of Expression under Article 39 of the Bangladesh Constitution
L-40	The Impact of Government Surveillance on Individuals Right to Privacy and Freedom of Expression in Bangladesh

Tea Break: 3:00 pm - 3:15 pm

Parallel Sessions Seven: 03:15 pm - 04:15 pm

Theme: Exploring Legal Reforms in Bangladesh: Perspectives on Land Digitalization, Arrest and Detention, and Pecuniary Matters

Venue: Administrative Building, Conference Room

Session Chair: Professor Dr. S M Masum Billah, Dean, Faculty of Law, Jagannath University

Paper ID	Title
L-5	Challenges and Prospects of Digitalization of Land Documents in Reducing Land-related Cases in Bangladesh
L-10	Arrest and Detention under Code of Civil Procedure: A Critique
L-19	Revisiting Major Legal Provisions Regarding Pecuniary Matters in Bangladesh

Closing and Award-giving Ceremony: 04:30 pm - 06:00 pm



**Extended Abstracts
on
Science**



Cooperative Spectrum Sensing in Full-Duplex Based CR-IoT Using Convolutional Neural Network

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Introduction: The next-generation Internet of Things (IoT) has numerous unique benefits including its cheap cost, and ample bandwidth (Gupta and Jha, 2015). In IoT networks, the spectrum use is poor, and the total spectral efficiency of the IoT networks is constrained by the ineffective spectrum access method. Cognitive radio (CR) is a promising technology for the next-generation IoT. In CR-IoT networks(Malik et al., 2022), each CR-IoT user is permitted to access the licensed spectrum of the primary users (PUs) by using three transmission approaches i.e., underlay, overlay and interweave approaches. Cooperative spectrum sensing (CSS) improves sensing performance to mitigate the effects of the hidden node problem. Many spectrum sensing techniques like cyclostationary, matched filter, and energy detection (ED) have been described (Chae et al., 2022). In (Krishnakumar et al., 2022), the authors investigated a machine learning (ML) based spectrum sensing in CR networks. In (Miah et al., 2022), the authors presented an ML algorithm where to identify and cluster malicious CR-IoT users using a support vector machine. In (Lee et al., 2018), the authors presented a convolution neural network (CNN) to enhance the performance in low SNR. However, the CNN-based CSS in full-duplex (FD)-based CR-IoT networks has not yet been examined in relation to sensing performance and security risks. In this paper, we propose CNN-based secure CSS in FD-based CR-IoT networks which enhances security by excluding unauthorized CR-IoT users (malicious user (MU)) from authorized CR-IoT users (secondary user (SU)). Due to the unauthorized CR-IoT users degrade the sensing performance. According to simulation results, the proposed scheme achieves a better sensing performance using hard fusion rules and enhances security compared to the conventional scheme.

Materials and methods: We consider the CSS in FD-based CR-IoT networks using CNN which consists of a pair of PUs i.e., PU_{TX} and PU_{RX}, K CR-IoT users including authorized users and unauthorized users, a fusion center (FC). Each CR-IoT user employs the FD approach where each CR-IoT user transmits and receives simultaneously. Also, FC is separating unauthorized CR-IoT users from authorized CR-IoT users based on CNN. During the sensing time slot, both authorized and unauthorized CR-IoT users sense the transmitted PU_{TX} signal through a radio frequency (RF) link, and transmit their own data between the transmitter and receiver of CR-IoT users during the reporting time, simultaneously. The received signal of the kth CR-IoT user, $y_k(t)$ under both hypotheses ($\mathbf{H}_0/\mathbf{H}_1$) as follows-

$$y_k(t) = \begin{cases} s_k(t) + n_k(t), & \mathbf{H}_0; t = 1, 2, 3, \dots, T \\ (x(t) + s_k(t) + n_k(t)), & \mathbf{H}_1; k = 1, 2, 3, \dots, K \end{cases}$$

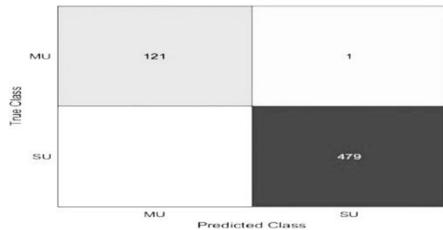
where the transmitted signal of PU_X(t), self-interference (SI) of CR-IoT users $s_k(t)$ and noise $n_k(t)$ is CSCG random variable with mean zero and variance $E[|x(t)|^2] = \delta_p^2$, $E[|s_k(t)|^2] = \delta_{s,k}^2$ and $E[|n_k(t)|^2] = \delta_{n,k}^2$, respectively. Now, we determine the average received signal energy of the kth CR-IoT user, E_k based on the ED technique as $E_k = \frac{1}{T} \sum_{t=1}^T |y_k(t)|^2$. CNN is one of the deep learning technologies which consists of a convolution layer, pooling layer, and fully connected layer. Also, its performance depends on some parameters including the configuration of each layer, size of the filter, initial weight, etc. In this paper, we assume the received signal energy, signal-to-interference-plus-noise ratio (SINR), and noise uncertainty factor as features. Based on these features, the CNN is separating the authorized CR-IoT users from unauthorized CR-IoT users. Based on the *n-out-*



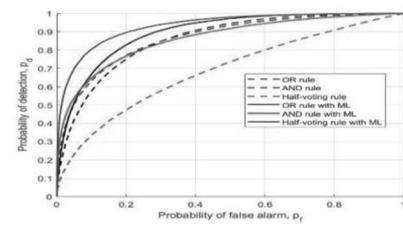
of- k rule, only the k^{th} authorized CR-IoT users are calculated for the probability of a false alarm $p_{k,f}$ and detection $p_{k,d}$, respectively which are given as-

$$p_{k,f} = \Pr[E_k \geq \beta_k | \mathbf{H}_0] = Q\left(\frac{\beta_k - T_k \left(1 + \frac{\delta_{s,k}^2}{\delta_{n,k}^2}\right)}{\sqrt{2T_k \left(1 + 2 \times \frac{\delta_{s,k}^2}{\delta_{n,k}^2}\right)}}\right), \text{ and } p_{k,d} = \Pr[E_k \geq \beta_k | \mathbf{H}_1] = Q\left(\frac{\beta_k - T_k \left(1 + \frac{\delta_p^2 + \delta_{s,k}^2}{\delta_{n,k}^2}\right)}{\sqrt{2T_k \left(1 + 2 \times \frac{\delta_p^2 + \delta_{s,k}^2}{\delta_{n,k}^2}\right)}}\right)$$

Results and discussion: To evaluate the performance of detection accuracy of CNN for total datasets (600), authorized users (481), unauthorized users (119), number of samples (300), training data (80%), and testing data (20%). The confusion matrix (CM) for CNN and detection gain are depicted in Figure 1(a), and 1(b), respectively. In Figure 1(a), the unauthorized CR-IoT users' detection accuracy of CNN is 99.80%. The probability of detection $p_{k,d}$ of the proposed scheme for half-voting, OR and AND rules enhance which is 0.90, 0.82, and 0.78, respectively under the probability of false alarm $p_{k,f}$ is 0.2 when compared to the conventional scheme (without CNN) in Figure 1(b). The sensing performance of the half-voting rule is higher than the other fusion rules like OR and AND rules.



(a) CM for CNN



(b) Receiver operating characteristics (ROC) curve

Figure 1: The CM and ROC of the proposed scheme and the conventional scheme (without CNN)

Conclusion: We concluded that our proposed scheme (with CNN) improves both security and sensing performance compared with the conventional scheme (without CNN). The simulation results show that the theoretical analysis is correct.

Acknowledgement: This work has been supported by the BANBEIS, Ministry of Education, Bangladesh (PCN No. IC20201325).

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Fracture Recognition from Pelvic X-ray Images Using Deep Convolutional Neural Networks (DCNN)

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Introduction: Pelvic fracture is a significant health concern, particularly among the elderly people (O'brien et al., 2002). In some cases, a pelvic fracture can lead to nerve damage and internal bleeding, which may lead to high morbidity. Hence, prompt diagnosis is critical for effective treatment and minimizing the risk of sequelae. However, the number of patients with pelvic fractures is continuously increasing in many countries (Marks, 2010). According to a recent study, hospitalization due to pelvic fractures is increasing even in Bangladesh (Hossain, et al., 2020). This increase in number of patients is also increasing the burden on radiologists, which contributes to initial misdiagnosis. Hence, the demand for an assistive system to diagnose pelvic fractures is increasing.

The objective of this study is to recognize fracture from pelvic X-ray (PXR) images using deep convolutional neural networks (DCNN). Moreover, the performance of three DCNNs, VGG16, Resnet50, and MobilenetV2, is assessed in order to determine the best performing DCNN for fracture identification from PXR.

Materials and methods: The PXR150 dataset is used in this study (Cheng et al., 2021). The dataset contains a total of 150 PXR images, 100 of which have fracture. The dataset is divided into two sets: training and test. The test dataset contains 20 PXR images with fracture and 10 PXR images without fracture. The remaining 120 images are part of the training dataset used to train DCNN. Random rotation, translation, vertical reflection, and shear are also used in training dataset to increase the variation and number of training data.

VGG16, Resnet50, and MobilenetV2 are used as DCNNs to train. Each DCNN is pre-trained using the ImageNet dataset (Russakovsky et al., 2015). Only the classification layers of the DCNNs are trained using the training dataset. Each DCNN is trained for 100 epochs with a batch size of 24, and initial learning rate of 0.0005. The learning rate is reduced by 0.1 in every 10 epochs. After the training, the performance of each DCNN is evaluated using the test dataset.

Results and discussion: The evaluation result of the trained model on the test dataset is summarized in Table 1. MobilenetV2 achieved the highest area under the receiver operating characteristic curve (AUROC), 0.856. VGG16 and Resnet50 achieved AUROC of 0.743 and 0.806 respectively. Hence, of the 3 DCNNs, MobilenetV2 was the best model to distinguish pelvic XR images with fracture from those without. The MobilenetV2 also obtained the highest precision, sensitivity, accuracy, and F1 score.

Table 1: Evaluation result on test dataset

DCNN	Precision	Sensitivity	Accuracy	F1 score	AUROC
VGG16	78.95%	75.00%	70.00%	0.769	0.743
Resnet50	80.00%	80.00%	73.33%	0.800	0.806
MobilenetV2	81.82%	90.00%	80.00%	0.857	0.856

Conclusion: In order to identify pelvic fractures from X-ray images, this study proposed a method using deep convolutional neural network (DCNN) and evaluated the performance of three distinct DCNN models: VGG16, Resnet50, and MobilenetV2. The models were trained and tested using the PXR150 dataset, which contains 150 pelvic X-ray images. MobilenetV2 delivered the best performance. According to the findings, DCNNs can be useful in diagnosing fractures from PXR images. The dataset employed in this study, however, is rather limited, with just 150 images, which may restrict the generalizability of the findings. Additionally, the study employed just one dataset, and further validation using bigger and varied datasets is essential to establish the usefulness of the proposed method in hospitals.

Keywords: DCNN, Pelvic X-ray, Fracture recognition



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Patient Allocation Management Tool for Infectious Disease Based on Data Mining with Machine Learning Algorithms: Case Study Covid-19

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Introduction: The Global Pandemic Preparedness ranking indicates that our country was unprepared to manage a pandemic as the number of infectious cases increased exponentially during the Pandemic, namely SARS-CoV-2 (Nuzzo, December 2021), (WHO, 19 December 2022), (Young-Saver, 2021). Separating the infectious cases from the infectiousness severity become so difficult for a little period of time. Since treating everyone, needs a vast amount of clinical assessment, an enormous number of patients will generate enormous clinical data. That results in much more difficulty in manually analyzing datasets by compensating for treatment time.

We will provide, through this study, a management tool by analyzing datasets with machine learning algorithms using MATLAB. This management tool will employ a highly efficient and effective hospital management system for the Covid-19 situation for tackling severe waves and regular Covid-19 (Figure: 1).

Materials and methods: The datasets used in this experiment are demi-datasets from secondary sources for primary detection of COVID-19 (0/1). The blood and clinical sampled datasets from patients confirmed to infect with Covid-19 and taking references from different secondary sources were generated into two sets of demi-data to detect and predict severity cases. Two hundred records were taken for binary classification and 150 for the multiclass classifier to indicate the severity level into three categories of Mild, Moderate, and Severe level (Huizen, 2020). The features comprise various clinical parameters broadly categorized under CRP, platelets, lymphocytes, monocytes, neutrophils, basophils, eosinophils, leukocytes, and hemoglobin (Guyi Wang, 2020), (L.Wang, 2020).

The raw demi-datasets were divided into two sets for binary and multiclass classification. Support Vector Machine (SVM), K-Nearest Neighbor (KNN), and Random Forest classifiers techniques were implemented on the Binary and Multiclass datasets. Performance evaluation will be based on accuracy, precision, recall, and f1-score.



Results and discussion: *Case I:* In the detection level, the binary classification approach, three different machine learning algorithms were applied to 80-20% and 70-30% of train-test data, respectively (Figure: 2). The average evaluation of performance parameters gives the best result for SVM and KNN algorithm.

Case: II: A similar approach is imposed on the multiclass classifier machine learning algorithm evaluating the accuracy, precision, f1-score, and recall. Training accuracy for multiclass algorithms implies that our model best fits for SVM algorithm giving the accuracy of 90.32% and 91.30% for 80-20% and 70-30% tarin-test ratios (Table: 1).

Table 1: Accuracy for various machine learning algorithm for different train-test ratios.

Model	80-20%	70-30%
SVM	90.32%	91.30%
KNN	90.32%	89.13%
Random forest	93.33%	86.67%

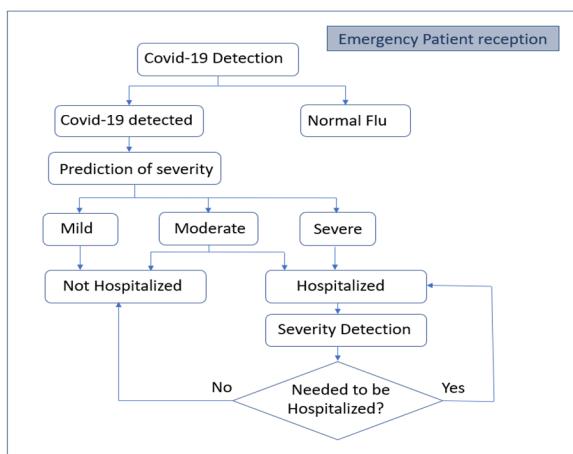


Figure 1: Schematic model for patient management plan during Covid-19.

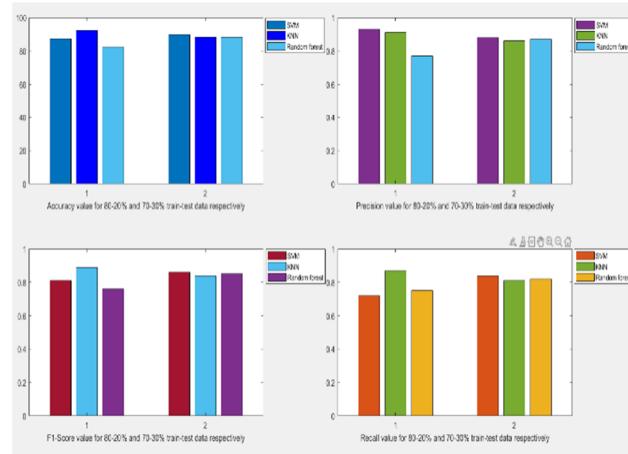


Figure 2: Performance evaluation parameter on four categories.

Conclusion: Throughout this study, we demonstrated a machine learning approach toward detecting Covid-19 and predicting its severance using clinical spectrum datasets. As, we add more attributes to our training data the accuracy, precision, f1-score, and recall improve significantly as the countries struggle with managing more patients than their capacity in any hospital. Proper utilization of patient allocation tools can enable to minimize risk for also noninfectious patients. This can be further implemented to reduce the contact for the healthcare workers as the number of patients visiting the hospital can increase significantly as the wave surges. The model output is a binary indicator for SARS-CoV-2 infection and indicates severance measurement for patient allocation.

In conclusion, we are optimistic that by using this process flow and training it on raw datasets resulting in rich data, this study's prediction can have a broad impact and achieve greater accuracy at less risk to human lives.

Keywords: Covid-19, Severity, Patient management tool

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Comparative Study of NLP and Fuzzy Logic for Text Summarization

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^b Power Grid Company of Bangladesh Limited, Bangladesh

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Introduction: Text summarization refers to the technique of shortening long pieces of text. The intention is to create a coherent and fluent summary having only the main points outlined in the document. Furthermore, applying text summarization reduces reading time, accelerates the process of researching for information, and increases the amount of information that can fit in an area. There are two different approaches that are used for text summarization. That is: 1. Extractive Summarization 2. Abstractive Summarization (Talukder et al., 2020). In Extractive summarization we identify the important sentences or phrases from the original text and extract only those from the text. Those extracted sentences would be our summary. On the other side, Abstractive summarization, we generate new sentences from the authentic text. This is in distinction to the extractive strategy we noticed in the past the place we used solely the sentences that have been present. The sentences generated thru abstractive summarization would possibly no longer be current in the unique textual content. Here are the two method of text summarization, by using NLP and Fuzzy logic. NLP refers to extractive summarization and Fuzzy logic refers to abstractive summarization (Awasthi et al., 2021). The research reflects a better approach to text summarization, showing that fuzzy logic-based abstractive summarization is superior to NLP-based extractive summarization. The fuzzy system is six times faster in generating summaries compared to the NLP system. In the proposed research, the human summary matching rate for fuzzy logic is 91%, whereas NLP only achieves 73% matching. The approach of text summarization uses to reduce reading time and help in better research work.

Materials and methods: The goal of text summarization based on extraction approach is sentence selection. One of the methods to obtain the suitable sentences is to assign some numerical measure of a sentence for the summary called sentence weighting and then select the best ones. We use two approach NLP and Fuzzy Logic. Both need those materials :Nltk, Pandas, Numpy. We use Programming Language python and the Platform is anaconda Jupiter notebook.

NLP is the method of summarizing the data in giant texts for faster consumption. NLP technique, a computer software shortens longer texts and generates summaries to pass by the supposed message, is described as Automatic Text Summarization and is a frequent trouble in machine learning and natural language processing (NLP).

Fuzzy logic approach in the structure of approximate reasoning affords selection assist and expert system with effective reasoning capabilities(Kyoomarsi et al., 2008). The purpose of text summarization based totally on extraction method is sentence selection. Fuzzy logic is one of the strategies to attain the appropriate sentences is to assign some numerical measure of a sentence for the precis referred to as sentence weighting and then pick the first-rate ones.



Results and discussion: Then we viewed various algorithms and techniques for text summarization we decided to use two approaches NLP and Fuzzy logic methods. This is two methods to supply their character precis in easiest ways and collectively offers unique kinds of summaries. User can give any variety of information (Document, paste information and additionally the textual content data) for generating summary.

In the comparative find out about on Text summarization using NLP and Fuzzy logic. The fantastic one of comparative is the Fuzzy logic model of Text summarization. Because of the, meaningful sentence and the clear photograph of the complete topic, it is also similar to the human summarization. In the case of the NLP, it is very quick to examine to Fuzzy logic. However, which means of sentence is very poor, essential sentences are lacking for the summary. Time consumption of NLP is too late than Fuzzy logic for providing the summary.

Fuzzy system is usually taking quick time for generating the summary when evaluating with NLP system. In the case of length of the precis NLP solely generate most important sentences and as a result the precis size will be shorter than Fuzzy. But there can be a state of affairs the place lacking of some necessary sentences in case of NLP. Both the strategies a good semantically right summary. If we compare both approaches, we can find the followings:

Table 1: Results

System	Average Time (s)	Average Length (words)	Syntactically Correct	Human Summary Matching (%)
NLP	15.34	90	✓	73%
Fuzzy Logic	2.45	350	✓	91%

Conclusion: Extractive summarization process is highly coherent, less redundant and cohesive (summary and information rich). Experimental results show that text rank algorithm could be used for the summarization task. With this growing increase of the Internet, it has made a huge amount of data available. For people it is difficult to interpret massive extent of data. Thus, a device that can limit the workload of human are extra vital to be build. Therefore, this assists human beings in lowering their time consumption and additionally their work discount in internet. When researching document, summaries, make the selection process easier. Summary can include phrases that are not explicitly existing in the authentic document. This software is limited to only text and big document. Multiple documents can't take input. Any link or website can't be given as input.

Keywords: Text summarization, NLP, Fuzzy logic.

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An IoT-based Intelligent Security System through Visualizing Human Faces for Access Control Using Raspberry Pi

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Introduction: In recent years, security has become an increasingly important concern in several places including homes, offices, airports, military areas, etc. Therefore, a continuous and constant security system that works 24/7 is required. However, there is a high risk of fraud and security breaches using traditional methods, such as a password and smart card. Besides, conventional face-recognition-based security systems are highly interruptible by spoof attacks (Sandeep Kumar, 2017). Hence, unauthorized access in secured areas may arise. In this paper, we propose an IoT-based intelligent security system by visualizing real-time human faces using Principle Component Analysis (PCA) and Convolutional Neural Network (CNN). The anti-spoof model is trained using supervised machine learning (CNN, Adam Optimizer, Binary Classification) on real and spoof image data to prevent fake face attacks. For evaluations, we implemented the proposal in the real testbed system with Raspberry Pi and the results confirmed the effectiveness of our proposal by notifying the e-mail with a captured image of the intruder.

Materials and Methods: The proposed method is intended to ensure security by controlling access to certain locations which is implemented in the real testbed system using raspberry pi. This method consists of three steps: i) data collection and analysis, ii) training the anti-spoof model, and iii) pre-processing the data for authorization.

Data Collection and Analysis: Two types of datasets are used in this proposal, the first dataset with two categories of images named ‘real’ and ‘spoof’ is adopted for training the anti-spoof model. Here, the ‘real’ images are the images taken by the camera directly. On the other hand, ‘spoof’ images are the images taken from ‘real’ images using a camera module. The second dataset is designed with 50 images of 10 authorized people which is considered as the raw dataset for authorization. Table 1 shows the amount of image data used to train the CNN anti-spoof model.

Table 1: The amount of model data

Training		Validation	
Real	Spoof	Real	Spoof
5228	2925	1954	1668

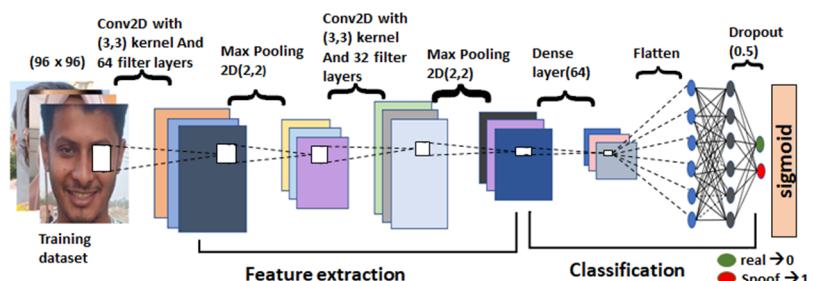


Figure 1: Schematic diagram of anti-spoof model training

(II) Training the model: The CNN model trains the dataset from Table 1, each input image passes through a series of 2 convolutional layers, 2 MaxPooling layers, a fully connected Dense layer, an Adam optimizer, and the sigmoid activation function to classify the images with probabilistic values between 0 and 1 (Abu-Naser, March - 2022). Figure 1 shows the schematic diagram of training the CNN anti-spoof model. The size of input images is (96,96,1) and the batch size is 32.

(III) Pre-processing the Authorization data: PCA is applied to the encodings of the authorized dataset to count the basic facial features only.

2.2 Experimental Setup: Figure 2 and Figure 3 show the experimental setup and the working procedure of the proposed method, respectively. Raspberry Pi 3 Model B and a Raspberry Pi camera module with 5Mega Pixel

resolution were adopted for the experiment. The proposal is implemented using Python programming language. The **Viola-Jones Face-detection** algorithm was used for this face detection.

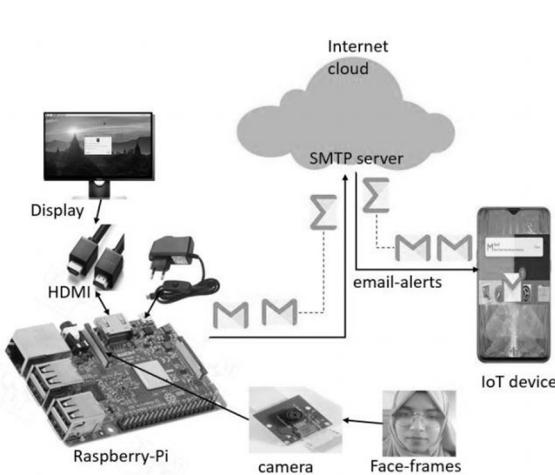


Figure 2: Experimental setup

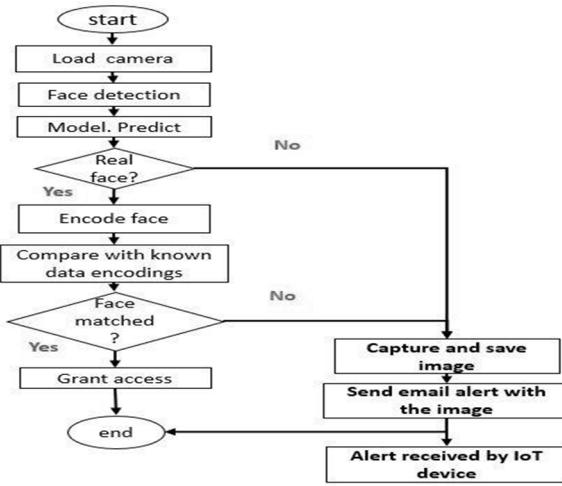


Figure 3: Workflow of the proposed method

Results and Discussions: The CNN anti-spoof model accuracy graph shown in Figure 4 demonstrates higher validation accuracy, approximately 96.32%, with 50 epochs. The collection of spoof images from real images results in differences in texture, 3D face shape, and resolutions between real and spoof/fake images.

Table 2: System accuracy in real testbed analysis

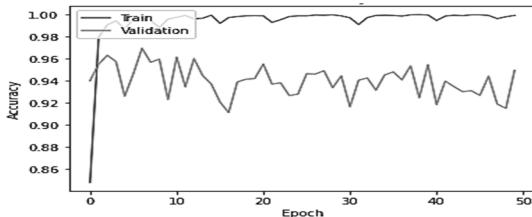


Figure 4: The anti-spoof model accuracy

Table 2 shows the accuracy of our proposed system in real testbed analysis. Our proposal achieves 100% accuracy when tested with 10 real faces. It makes 9 correct predictions out of 10 fake faces. Also, the system achieves 85% accuracy for video replay attacks.

Conclusion: This paper proposed an IoT-based intelligent security system by visualizing real-time human faces for access control. Supervised machine learning is adopted in this proposal to train the anti-spoof model using real and spoof image data. The proposal was implemented using principle component analysis (PCA) and convolutional neural network (CNN) using Raspberry Pi. The effectiveness was confirmed through real testbed experiments which allows only real and authorized faces into the system and sent alerts for other conditions. In future works, we will perform the experiments under various lighting conditions and verify them for the effectiveness of our proposal.

Keywords: Security-system, CNN anti-spoof model, Email alert, Raspberry Pi, IoT

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A Hyper-Tuned Vision Transformer Model with Explainable AI for Eye Disease Detection and Classification from Retinal Images

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Introduction: Eye disease is a significant health issue that affects millions of people worldwide. Timely and accurate detection and classification of eye diseases are crucial for effective treatment and management (He et al., 2021). Retinal image analysis is an effective method for early detection and diagnosis of eye diseases, but it remains challenging (Razzak et al., 2018). Manual inspection is time-consuming and prone to error, and there is a shortage of ophthalmologists in many parts of the world. Automated methods using machine learning can improve accuracy and efficiency but face challenges such as image quality, variability in pathology, data annotation, imbalanced data, and ethical/legal issues. Therefore, this study aims to develop a robust algorithm for detecting and classifying eye diseases from retinal images, using machine learning and large annotated datasets, to provide accurate and timely diagnosis, particularly in underserved communities. Hence, this research presents a novel eye disease detection and classification approach using a hyper-tuned Vision Transformer model with Explainable AI techniques. This model leverages state-of-the-art techniques and a diverse dataset of medical images, with the potential for broad applicability in healthcare. The method is built on a state-of-the-art Vision Transformer architecture that has been fine-tuned on a diverse dataset of medical images (Almalik et al., 2022). The model is optimized using a hyper-parameter tuning technique to improve its accuracy and generalization performance. An Explainable AI technique is incorporated to make the model more interpretable and explainable, allowing clinicians to understand the model's decision-making process and provide insights into the underlying factors driving the diagnosis (van der Velden et al., 2022). The results show that our approach achieves superior accuracy (91.40%), precision, recall, and F1 score compared to several state-of-the-art methods. Furthermore, the Explainable AI technique provides additional insights into the model's decision-making process, which can be used to improve the quality of care for patients.

Materials and methods:

Dataset: Our dataset “Cataract Dataset” consists of four folders of images: normal images, cataract images, glaucoma images, and retinal disease images. The dataset includes 601 as complete dataset images are in ‘png’ format sizes 300×200 . However, we used the dataset after augmenting the images into a more significant number which helped us immensely in conducting this project.

Model architecture: We proposed a hyper-tuned Vision Transformer-based approach with Explainable AI for Eye disease detection and classification from retinal images. Our suggested model consists of three fundamental components: an embedding layer, an encoder, and a decoder. The original input image from the training set is processed to produce an enhanced input image; these images are then segmented into non-overlapping patches and sent to the embedding layer, followed by the encoder. Additionally, the encoder is coupled to two distinct classifiers: the token and distiller classifiers. In the following subsections, the model's components are discussed in depth.

Training and evaluation: On the training dataset, we used gradient descent with a learning rate of 0.0001 over 100 epochs to train the suggested model. We applied data augmentation methods such as random rotation, horizontal flipping, and scaling to reduce overfitting. We did hyper-parameter tuning to optimize the model while also monitoring the model's performance on the validation set throughout training. We employ a feature extraction technique to find critical features for the suggested model. In terms of performance metrics, including accuracy, precision, sensitivity, specificity, and area under the ROC curve, we assessed the proposed model's performance.

Results and discussion: The primary purpose of our proposed model is to classify normal, cataract, glaucoma, and retinal diseases from the dataset using a hyper-tuned Vision Transformer model. The results are obtained from the images taken after the data pre-processing steps. Moreover, the study experiments with some transfer learning models with 80% of training, 10% of validation, and 20% of testing images. Figure 1 shows the accuracy vs. loss curve obtained from the proposed model. Our proposed model achieved 91.40% accuracy with the least execution time compared to existing models. Following multiple iterations of fine-tuning, the best results were obtained with 100 epochs and an area under the curve (AUC) value of 0.93 for normal (class 0), 0.95 for cataract (class 1), 0.93 for glaucoma (class 2), and 0.93 for retinal diseases (class 3). The AUC for Macro and Micro is 0.94, as shown in Figure 1.

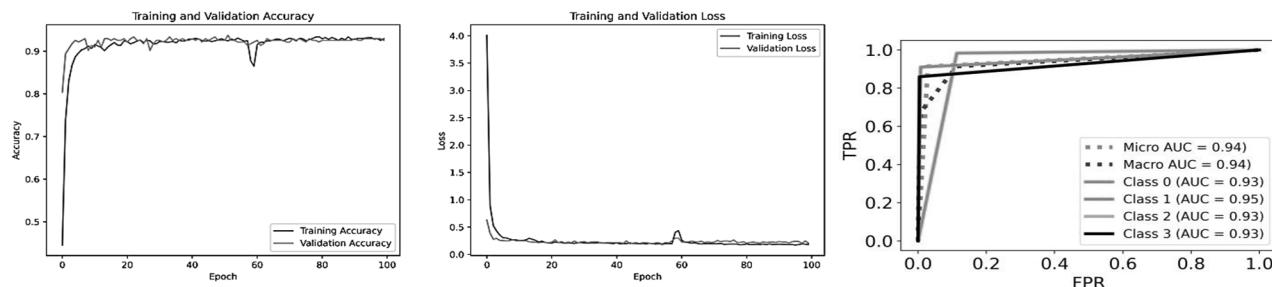


Figure 1: Accuracy, loss, and Receiver Operating Characteristic curve of the proposed model.

We have implemented a vision transformer model to classify and recognize eye disorders. Our primary contribution is the presentation of a unified paradigm to address cataracts, glaucoma, and retinal disease. The suggested model attained an average localization precision of 94.07%, recall of 89.05%, F1 score of 91.28%, and accuracy of 91.40%.

Conclusion: In this project, we proposed a hyper-tuned Vision Transformer-based approach with Explainable AI for Eye disease detection and classification from retinal images. The model can accurately identify and classify four different types of eye diseases, which can help in the early detection and treatment of eye diseases. Our approach achieved a high accuracy of 91.40%, outperforming existing models while requiring less time for training. The results of this study suggest that our approach is a promising tool for eye disease detection and classification and can improve the accuracy and efficiency of diagnosis and treatment. Furthermore, the Explainable AI component of our approach provides transparency into the model's decision-making process, which can aid in clinical decision-making and improve patient outcomes. Further research and validation are required to assess the clinical utility of our proposed approach.

Acknowledgement: The authors would like to acknowledge the support provided by the Department of Biomedical Engineering (BME), Islamic University, Kushtia 7003, Bangladesh, for this work.

Keywords: Deep learning, Vision transformer, Eye disease, XAI

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BanglaDigitNet: Bangla Handwritten Digit Recognition Using Convolutional Neural Network

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Introduction: Handwritten number recognition is one of the most classical issues in the area of pattern recognition. Handwritten Number Recognition has seen tremendous advancement because of the recent vast spread of computing coffers. Generous workshops have formerly been done on English, Arabic, Chinese, and Japanese handwritten scripts and they give a satisfactory delicacy on those languages. But in Bangla, there are several works on Handwritten Number Recognition (Shuvo et al., 2020). There are several styles and algorithms that are used in this field, like SVM (Support Vector Machine), Gaussian Naïve Bayes, Decision trees, Random timber, K-Nearest Neighbor (KNN), Stochastic Gradient Descent, CNN, GAN, Deep learning algorithms, transfer learning etc. Using CNN model, we want to fete the handwritten Bangla number

Materials and methods: Here, we put MathNet's method into practice. Step by step, we follow the architecture in the article. For both digit and symbol, MathNet suggested their technique. However, we just use their method for digits. The numeral recognizer in this method is a Convolutional Neural Network (CNN).

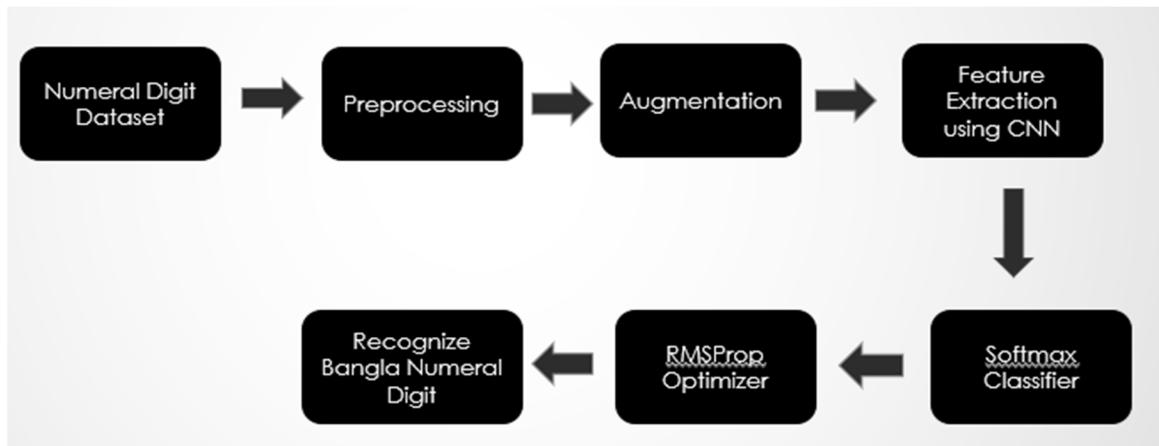


Figure 1: Block Diagram of Proposed Method

We implement the MathNet Recognition (Shuvo et al., 2020) architecture by following the proposed model's step-by-step procedure. In Ekush (Rabby et al., 2019) dataset, there are 15068 numerals data, from where we take 9643 for training, 2411 for validation, and 3014 for testing. In the existing method, we pre-proceed the data using threshold and equalize histogram. Using thresholding, we convert images from grayscale into binary images and using Histogram Equalization, adjust the contrast of images.

Result and discussion: In Ekush (Rabby et al., 2019) dataset, there are a total of 15068 numerals data, 9643 for training, 2411 for validation, and 3014 for testing. In the existing method, we pre-proceed the data using threshold and equalize histogram. Using thresholding, we convert images from grayscale into binary images and using Histogram Equalization, adjust the contrast of images. After running 50 epochs and training the model with batch size 86, the model achieves 99.61% training accuracy and 98.09% validation accuracy and the test accuracy of the proposed model achieved 98.63%.

**Table 1:** Comparison proposed approach with other approaches

Methods	Accuracy
MathNet(Shuvo et al., 2020)	96.01%
Wahid((Wahid et al., 2021))	95.68%
Proposed Method	98.63%

Table 2: Accuracy of the proposed technique for the Ekush dataset and the Bagla Lekha Isolated dataset

Datasets	No of Images	Training Accuracy	Validation Accuracy	Test Accuracy
Ekush (Rabby et al., 2019)	15068	99.61%	98.09%	98.63%
Bangla Lekha Isolated (Biswas et al., 2017)	19748	99.79%	98.88%	98.45%

Conclusion: There had many works been already done on the Bangla written Digit Recognition in numerous models of Machine Learning This CNN model has been successfully recognizing all of the test data and having good performance. Bangla handwritten digit recognition using CNN is a promising approach that has shown great potential in achieving high accuracy in recognizing handwritten digits in Bangla script. As more research and developments are made in this area, it is likely that the accuracy and efficiency of CNN models for Bangla digit recognition will continue to improve.

Keywords: Bengali digits, CNN, Deep learning, Handwritten numerals, Image classification

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Unlocking Potential: The Impact of ICT on Female Education and Employment in Bangladesh

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Introduction: The use of information and communication technology (ICT) has shown great promise in unlocking the potential of female learners (Hussain, 2021) in Bangladesh by enhancing their educational opportunities and improving their employment prospects (Amarjeet and Bhura, 2023). The paper begins by providing an overview of the current state of female education and employment in Bangladesh. Despite some progress, women continue to face significant barriers in accessing education (Yousaf and Schmiede, 2017) and securing formal employment opportunities (Banks, 2013). However, the widespread adoption of ICT in recent years has opened up new avenues for female learners and job seekers, creating opportunities for skill development and career advancement (Gadi, 2022). Therefore, this paper explores the impact of ICT on female education and employment in Bangladesh and identifies the potential for future growth and development.

Materials and methods: To investigate the impact of ICT on female education and employment in Bangladesh, the author conducted a cross-sectional survey of 200 female respondents who belonged to the Jatiya Kabi Kazi Nazrul Islam University, Trishal, Mymensingh whereas 100 respondents were female students and 100 respondents were female employees. The survey was conducted using a structured questionnaire that included questions related to their access to and use of ICT, their educational and employment status, and their perceptions of the impact of ICT on their education and employment. The collected data were analyzed using the statistical software SPSS version 20. Descriptive statistics such as frequencies, means, and standard deviations were calculated to summarize the characteristics of the sample.

Results and discussion: The findings of the study illustrate that the majority of both female students (84%) and female employees (87%) reported having access to a smartphone, whereas, only 33% of female students and 40% of female employees reported access to a computer and 24% of female students and 30% of female employees reporting access to a tablet. In this regard, the given statistics clearly indicate that most females are now enjoying the benefits of using ICT tools including smartphones, computers, and tablets in their education and employment. Additionally, the survey findings demonstrate that ICT has brought a significant revolution for females in terms of unlocking their potential in education and employment. Therefore, the study found a significant association between access to ICT and the educational and employment outcomes of female learners and employees.

Conclusion: Finally, the paper concludes by highlighting the potential for further growth and development in the ICT sector in Bangladesh, particularly in terms of its impact on female learners and job seekers. It emphasizes the importance of continued investment in ICT infrastructure and suitable initiatives that promote digital literacy and gender equity, in order to unlock the full potential of female education and employment in the country.

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Real Time BCI Scheme to Assisting Disabled Persons Using Motor Imagery EEG Signal Classification

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Introduction: EEG-controlled brain-computer interface (BCI) technology provides physically challenged persons hope for a stress-free existence. Due to the many types of artifacts included in the raw EEG signal, preprocessing EEG data to make it suitable for use in neuro-robotics applications is rather difficult. This work proposes a real-time BCI system that is practical and effective for neuro-robotics applications in physically impaired people's rehabilitation since they need to do real-time activities. The raw brain signal that was recorded has been cleaned of noise using the methods that are currently available. The feature extraction techniques extract the features after getting the artifact-free EEG data. The goal is to classify four-class motor imagery (MI) task-related signals, such as hand, foot, and tongue movements, using the most effective classification method. The proposed WPD+CSP+ANN technique outperforms the competition with an average kappa of 0.69 and an average accuracy of 77.16 percent, respectively, for the dataset taken. Skl-ANN, SVM, LDA, and other classifiers have been assessed for the subjects taken. Experiments should show how well the proposed technique works in real-world situations. The proposed BCI scheme is expected to be used in real-world situations to aid in the rehabilitation and reintegration of physically disabled people because of its improved classification accuracy and reduced processing burden. The low signal-to-noise ratio (SNR), intrinsic complexity, and inter-subject variability of electroencephalogram (EEG) data present substantial challenges that severely reduce the MI classifier's performance.

Materials and methods: In this study, the BCI IV 2a dataset (Tangermann et al., 2012) is employed for four-class MI task classification. Here, four subjects EEG signals are taken, each consisting of 25 channels (3 EOG channels) of the recorded signal. As the raw signal is contaminated, preprocessing of the dataset is needed to make it suitable for further processing by selecting 22 good channels. Fig. 1 depicts the proposed model's block diagram. This diagram gives a clear idea of how the proposed method works, step by step.

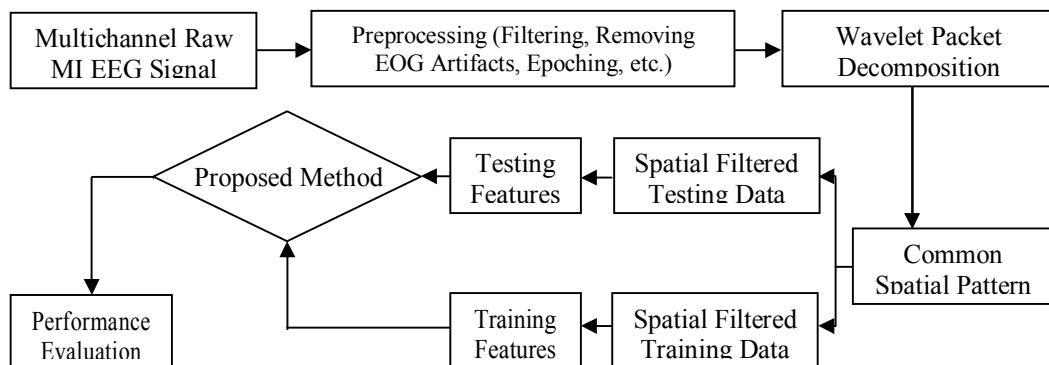


Figure 1: Block diagram of the proposed model

Results and discussion: Using the dataset, efforts have been made to evaluate the performance of SVM, KNN, LDA, and Skl-ANN classifier models against the proposed scheme. The comparison chart (Fig. 2) and Table 1 show that the proposed model performs better than the alternatives. Using the proposed strategy results in an average classification accuracy rating of 77.16 percent for the four subjects taken. Nevertheless, when the SVM, KNN, LDA, and Skl-ANN classifier models are employed separately, the best average classification accuracy found for the subject A03 is 80.34%, 76.90%, 82.07%, and 80.34% (Fig. 2), respectively. In the case of subject



A03, the proposed scheme performs superior to other models, with an accuracy of 83.79%. For the rest of the subjects, the proposed method outperforms cutting-edge techniques for classifying EEG data into four classes related to motor imagery (See Table 1).

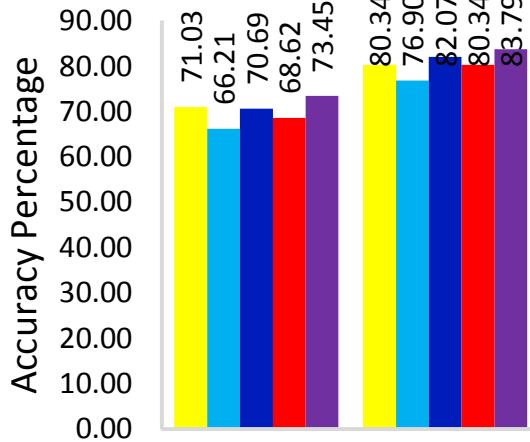


Figure 2: A comparative analysis of accuracy with other classification algorithms we experimented with for all the subjects tested is visualized in the chart above. Here, we see that the proposed method, WPD+CSP+ANN outperforms the others.

Table 1: A comparative analysis of average accuracy values for the proposed method with others. Here, the proposed WPD+CSP+ANN method attains maximum accuracy than others.

Methods (4 Class MI EEG Classification)	Accuracy (%)
CSP + 3CNNs (Zouch & Echtioui, 2022)	62.45
CSP+KNN (Nguyen et al., 2017)	58.88
Ensemble (Nguyen et al., 2017)	58.22
CSP+LDA (Nguyen et al., 2017)	63.62
CSP+NB (Nguyen et al., 2017)	62.77
CSP+SVM (Nguyen et al., 2017)	63.97
CSP+FLS (Nguyen et al., 2017)	65.01
WPD+CSP+ANN (Proposed)	77.16

Conclusion: The field of brain computer interface (BCI) technology is exciting and growing quickly. It could change the way humans interact with computers and other devices. BCI systems can let people control devices and interfaces without having to touch them. They do this by picking up and interpreting electrical signals from the brain. However, developing effective BCI systems requires overcoming numerous technical challenges, including how to process and interpret complex and noisy signals. With the proposed method, it has been seen that setting up the classifier with the right method is a big problem, and unique feature extraction is also needed. The PCA/ICA-based wavelet packet transformation feature extraction method is a great way to find out what the EEG signal is made of, but it can't accurately separate the four types of motor imagery signals. But compared to other methods, the proposed WPD+CSP+ANN method works better for the dataset without changing or adding to the recorded data. So, it is hoped that this idea will work better than the traditional way of using BCI in the real world. Robotic actuators will be interfaced with the method in the future to make it work better at the application level.

Acknowledgment: I am thankful to the Research and Extension Center, Jatiya Kabi Nazrul Islam University, Trishal, Mymensingh, Bangladesh, for supporting me with the research fellowship.

Keywords: Brain-computer interface (BCI), Neuro-robotics rehabilitation, Four-class motor imagery (MI), Wavelet packet decomposition (WPD), Artificial neural network (ANN)

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Enhancing Lung Cancer Diagnosis Using a Hybrid VGG-16 and Vision Transformer Model

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Introduction: Lung cancer is a serious and often fatal disease. An accurate and early diagnosis of lung cancer is crucial in clinical practice. However, it can be challenging, even for experienced radiologists, to interpret lung CT scans. To address this challenge, an automatic diagnosis of lung cancer is essential. In recent years, several researchers have investigated the potential of utilizing deep learning (DL) methods to automate the diagnosis of lung cancer (Agarwal et al., 2021; Gumma et al., 2021). DL can be used as a feature extractor and subsequently employ it as a classifier. In particular, convolutional neural network (CNN) models, such as VGG16 (Ramanjaneyulu et al., 2022), have been widely used to extract features from lung CT images, while transformer-based models, such as vision transformers (ViT) (Sun et al., 2023), have been shown to be effective in learning spatial relationships among features.

In this study, we propose a hybrid VGG16-ViT model for enhancing the diagnosis of lung cancer. By combining the strengths of both models, we aim to improve the accuracy and reliability of lung cancer diagnosis. Initially, the VGG16 model identifies crucial features from the input image, and subsequently, the ViT model establishes effective correlations between these features. The proposed model was trained and tested on a vast collection of lung CT scans, and its performance was measured against existing state-of-the-art techniques. Our results show that the proposed model outperforms existing methods, achieving high accuracy and an area under the receiver operating characteristic (ROC) curve for diagnosing lung cancer.

Materials and methods:

Dataset: We used in this study IQ-OTH/NCCD lung cancer dataset that includes 1190 CT scans of 110 cases, comprising patients with lung cancer and healthy individuals. It is classified into three categories - normal, benign, and malignant - and was collected over a three-month period in 2019 from the Iraq-Oncology Teaching Hospital/National Center for Cancer Diseases. The scans were obtained in DICOM format using a Siemens scanner, with 80-200 slices per scan and a slice thickness of 1 mm. The institutional review board approved the study, and the cases come from various regions of Iraq with different demographics. All images were de-identified before analysis. We split the dataset into 70% for training, 15% for validation, and 15% for testing.

Preprocessing: The preprocessing stage is a crucial step that prepares the input data for feeding into the model. The preprocessing of the scans involves several steps, including noise reduction, contrast enhancement, resizing, and normalization. Additionally, we used data augmentation techniques such as random rotation, horizontal flip, and scaling to reduce overfitting.

Proposed model: We proposed a hybrid VGG16-ViT model for enhancing the diagnosis of lung abnormalities. The VGG16 model is used to extract high-level features from the input images, while the ViT model is used to learn the spatial relationships among the features. Specifically, we used the VGG16 model pre-trained and replaced the fully connected layer with a global average pooling layer. We then fed the output of the global average pooling layer to the ViT model, which consists of multiple transformer layers followed by a classification head. We trained the model using a cross-entropy loss function.



Training and evaluation: We trained the proposed model on the training dataset using the Adam optimizer with a learning rate of 0.0001 for 100 epochs. We evaluated the model on the validation set during training to monitor its performance and performed hyperparameter tuning to optimize the model. We evaluated the proposed model performance in terms of performance matrices including accuracy, precision, sensitivity, specificity, and area under the ROC curve.

Results and discussion: Our hybrid VGG16- ViT model, which combines the strengths of VGG16 and ViT, shows great promise in diagnosing lung cancer. In fact, our model achieved outstanding results with an accuracy of 98.19%, precision of 98%, sensitivity of 98%, specificity of 99%, and an area under the ROC curve of 0.98. These results exceed those of existing state-of-the-art methods, demonstrating the potential of our model in accurately diagnosing lung cancer. The accuracy and loss curve of our proposed VGG16-ViT model with a train-validation-test split of 70/15/15 and trained using the Adam optimizer is depicted in Figure 1.

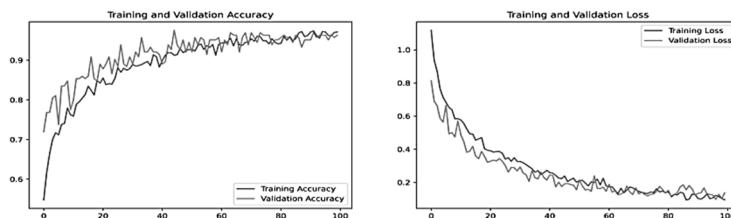


Figure 1: Accuracy and Loss curve of the proposed VGG16-ViT model.

Our hybrid model combines the strengths of VGG16 and ViT models for improved lung cancer diagnosis. VGG16 extracts high-level features while ViT captures spatial relationships among features. This model extracts local and global features from CT images, capturing long-range dependencies for better performance. The model achieves high accuracy and ROC area for diagnosis, potentially assisting radiologists in making more accurate diagnoses and leading to better treatment decisions for patients with lung abnormalities.

Conclusion: In conclusion, our proposed hybrid model demonstrated high accuracy in detecting and classifying lung cancer. Specifically, the hybrid model achieved an accuracy of 98.19%, sensitivity and precision of 98%, and specificity of 99% in the detection and classification of lung cancer. In addition, the high value of the AUC curve indicates the best performance of the model. Overall, our findings suggest that this hybrid model can improve the accuracy and efficiency of lung cancer diagnosis, thereby enabling timely and effective treatment for patients. Future work will focus on extending our model to other medical imaging modalities and integrating it into clinical decision support systems to aid radiologists in making more accurate and timely diagnoses.

Acknowledgement: The authors would like to acknowledge the support provided by the Department of Biomedical Engineering (BME), Islamic University, Kushtia, Bangladesh for this work.

Keywords: Deep learning, Vision transformer, Lung abnormalities, Convolution neural network

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Speaker Independent Bangla Isolated Speech Recognition Using Deep Neural Network

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Introduction: In this work, a dataset is created containing both Bangla and English words spoken by Bengali Speaker. An approach is proposed in this work to recognize isolated spoken words using the Mel Frequency Cepstral Coefficient (MFCC) and Deep Feed-Forward Fully Connected Neural Network (DFFNN) as a classifier. In this work the depth of the neural network is more than ever reported for Bangla speech recognition and the result of this work is showing better recognition accuracy compared to the most of the works done previously on Bangla.

Materials and methods: **Dataset creation:** A dataset is created containing 36 Bangla words and 24 English words with the help of 25 different persons from different regions of Bangladesh. 30 samples per word from both male and female speakers are recorded using smartphones in room environment.

Table 1: Database size and distribution

Training Sample Size	Test Sample Size	Total Dataset Size
1200 Sample	600 Sample	1800 Sample
66.67%	33.33%	100%

Preprocessing: Down sampling, normalization, silence removal, windowing and pre-emphasis are done as preprocessing of speech signal in this work.

Down Sampling: The speech sample words are recorded with a high sampling frequency (44.10 kHz) to create this dataset. So the recorded speech signals are down-sampled at 10 kHz.

Normalization: Normalization is done by dividing the sample values of every speech signal with the maximum value present in that speech signal. Normalized signal, $\hat{x} = \frac{\text{signal, } x}{\text{maximum (x)}}$

Voice Activity Detection and Silence Removal: The voiced part of a speech signal is detected based on the energy level of that signal within a window of 108 millisecond. And then a threshold is used to determine whether it is a voiced portion or silence portion. After that, the silence portion is removed.

Windowing: In this work, Hamming window with the frame length of 300 and the 100 sample frame shift is used. 3/4 frame overlap is considered. So one frame is 30 ms and the frame shift is 10 ms.

Pre-emphasis: Pre-emphasis is done by a first-order high-pass filtering, difference equation in time domain is: Emphasis Signal (n) = Signal (n) - a * Signal (n - 1); in this work 'a' is set to 0.9375.

Feature Extraction: After pre-processing, compressed MFCCs are used as features. Here k-means clustering is used as feature compression technique.

MFCC: In this work 40 filters are used. The number of filter banks: 40, frame length: 300 and 300-100=200 is the frame overlap. The result is a N×14 matrix of MFCCs for each N frame.

Feature Compression: k-means classifier is used to cluster the vectors that contain the MFCCs to get compressed feature vectors. In this work, used 'K' value is 5 & 8 to analyze the performance. Final value of K is 8. The result is a 8×14 matrix, instead of the previous N by 14 matrix.

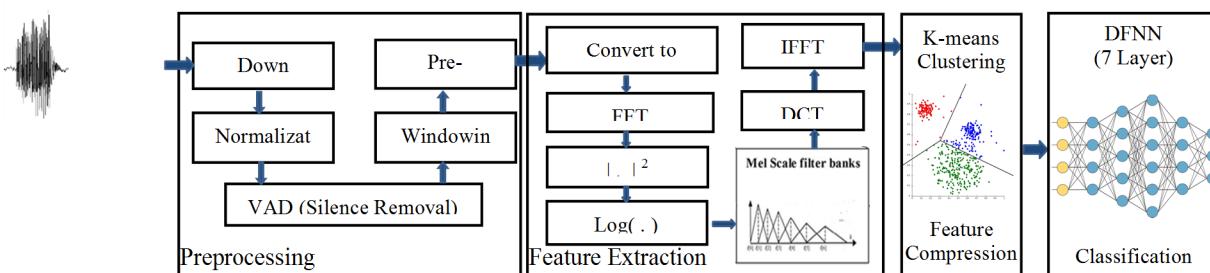


Figure 1: Block Diagram of proposed scheme



DFFNN for classification: DFFNN of 7 layers (1 input, 5 hidden and 1 output) is used as a classifier for this work. In the input layer, number of neurons is 112 ($=8 \times 14$) and output layer has 60 neurons. Different number of neurons in hidden layers is investigated to get the best network architecture.

Results and Discussion: Parameters of the proposed system:

- 14 MFCCs as features (compressed into 1×112 vector with K-means classifier with $K=8$)
- Weight and Bias initialization method: Gaussian distribution random numbers
- Learning rate: 0.05, Decay factor: 0.95, Batch size: 1, Training algorithm: Backpropagation
- Activation function: Sigmoid, Cost function: Square Error (Euclidean distance)
- Neural Network architecture is: (112, 100, 95, 90, 95, 100, 60), total weights and biases: 53,840

Accuracy, Standard Deviation and Variance on test dataset:

Table 2: Accuracy, Standard Deviation and Variance on test dataset

Sample Information		Test set Accuracy (%)	Variance and Standard Deviation
No of Class=60 Test Sample =600		93.42%	Variance =0.02070764 Standard Deviation =0.1439

Comparative Analysis of the performance of DFFNN with different neuron number and Compressed MFCCs as input features

Table 3: Comparison with some reported work of Bangla speech recognition:

Sl. No.	Work Reference	Database information	Feature Extraction & Classifier	Reported Accuracy
1.	(Hossain, et al. 2013)	*10 classes, 10 speakers, 150 training samples, 150 test samples	*MFCC features *ANN with 1 hidden layer	92%
2.	(Noman & Cheng, 2022)	*7 classes (words) * 28 training samples * no other info about dataset	* absolute value of DFT *ANN with one hidden layer	95.23%
3.	(Sen, et al., 2022)	*100 classes, 100 samples for each class=10000 words *40,000 samples created	*MFCC spectrogram * CNN (4 Conv layer, 1 dense, 1 output layer)	89.61%
4.	Proposed Method	* 60 words, 30 samples/word Total = 1800 samples. (1200 samples for training and 600 samples for testing)	* MFCC *DFFNN (7 Layers)	93.42%

Table 4: Analysis of the performance of DFNN with different number of neurons

Hidden Layer and Features		No. of Neurons	Epoch	Learning Rate, ETA	Training Accuracy
5 hidden layer (MFCCs as feature)	K=5	85,90,85,90,90	50k	0.05	88.41%
	K=8	85,85,85,85	60k	0.06	91.75%
	K=8	100, 95, 90, 95, 100	100k	0.05	93.75%

We can see, the proposed system out-performs other prominent works on Bangla speech recognition considering database size, number of classes and recognition accuracy.

Conclusion: In this work, not only a moderate dataset has been created but also this work proposes a recognition model that gives better recognition accuracy compared to the most of the works done previously on Bangla considering the class number. 7 layer DFFNN along with MFCC as features compressed by K-means classifier with $K=8$ seem to provide the best output among all the trials.

Keywords: MFCC, Deep neural net, Bangla speech recognition, Speaker independent, Isolated speech

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Efficient Techniques for Moving Object Detection Using Deep Learning

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Introduction: Since the beginning of society, security has been a top priority for human to protect their life and valuable goods at any place. Closed-Circuit Television (CCTV) cameras were invented to capture footage of any object within their coverage area. With technological advancements, these cameras now capture live video and images of people. The use of security cameras has become more prevalent, tracing people from the footage and identifying them remains a time-consuming task that demands additional human effort. An automated video surveillance system plays a crucial role in supporting and replacing human observers by monitoring individuals and their activities. Surveillance systems using image processing techniques can collect diverse information from captured footage, benefiting various organizations.

This study focuses on detecting and recognizing of individuals from captured videos using multiple features have been the primary objectives of this research using deep learning techniques, as it can improve the automation system for detecting people. However, the existing methods still have limitations. To address these challenges, we propose a new system that automatically identifies people in video footage and enhances existing efforts by combining multiple features. Various methods are used to identify people, including their faces, physical conditions, gestures, and clothing. To achieve these objectives, we use some techniques such as full body recognition, tiny face detection, and human gesture recognition (*Casillas-Perez et al., 2016*).

Our system can recognize people even in noisy images such as small-sized bodies and tiny faces, long-distance images, and moving persons. And it's also effective, and efficient, and outperforms existing methods in terms of detection performance. Overall, this paper provides a new contribution to the field of surveillance and security systems and demonstrates the effectiveness of our proposed system in enhancing existing methods.

Materials and Methods: Initially, CCTV footage of the Science Building of Jatiya Kabi Kazi Nazrul Islam University was collected from the proctor's office for two days. Subsequently, human body localization within the video footage was performed using the YOLO model, and each body, face, and image sequence was cropped for our solution using the OpenCV module. The datasets were divided into three sets: 80% for training, 10% for validation, and 10% for testing. In order to enable future prediction under various conditions, the data augmentation technique was applied to each category. such as brightness alteration, rotation, shearing, and clipping. The resulting data required conversion into a machine-readable format, which was achieved through the utilization of data normalization techniques such as the MinMax normalization algorithm. This algorithm facilitated the conversion of pixel values from a range of 0 to 255 to a range of 0 to 1. Furthermore, the label encoder algorithm was utilized to convert labels into a numeric format, followed by the application of the one-hot encoder algorithm to transform each label into an array format that was compatible with machine learning models, given the multiclass classification involved. In the pursuit of greater identification accuracy, our system incorporates a full-body recognition approach, which utilizes clothing and physical condition as identifying features. While modifying an existing model improved accuracy, the existing model was also found to be effective for this purpose. However, due to individuals being potentially positioned in non-frontal orientations, relying solely on physical characteristics and clothing could result in incorrect predictions. To address this issue, we incorporated face recognition into the system. In response, we implemented an image enhancement approach (*Koo et al., 2020*) through the use of Enhanced Super-Resolution Generative Adversarial Networks (ESRGAN), which enhances the image quality without generating fake images like other GAN models, which is a deep network in combination with an adversary network to produce higher resolution images. This method enabled greater distinction between images and enhanced the accuracy of our classification task. For classification purposes, the RESTNET 101 model was utilized. Finally, for individuals whose back-facing bodies were visible

in the footage, the system was enhanced with human walking gesture recognition capabilities to further improve identification accuracy. The data used for gesture recognition consists of a sequence of images. Each image undergoes feature extraction using convolutional neural networks (CNNs), followed by processing with long short-term memory (LSTM) networks. These LSTM networks retain information from the previous sequence and generate an output, enabling the effective operation of gesture recognition in this context. By combining these three recognition techniques, namely full-body recognition, tiny face recognition, and gesture recognition, can lead to an increased a higher degree of accuracy in the identification of individuals.

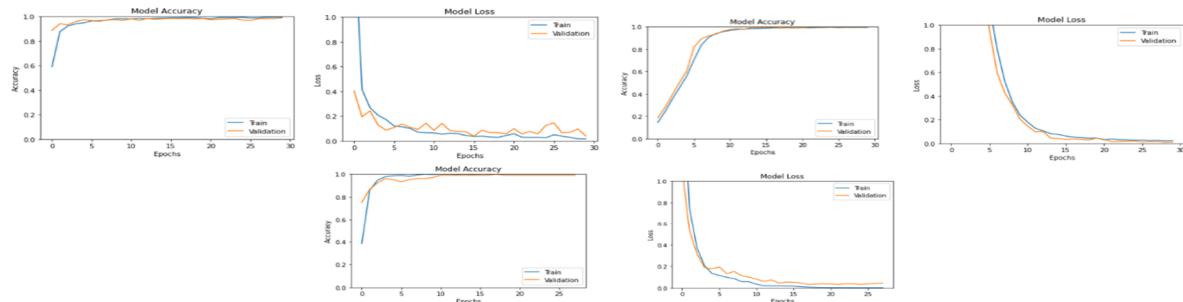


Figure 1: Training and Validation Accuracy Curve

Results and discussion: The training and validation accuracy curves, as well as the training and validation loss curves are shown in the following Fig.1. Additionally, the performance of the models was evaluated using various metrics, such as accuracy, loss, precision, recall, and f1 scores, which are presented in Table.1 where we have got hightest accuracy of 98-100% for 11 persons and 31 persons while using ESRGAN and RestNet and 99% for Gesture recognition.

Table 1: Evaluation result on test dataset

Purpose	Model	Human Count	Epoch	Precision	Recall	F1 Score	Training Loss	Validation Loss	Training Accuracy	Validation Accuracy	Test Accuracy
Full Body Recognition	VGG 16	14	40	0.99	0.99	0.99	0.0397	0.1024	0.9875	0.9757	0.97
	Xception Net	14	30	0.98	0.98	0.98	0.0237	0.0444	0.9971	1.00	0.98
	Modified VGG 16	14	30	0.99	0.99	0.99	0.0157	0.0392	0.9950	0.9886	0.99
Tiny Face Detection	ESRGAN + RestNet101	11	30	1.00	1.00	1.00	0.0235	0.0101	0.9945	0.9982	1.00
		31	30	0.98	0.98	0.98	0.0406	0.1098	0.9878	0.9682	0.98
Human Gesture Recognition	CNN+LSTM	14	28	0.99	0.99	0.99	0.0023	0.045	1.00	0.9905	0.99
		30	15	0.99	0.99	0.99	0.0017	0.0281	1.00	0.9956	0.99

Conclusion: In conclusion, this study presents a novel system for identifying individuals in video footage human data by integrating various features, such as full-body recognition, tiny face detection, and human gesture recognition. The proposed system demonstrates superior performance compared to existing methods and was developed using multiple combinations of techniques. It should be noted, however, that the current system is limited to the recognition of human bodies and does not support online training. In future work, it may be extended to incorporate multiple object recognition and online training capabilities.

Keywords: ESRGAN, CNN, LSTM, Automated human detection

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Prospective Methodology of Hand Gesture Image Processing for Human-Computer Interaction Systems

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Introduction: Hand gesture recognition is now an emerging technology in the field of human-computer interaction (HCI), enabling users to interact with computers and other devices without needing physical touch. Thus, using hand gestures, users can perform transactions without touching physical buttons or screens, thereby reducing the risk of contamination and the spread of diseases. The implementation of gesture recognition technology in the HCI system has been made possible by advances in computer vision and deep learning techniques. These techniques have enabled computers to recognize and understand hand gestures, paving the way for touchless interaction. The dynamic hand gesture is then classified using deep learning approaches, like recurrent neural networks (RNNs). This method helps recognize hand gestures that involve motion, such as waving or pointing. This study aims to process and create a hand gesture dataset used for gesture recognition-based touchless HCI. The proposed system will provide a more natural and intuitive way of interacting with computers through a virtual mouse or keyboard controlled by hand/finger gestures.

Materials and methods: This paper explores the development of a hand gesture dataset for a gesture recognition-based HCI system. The following methodological steps are essential in providing a comprehensive dataset preparation that can be used to evaluate the performance of hand gesture recognition algorithms in an HCI system.

1. **Gesture Image Processing:** The initial step in image processing is image frame acquisition, which consists in capturing raw frames from video streams using hardware components like cameras, image sensors, and image capture devices. The next step is pre-processing, which involves a series of operations to improve the quality of the image and enhance the features of interest. This includes techniques such as noise reduction, image filtering, and normalization. Finally, feature extraction is the process of identifying the relevant features in the image that can be used for gesture recognition.
2. **Dataset Partitioning and Augmentation:** The dataset used in this study contains hand and non-hand images. Data skewness problem can occur when one class has significantly more samples than the other (hand and non-hand type). It is required to minimize data skewness by balancing the hand and non-hand images in the dataset. This is done by creating new samples from existing ones through popular techniques, like data augmentation or synthetic data generation. Various methods exist for data augmentation on specific image transformations like flipping, zoom, and brightness. Thus, the augmentation process results in a fourfold increase in the dataset size.
3. **Hand Gesture Recognition:** Once features have been isolated, hand detection algorithms are applied to identify the presence and location of hands within the image or video stream. These algorithms can employ skin color detection, template matching, and machine learning-based approaches. Landmark generation algorithms are applied to identify key points on the hand, such as fingers, joints, or other hand features. Landmark tracking algorithms then track these identified points' movement over time, enabling the system to recognize hand gestures accurately and in real-time using deep neural network. Hand landmarks involve tracking 21 locating points on the hand gesture image.
4. **Fingertip Prediction and Actions:** To predict fingertip positions, it is required to identify distinct fingers and compute distances between them. The predicted fingertip angle is classified to perform appropriate actions for virtual mouse and keyboard activities. This process uses image analysis algorithms to capture real-time fingertip movements, detect hand gestures, and track the moving hand region.

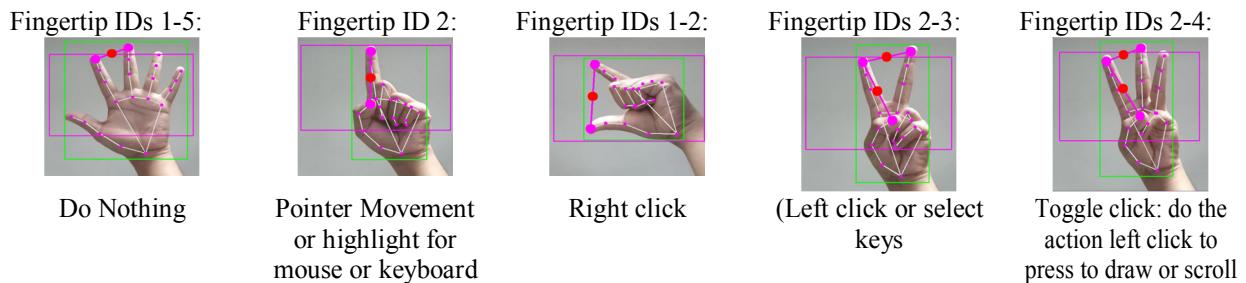


Figure 1: Hand gesture patterns and associated actions performed in the HCT system.

5. Designing of Touchless HCI System: A real-time human-computer interaction is deployed using hand gesture recognition based on computer vision and deep learning methods. Hand gesture recognition analyzes the number and type of fingers present to detect and identify hand movements, which is used to control virtual reality environments. In addition, this study proposes an innovative layout for controlling a computer using hand gestures without physical interaction.

Results and discussion: The experiments were done in a Python programming environment using essential libraries like OpenCV, NumPy, MediaPipe, and Autopy to implement computer vision approaches and DNN models. The experiments demonstrate the creation of a gesture dataset by acquiring many hand images from individuals, and the mobile camera captures them in various environments to enhance diversity. The hand data class contains 5084 images, including multiple signs made from hand gestures, and the non-hand category contains 5028 images without hand gestures. The augmentation process results in a fourfold increase in the dataset size, providing 40448 (40K) images. The primarily used hand gesture patterns and the associated HCI actions are illustrated in Figure 1. The proposed DNN-based virtual mouse and keyboard interface boasts several unique features that enhance its usability. Two noteworthy features include a toggle switch and the case conversion button. The proposed touchless HCI system provides a practical communication approach with a computer controlled by hand gestures and an easy way to work on My Computer Explorer, Notepad, Paint, MS Office, and other applications. A few activities of HCI using hand gesture recognition in some applications are illustrated in Figure 2.

Conclusion: This paper comprehensively analyzes the development of a hand gesture recognition dataset utilized for any HCI system. The methodology of hand gesture recognition dependencies involves several essential steps, such as data collection, dataset partitioning, data balancing and augmentation, image processing and feature extraction, hand detection, and evaluation. This study contributes to the advancement of touchless HCI by providing a DNN-based virtual mouse and keyboard using gesture recognition technology. Different actions are performed on the proposed HCI system using hand gestures, including mouse pointer movement, left and right clicking, toggling, drawing, scrolling, selecting keys on the keyboard, and typing. However, these datasets have limitations that may affect their efficacy in developing effective HCI systems. These limitations include limited diversity, size, annotations, and environmental and temporal variability. Hand positions, orientations, and movements also affect real-time HCI systems' performance. Several potential areas of future work can enhance the usefulness and applicability of these datasets by developing large-scale datasets and advanced methods for handling dynamic hand gestures.

Keywords: Computer vision, Deep learning, Human-computer interaction, Hand gesture recognition.

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Ontology-based Spatio-temporal Data Mining Approach for Health Care in Bangladesh

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Introduction: The healthcare sector generates a huge volume of data in an unstructured or semi-structured form for the Internet as it expands dramatically throughout the world, in order to satisfy both individual corporate goals and public demands. Bangladesh is a country with a large population that generates an enormous quantity of medical data that neither the government nor the private sector manages centrally. The future success of industries, however, will depend on the systematic storage and analysis of these vast amounts of data (Raghupathi, 2014). Moreover, the health-care related data sources contain spatio-temporal aspects with human understandable representations on the web; however, these representations are inadequate for a smarter method of getting specific information. Traditional technologies may generate more successful web pages, but they are incompatible with defining the semantics to create an intelligent method for locating specific web content. Moreover, modern businesses utilize cloud-based systems to facilitate management's analysis of web-based data and to make predictions with minimal effort.

In this regard, the fundamental objective of our research is to develop a machine-understandable database for the healthcare domain utilizing semantic web technologies in order to address resource sharing and interoperability issues more quickly and effectively (Berners-Lee, 2006). The database BD-Health-Network produces 0.2 million graphs of data that enable information extraction using the graph-based SPARQL query language and integration with other sources, such as the spatial knowledge repository Geo-BD (Rahman, Chakraborty, & Seddiqi, 2014). We conducted a large number of experiments in order to demonstrate the effectiveness of our proposed knowledge repository for Bangladesh-related healthcare data, retrieving and inferring specific information using SPARQL.

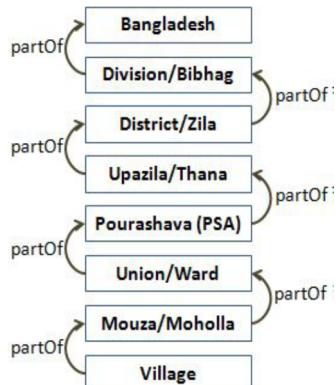


Figure 1: Logical Relationship between Different Levels of Bangladesh

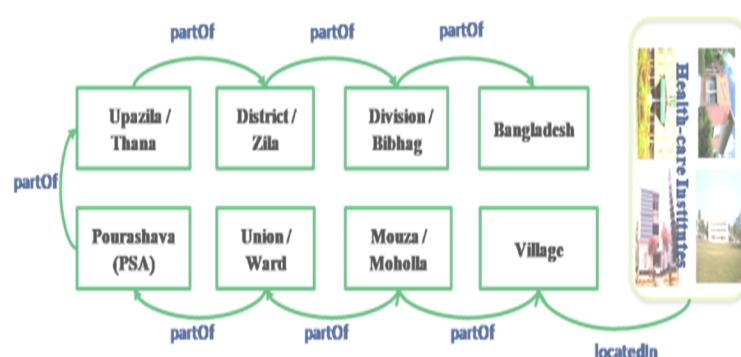


Figure 2: Health-care institutes part of administrative structure of Bangladesh

Materials and methods: Figure 1 illustrates the logical relationship between the various administrative levels of Bangladesh. Each level has its own designation, latitude, longitude, etc. that corresponds to its geographic information. In this structure, each level has a logical relationship "partOf" with its upper and lower levels. (Rahman, Chakraborty, & Seddiqi, 2014). The healthcare organizations generate the spatio-temporal health data shown in Figure 2. In addition, Figure 3 illustrates a summary of our research.

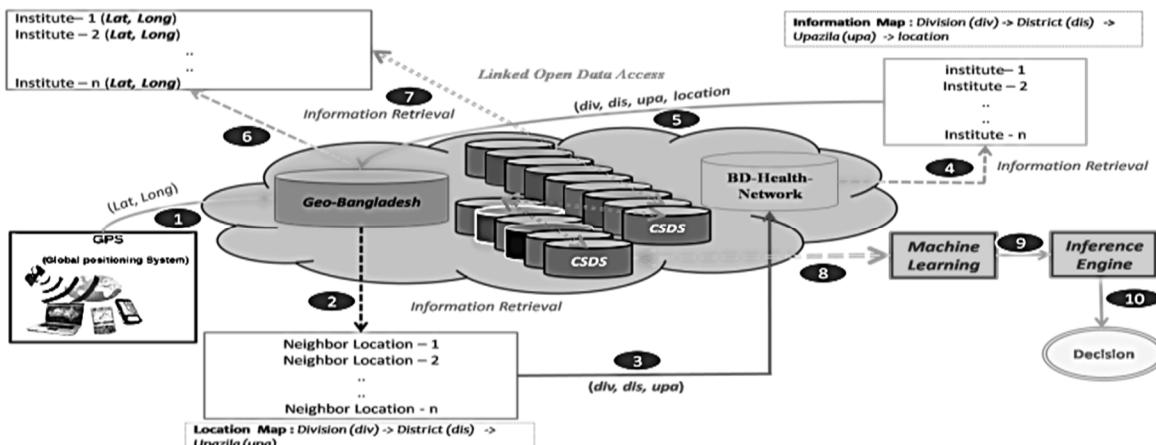


Figure 3: Overview of Ontology-based spatio-temporal data mining approach for health-care in Bangladesh

Results and discussion: In the healthcare sector, spatial-temporal information is a motivated problem with a wide range of applications, such as finding relevant differentiating information from an interoperable web of data. In our research, we model background information in ontologies using RDF, RDFS and OWL to accomplish a higher level of automation, integration, and interoperability. The RDF data model employs semantic descriptors to publish meta-data-level background information as triples. We generate 0.20 million triples from the healthcare domain with data from other domains to create a web chain. The representation is depicted in Fig. 4.

Subject	Predicate	Object
< http://www.sc.org/#21038 >	< http://www.w3.org/ns/org#memberOf >	< http://www.sc.org/#4 >.
< http://www.sc.org/#21038 >	< http://www.w3.org/2000/01/rdf-schema#label >	"Medical College Hospital@en".
< http://www.sc.org/#515 >	< http://www.w3.org/ns/org#memberOf >	< http://www.sc.org/#5 >.
< http://www.sc.org/#515 >	< http://www.w3.org/2000/01/rdf-schema#label >	"District @en".
< http://www.sc.org/#10000756 >	< http://www.w3.org/1999/02/22-rdf-syntax-ns#type >	< http://www.w3.org/ns/org#Organization >.
< http://www.sc.org/#10000756 >	< http://www.w3.org/2000/01/rdf-schema#label >	"Chittagong Medical College Hospital@en".
< http://www.sc.org/#10000756 >	< http://www.sc.org/#hasGroup >	< http://www.sc.org/#21038 >.
< http://www.sc.org/#10000756 >	< http://www.sc.org/#hasFunction >	< http://www.sc.org/#21 >.

Figure 4: N-TRIPLE formatted data for the BD-Health Network

```
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>
PREFIX org: <http://www.w3.org/ns/org#>
PREFIX skeim: <http://www.sc.org/#>
```

```
SELECT ? LocationName
WHERE
{
  <http://www.sc.org/#10000756> org:site ? LocationName
}
```

These resulting meta-data, which are considered a labeled graph structure, establish a chain of data on the web by generating typed links, a concept known as linked data. These linked data sources might significantly improve the performance based on their underlying ontologies, which are the sources of spatio-temporal applications.

Figure 5: The SPARQL statement to get an organization's location name

Conclusion: Ontology-based spatio-temporal data mining is crucial for a country to develop a collaborative healthcare-related information integration framework. This framework enables us to infer knowledge that will aid individuals in making decisions regarding health service provision.

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A Study on Machine Learning Algorithms with Different Encoding Techniques for Identifying the Right One for Patients' Big Data

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Introduction: Machine learning is being important field in the medical sector for creating different classifications through making a decision on patients' big data (Wiens & Shenoy, 2018). For instance, to classify healthy and unhealthy patients, identify abnormalities, different diseases, treatment selection, etc. (Rajkomar et al., 2018). In predictive modeling, categorical features often arise problems because most supervised machine learning algorithms can read numerical data as input instead of categorical attributes (Potdar et al., 2017; Gupta et al., 2022). As a result, many encoding techniques are used to convert categorical values into a machine-understandable format because the performance of machine learning algorithms is dependent on the preprocessing of categorical data. Identifying the right encoding technique and machine learning algorithm have a significant impact to keep low running time complexity and better efficiency (Hancock, & Khoshgoftaar, 2020). Therefore, the article's aim is to apply various encoding and composite encoding techniques to convert categorical variables to numerical variables for use in different machine learning algorithms to identify algorithms that are suitable for patients' Big data.

Materials and methods: For this study, we used healthcare data with categorical variables available in the openML database provided by Rijn (2014). The source dataset consists of over 1000000 instances. To conduct the experiment, we first preprocessed the data and then learned the models. In preprocessing, we encoded categorical variables using various encoding techniques- Binary Encoding (BE), Frequency Encoding (FE), Label Encoding (LE), Mean Encoding, One-hot Encoding (OhE), and composite encoding strategies- Binary-Label Encoding (BL), Frequency-Label Encoding (FL), Frequency-One-hot Encoding (FO), Label-Ordinal Encoding (LOrd), and Mean-Ordinal Encoding (MOrd). After encoding, the number of input features containing nominal values changed in terms of dimensions. In the learning phase, the preprocessed dataset is used to train seven different machine learning models- Classification and Regression Tree (CART), K-Nearest Neighbor (KNN), Logistic Regression (LR), Linear Discriminant Analysis (LDA), Naive Bayes (NB), Random Forest Classifier (RFC), Support Vector Machine (SVM). We also measured other statistical metrics (Standard Deviation, training time) as well as the accuracy to see the fitness of different models to patients' datasets.

Results and discussion: We trained different models using Scikit-learn, an open-source Python library, and executed them on Google Colab. We used 20% of the data as test data and 10-fold cross-validation to generate the best hyperparameters for each learning model. The results of the accuracy by taking various input features indicated that KNN and SVM models did not work for a large volume of data. The CART and RFC provide comparatively better accuracy than other experimented algorithms, and both of them receive data from label encoding. The standard deviation of various learning models showed that the two composite encoding techniques (FL, LOrd) and Label encoding performed with lower standard deviation. In spite of having a lower standard deviation of the mixed encoding for LR and LDA than CART, the CART model performs better with the Label Encoding technique for the patient dataset due to having higher accuracy than LR and LDA. The required time to train the various machine learning algorithms using composite/ encoding techniques is shown in Figure 1(a) and (b). The figures show that the NB model required the lowest amount of time to train among the models using data from all encoding techniques. However, the accuracy of this model is not remarkably lower compared to other models.

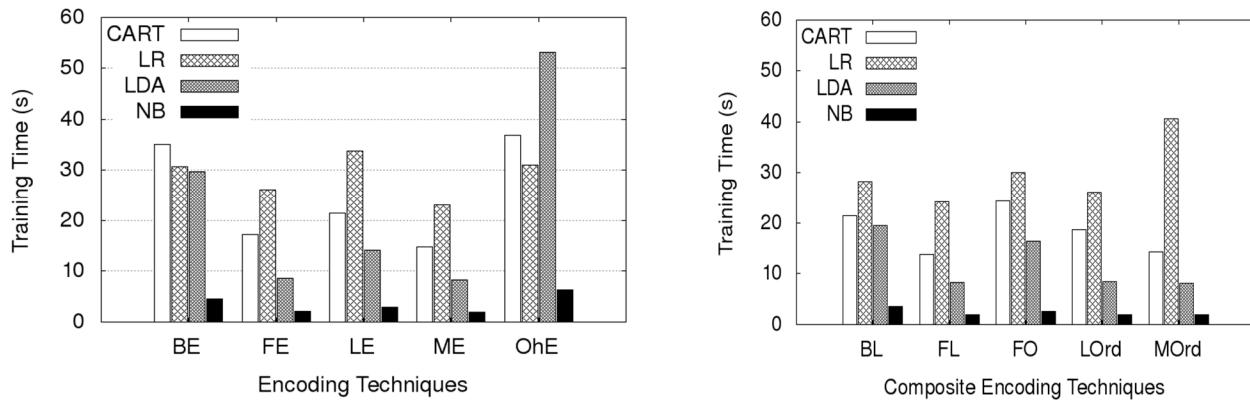


Figure 1: Time required to train various machine learning algorithms (a) using encoding strategies, (b) using composite encoding strategies

The Random Forest Classifier took much time to train itself and the lowest trained time of RFC was about 500s for Frequency-Label encoding, which was much higher than other models. Therefore, RFC also would not work better for a large volume of patients' datasets.

Conclusion: The goal of this study was to check what learning models comparatively suit better with what categorical features for patients' big data. The result shows that KNN and SVM are not possible to train against patients' big data. The RFC is possible to learn, but it takes a long time to be done. Among all models experimented here, the training time of NB was the lowest for all encoding techniques, but the accuracy was moderated. In all respects, the CART shows a better performance for the healthcare dataset with the Label encoding technique.

Keywords: Healthcare Data, Encoding Techniques, Machine Learning Algorithms, Big Data, Statistical Metrics

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<https://www.openml.org/search?type=data&sort=runs&id=77&status=active>



Child Drowning Prevention: GPS and LoRa Based Emergency Alert System

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Introduction: This research aims to develop a smartphone-based community-driven surveillance service towards safeguarding children from drowning in rivers by using GPS and LoRa based emergency alert system. UNICEF recently published in the "Country Office Report 2021" about the mortality of children in Bangladesh, "Every day, 30 children die from drowning – Bangladesh's second leading cause of under-five mortality. Drowning is preventable, and most cases occur within a child's home community." To address this newly acknowledged and substantial killer of children, cost-effective, inexpensive, and sustainable technologies appropriate for Bangladesh are unavailable. There are advanced technologies like robotic detectors for intrusion detection systems that can be used to monitor river or water reservoir surroundings to detect underage kids nearby and send an alert to surveillance authorities(Golshekan & Davoudi Kiakalayeh, 2022). Drone technologies can be utilized to conduct continuous monitoring to restrain children from entering the dangerous area around the water reservoir (Trumpeter, 2023). These computer vision-based solutions are complex to operate for village communities in Bangladesh. There are kids' location tracking systems implemented using RFID (Gul, 2021), but the cheap RFID tags are limited in low-range coverage of only centimeters (cm) distance. The GPS-based location tracking system uses a 4.5G/3G/GSM mobile communication system, and the tracking system includes many components like a smartphone application, surveillance server, Google map service subscription, and mobile operator's sms/data service(Bhoyer, 2018). This type of solution incurs cost and complexity in implementation and operation. In our research, the emergency alert system is designed to be cost-effective and user-friendly for village communities in Bangladesh. The system is divided into two components: the kid is equipped with the transmitter, and the receiver is placed at home. The transmitter and receiver both use a LoRa transmission module that can communicate accurately within a 500-meter range (coverage up to 10 Kilometers) and can transmit 256 bytes of data. The transmitter collects geolocation data using a GPS module and sends the data to the receiver using the LoRa module. The receiver module is configured by setting up the geolocation of risky places. The receiver will alert the parents when the transmitter or kid is nearby risky places. Additionally, the transmitter and receiver communicate encrypted messages using AES 128-bit symmetric encryption technology compatible with Arduino Nano controller. Thus, our emergency alert system can save children from drowning in the home environment.

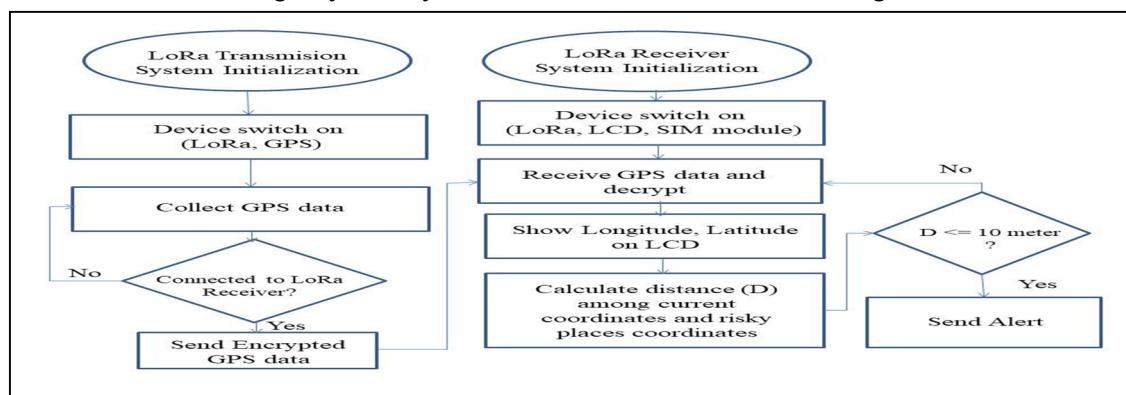


Figure 1: Children safety alerting process using LoRa and GPS

Materials and methods: Figure 1 shows the emergency alert operation process to save children from going to risky places in the village using the LoRa transmitter, GPS, and LoRa receiver devices. In this research, we have used equirectangular approximation method to calculate the distance between the GPS position of the transmitter and GPS coordinates of dangerous places. If the distance is less than 10 meters, the alert system will send an alert to the parents. Figure 4 shows the longitude and latitude of the GPS location of the transmitter in the receiver LCD.



Figure 2: LoRa transmitter & GPA

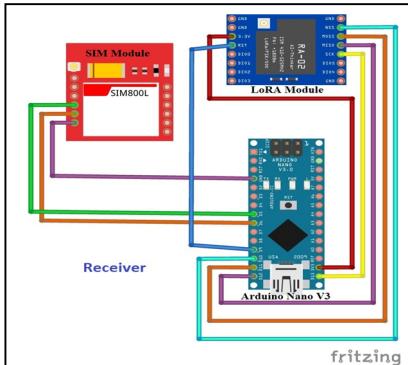


Figure 3: LoRa receiver

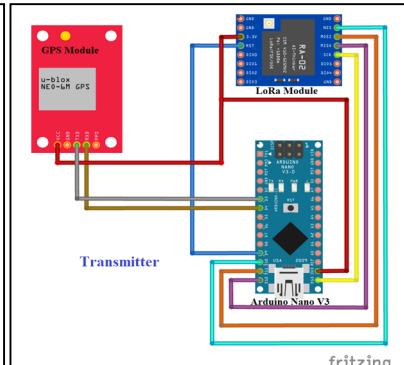


Figure 4: Output: longitude, latitude

Results and discussion: The receiver device is established outside the house in the open air. We have kept a record of the receiver's Received Signal Strength Indication (RSSI) values while the kid is wandering around with the transmitter device. The following Figure 5 shows the RSSI values of the received signal measured in dBm to the distance between the transmitter and receiver. If RSSI=-30dBm: signal is strong. If RSSI=-120dBm: the signal is weak.

Table 1: Distance from the receiver and Received Signal Strength Indication (RSSI)

Distance (m)	RSSI (-dBm) (Average)
10	20.5
50	53.4
100	71.0
150	74.8

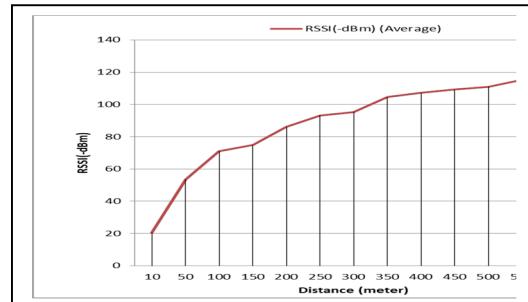


Figure 5: RSSI values to distance graph

Conclusion: The system has been tested, which works properly for child security and will play an important role in reducing the drowning problem. The proposed system can accurately alert parents about children entering the risky area. The Equirectangular approximation method calculates the distance between children's positions from risky areas. Many methods, including the haversine formula, Cross-track distance, can be tested to get a more precise distance in less time. The different types of encryption technologies like DES, Triple-DES, RC2, RC4, RC6, and Blowfish can be compared for optimized CPU time utilization in Android Nano.

Keywords: LoRa, GPS, Arduino nano, AES 128

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A Hexagonal Low Loss PCF with Five Ring of Air Hole Exhibiting Near-Zero Ultra-Flattened Dispersion for Broadband Optical Communication

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Introduction: The need for broadband data transmission at high bitrates over long distances has inspired researchers to evolve in-line compensators like dispersion-compensating fibers and erbium-doped fiber amplifiers to cancel the accumulated dispersion and expiate the attenuation in conventional optical fibers, respectively. Photonic crystal fiber (PCF) is a single structure capable of meeting all of these requirements in an optical link which has improved performance compared to conventional optical fibers. The major challenges in this field are the management of dispersion and confinement loss. To ensure effective optical transmission, it is crucial to achieve low loss, ultra-flattened dispersion that is nearly zero, and a large effective area across a broad range of wavelengths for optical communication. This article introduces two hexagonal photonic crystal fibers (PCF), of only five hexagonal rings and two ellipses and four ellipses in the center, that meet these requirements and offers a highly efficient optical link for future optical communication.

Materials and methods: COMSOL Multiphysics 5.0 has been used to simulate the photonic Crystal Fiber. To calculate the effective refractive index (η_{eff}), chromatic dispersion (D), and confinement loss (L_c), the 2D finite difference time domain method with a perfectly matched layer boundary condition was employed.

Equations (1) & (2) can be utilized to attain the optical characteristics of the PCF.

$$L_c = 8.686 \times \text{Im} [\kappa_{\text{on}}] \dots \quad (2)$$

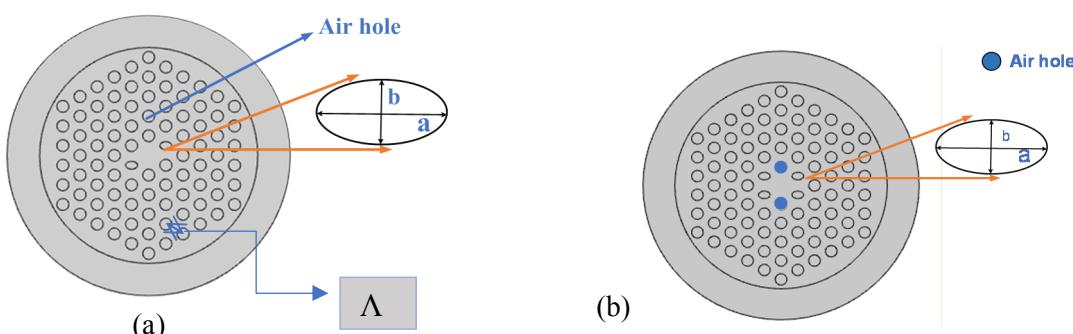


Figure 1: The proposed solid-core photonic crystal fiber (a) with two ellipses in the center (b) with four ellipses in the center

Table 1: Material and Parameters used

Pitch, $\Lambda=2\mu\text{m}$	Aspect ratio, $R=0.6666$	PML= $14.3\mu\text{m}$	Backend. material-Silica
	Diameter, $a = 60\% \text{ of } \Lambda$	Diameter, $b = R \cdot a$	diameter, $d/\Lambda = 60\%$

In Figure 1, the schematic diagram of the proposed PCFs examined in this study has been displayed. This PCF features a solid hexagonal core and five rings of air holes in silica. Other parameters and materials are shown in Table 1. The structure was proposed with a lattice constant Λ of $2 \mu\text{m}$ to obtain ultra-flattened dispersion that is nearly zero for optical data transmission.

Results and discussion: At first, two elliptical air holes have been used in the core and the dispersion is observed for different wavelengths for X-polarized light and Y-polarized light. Next, another two circular air holes have been replaced with elliptical ones. In the following figures, dispersion and confinement loss have been illustrated for the aforementioned PCFs. As we can see, nearly Zero (0.5718 ps/nm/km) dispersion is found within (1.35-

$1.4\mu\text{m}$) for both X and Y polarization with a minimum loss of $1.04 \times 10^{-10}\text{dB/km}$ and (0.5966ps/nm/km) is found within ($1.35\text{-}1.5\mu\text{m}$) with a minimum loss of $8.84 \times 10^{-11}\text{dB/km}$ for two and four elliptical air holes respectively.

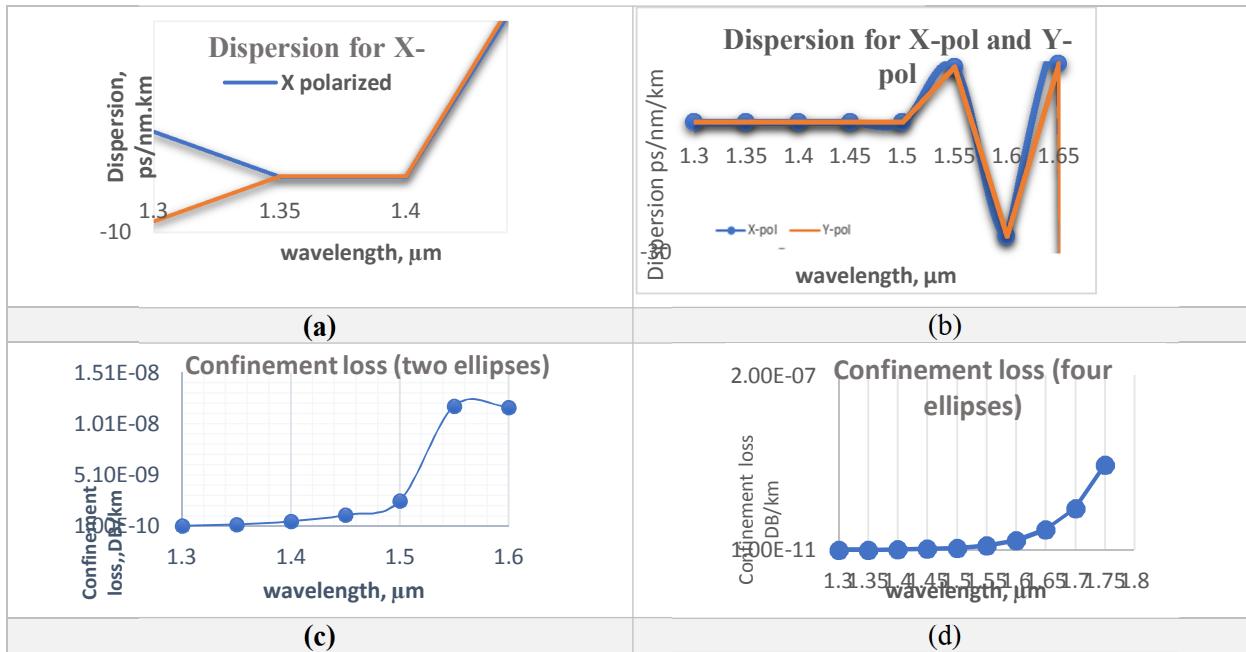


Figure 2: (a, b) dispersion and (c, d) confinement loss for photonic crystal fiber with two and four elliptical air

Table 2: Comparative study of different PCF structures with proposed structures

Ref.	PCF type	Wave length [μm]	Dispersion [ps/nm/km]	Confinement Loss (Db/km)
(Wang et al.,2009)	Double Cladding	1.35 -1.62	-0.023 to 0.021	0.13
(Hai et al., 2010)	Hexagonal	1.14-1.7	0 ± 0.22	10^{-8}
(Mohammadzadehasl & Noori, 2019)	Hexagonal	1-2	1.69 ± 0.08	10^{-14}
P. model (2 ellipses)	Hexagonal (5 rings)	1.3-1.5	X-pol 0.571863195, Y Pol 0.63096405	10^{-10}
P. Model(4 ellipses)	Hexagonal (5 rings)	1.3-1.75	X-pol 0.596693965 ± 0.1 , Y-pol 0.680072508 ± 0.1	10^{-11}

Conclusion: This study proposes a simple five-ring hexagonal PCF, which can be operated on a long wavelength optical band (1300-1500 nm) with zero-flat dispersion as 0.596693965 ± 0.1 ps/nm.km and loss of 10^{-11}dB/km . However, to make this design viable, developing and commercializing appropriate lasers, detectors, and regenerators that can operate over a wide range of wavelengths is necessary. Despite its simplicity, the proposed single-mode PCF achieves all of the desirable characteristics for optical transmission links, making it superior to other designs.

Keywords: PCF, Dispersion, Optical Communication, Confinement Loss

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Mobile Phone Controlled Robots Using DTMF Technology: An Innovative Approach for Efficient and Versatile Control

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Introduction: Robotic technology is gaining significant importance in various sectors, ranging from science and space exploration to everyday activities. The ability of robots to carry out diverse tasks under computer programming and wireless control from remote locations provides immense benefits. However, the current radio frequency (RF) circuits used for controlling robots remotely have some drawbacks, such as limited frequency range, operating distance, and control precision (Sanhit et al., 2022). To address these limitations, this paper presents a new approach for controlling robots using mobile phones and dual-tone multi-frequency (DTMF) technology.

The proposed approach enables users to remotely operate robots by sending DTMF signals from their mobile phones' keypads, providing robust control, a wide operating range equivalent to the telecom coverage area, and up to twelve to sixteen controls without interfering with other controllers. (Callahan, 1979) (Nayem et al., 2018). This research aims to improve the quality of device operation, reduce time consumption, and increase overall efficiency by utilizing microcontroller features, embedded technology concepts, and mobile communication systems. The novelty of this study lies in the application of DTMF technology, embedded technology principles, and mobile communication systems to control robots, resulting in a versatile and powerful tool for delivering services from any location at any time. The multisensory robot is designed to detect humans, noxious gases, bombs, metals, and fire in remote and war-torn areas, as well as provide assistance in terrorist arrest and rescue operations (Kaur & Kumar, 2015).

The proposed system is an intelligent and efficient one that integrates motion sensors, light-dependent resistors (LDR) for security and exploration purposes, a camera for video calling, and a solar panel for uninterrupted power supply (Zadid Shifat et al., 2014). Furthermore, the system includes a weapon for military operations, and it can retrace the robot's path and display it on a map using GSM networks, adding a unique and valuable contribution to the research (Ranjan et al., 2022).

Materials and Methods: The mobile receiver is connected to a DTMF decoder MT8870 via an audio jack, which converts the analog signals into binary digits, which are then fed into the input port of an Atmega32. After verifying the password, the MCU sends signals to the robot to control its movement and collect data from several sensors. Additionally, a video call is established between the MCU and the robot. The system detects incidents such as movement, metal, or fire using sensors, and activates a buzzer while displaying the incident on the LCD. If excessive heat is detected by the temperature sensor, the robot stops moving forward. Additionally, the flash light is activated when low light is detected by the LDR. After password authentication, the control key allows the user to move the robot in different directions using 5 for forward, 0 for backward, * for left, and # for right. The robot's movements are stored in an array as "F" for forward, "B" for backward, "L" for left, and "R" for right. When no key press is detected for 60 seconds, the MCU receives an interrupt request and initiates the robot to move in a 360-degree direction based on previously stored data in an array until the array is empty, causing the robot to return to its initial position. During this operation, the MCU suspends the reception of decoder signals until the task is accomplished. The video camera of mobile allows the user to observe the surrounding area and adjust the laser beam towards a particular target. In an emergency, the user can activate the firing mechanism towards the target by pressing the "3" key. There is a mechanical arm which can pick something by pressing "9" key on the mobile phone. A GSM network is used to trace the robot's location on a map, ensuring precise incident location. The system is powered by solar energy, and the panel's tilt angle is automatically adjusted.

Results and Discussion: The explorer robot prototype uses sensors and two mobile devices for transmission and reception. It accurately receives phone and Skype calls, allowing for video and DTMF signal transmission. The



robot's movement can be controlled via cell phone keypad numbers. To control the robot's motors and effectively implement its control mechanism, the Atmega 32 microcontroller connects with the DTMF decoder, sensors, and motor driver circuit. It enters auto retrace mode after 60 seconds of inactivity. When a fire or a high temperature is detected, the flame and temperature sensors notify and halt the robot. The PIR sensor sensed movement, the metal detector alarmed whenever it found metal, and the LDR triggered the flush light in low light situations. The working summary of used sensors is given on Table 1.

Table 1: Commands given and actions taken by keypress and sensor.

Key	Decision Taken	Sensor and device	Action
78	Password match	PIR Reading	When motion is detected, the buzzer alerts and relevant data is shown on the LCD.
5	Forward	LDR	Flush light activated at low light.
0	Backward	Flame sensor	Flame detected and sounds buzzer differently, stops moving forward.
*	Right	LM35 sensor	Shows temperature and stops moving forward at high temperature.
#	Left	Metal detector	Sounds buzzer differently.
1	Stop		
3	Fire	Gun	Makes fire
9	Pick	Arm	Pick and place something

The robot's batteries and system are powered by a sun-tracking solar panel that adjusts its position to optimize light exposure and capture maximum irradiance. When a specified key is pressed, the robot uses a laser and video camera to aim and fire targets with a revolver. A computer or smartphone can be used to locate the robot on a map. The arm can pick and place objects by pressing a specific key combination.

Conclusion: This research paper has presented the design, execution, and testing of a highly versatile low-cost robot that can be operated remotely from anywhere in the globe using a mobile phone, which was successfully executed and met all specified objectives. The robot is password protected, solar-powered, has a backup battery, and can be tracked on a map, ensuring high security and reliability. It is cost-effective due to renewable energy, DTMF, and a smartphone used as a video camera. The robot's weapon and arm make it perfect for law enforcement, military, and rescue operations where human involvement can be risky. With its diverse applications, this robot will be an immense breakthrough in the field of robotics and will have significant future development potential.

Keywords: DTMF, Retrace, Rescue robot, Firing robot, Video call, Solar tracking

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Antenna-based Detection of the Breast Cancer: A Feasibility Study

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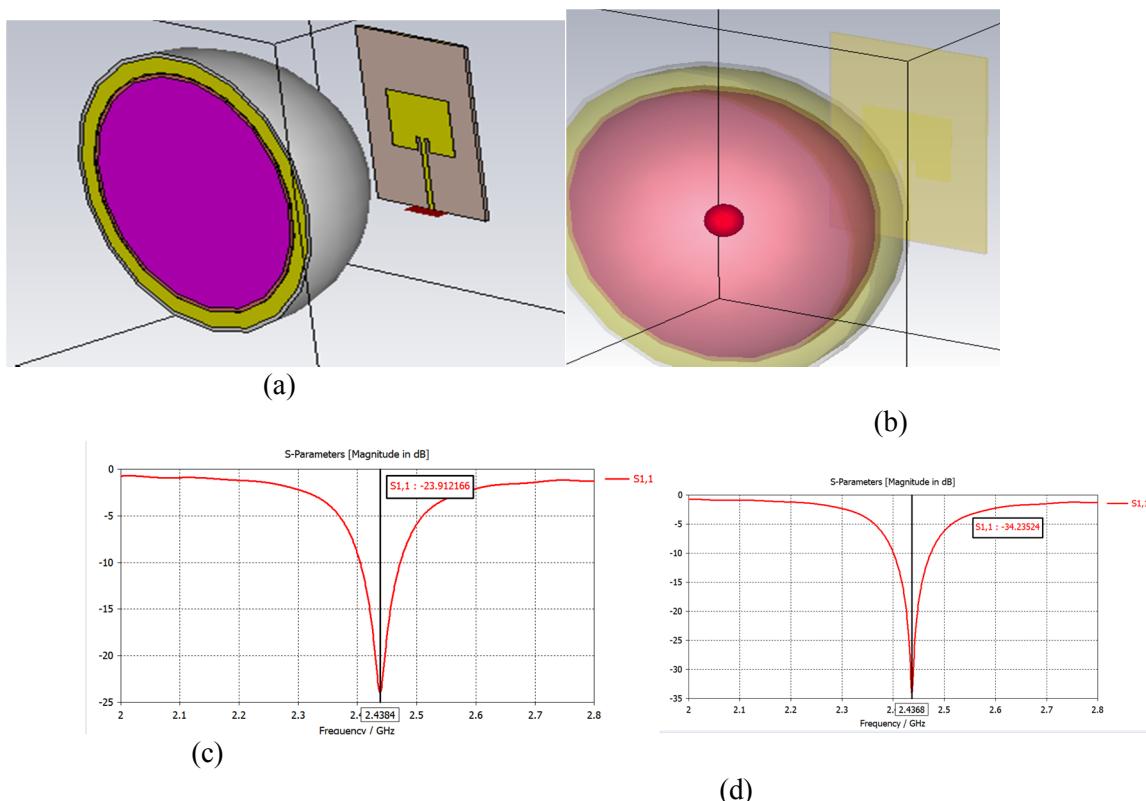
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Introduction: Breast cancer is a widespread disease affecting women worldwide, often with delayed detection causing complications. It involves the growth of malignant tumors in breast tissues, leading to uncontrolled cell proliferation and metastasis. It is a highly prevalent cancer type with approximately 2.1 million new cases annually. However, microwave-imaging techniques offer hope for non-invasive and cost-effective early detection by analyzing tissue electrical properties, contributing to breast cancer diagnosis and treatment advancements.

Materials and Methods: Microstrip patch antennas offer a cost-effective and reliable solution for detecting breast cancer by transmitting and receiving microwave signals that interact with biological tissue. These antennas consist of a metallic patch on a dielectric substrate with a metallic ground plane, with their size and shape determining operating frequency and radiation characteristics. Signal processing techniques optimize antenna performance, enabling precise detection within specific frequency ranges, enhancing accuracy and reliability.

Results and Discussion: This study explores the use of single and double-patch antennas to detect breast tumors in a phantom. By comparing data values, the presence of malignant tissue can be easily determined. The Reflection Factor, measured in dB, plays a crucial role in antenna performance, with a higher magnitude preferred for improved efficiency in body applications.



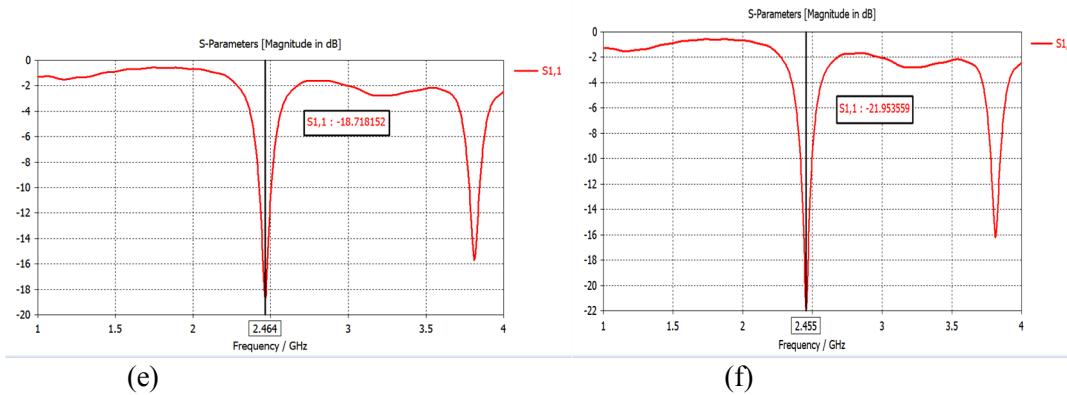


Figure: Simulation Results. (a) A simulation model of Breast Phantom with a single microstrip patch antenna without a cancerous tumor. (b) A simulation model of Breast Phantom with a single microstrip patch antenna with a cancerous tumor. (c) The s-Parameters of a breast phantom without a cancerous tumor is -23.912166 dB. (d) S-Parameters of a breast phantom with a cancerous tumor is -34.23524 dB. (e) S-Parameters with array antenna without a cancerous tumor is -18.718152 dB. (f) S-Parameters with array antenna with a cancerous tumor is -21.953559 dB

Table 1: Simulation results (E field, H field, Current density, SAR) for cancerous tumor detection in the breast phantom. (Sze = size of the tumor, D = distance of cancerous tumor from the antenna)

Parameters	Single patch antenna Without cancerous tumor	With cancerous tumor					Dual patch antenna Without cancerous tumor	With cancerous tumor		
		Sze= 2 mm D=55 mm	Sze= 3.5 mm D= 65 mm	Sze= 5 mm D=62 mm	Sze= 7 mm D=60 mm	Sze= 10 mm D= 57 mm		Sze= 2 mm	Sze= 5 mm	Sze= 10 mm
E Field (V/m)	10252	10077	9977	9942	9976	9987	7603	7568	7869	7728
H Field (A/m)	35.6	35.5	34.8	34.9	34.7	34.9	44.8	45.2	45	45.2
Current Density (A/m^2)	145	140	139	138	139	139	180	178	177	177
Specific Absorption Rate (W/kg)	0.342	0.331	0.327	0.325	0.327	0.327				

Conclusion: Our study analyzed the simulation results of a breast phantom to detect cancer cells with microstrip patch antennas, considering parameters like return loss, E-field, H-field, current density, and SAR. Increased return loss values indicated the presence of cancer cells, while SAR values remained safe. Varying cancer cell radii revealed differences in return loss values.

Keywords: Breast cancer, Microwave imaging, Microstrip patch antenna



Millimeter Wave C-Slotted Microstrip Patch Antenna for 5g Communication

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Introduction: The fifth generation (5G) of wireless communication is more sophisticated, high-speed, and reliable than 4G. The goal of this research is to propose a microstrip patch antenna for 5G communication. While the market for mobile communications is growing, there have been no significant modifications made to the network's structure. That is why 5G is in everyone's attention (Hedi Ragad et al., 2017). It is anticipated that 5G mobile internet rates would be up to 1,000 times faster than those of 4G (Mohammad Faisal et al., 2019). The fundamental foundation for the New Generation may be provided by millimeter-wave radio frequency (5G). To meet the demands of the future generation, millimeter waves can use the untapped spectrum (3 GHz–300 GHz). Printed antennas have been favored because of their advantages over other radiating antennas in order to establish communication between wireless devices on higher frequency bands, such as the millimeter wave band, where we need antennas that are conformal, small, compact, inexpensive, and simple to fabricate (Ravi Kumar Goyal and K. K. Sharma, 2016). The overall dimensions of our proposed microstrip patch antenna are $2.42 \times 2.80 \times 0.66$ mm³, and its operating frequency is 37.7 GHz. The antenna reflection coefficient S_{11} , bandwidth, gain, and voltage standing wave ratio (VSWR) are improved with the use of a rectangular patch with a "C"-shaped slot.

Materials and methods: A ground plane and a radiating metallic patch are printed on opposite sides of a dielectric substrate to create the microstrip patch antenna shown in Figure 1. The patch and ground plane are made of copper (annealed), and the dielectric substrate is FR-4, whose dielectric constant is 4.3 and loss tangent is 0.02. We design the microstrip patch antenna in the simulation platform of FEKO with proper dimensions and impedance matching of 50 ohms, which gives the best result, and we obtain the required outcomes.

Results and discussion: The S-Parameter displays the input-output relationship between ports. The return loss is denoted by S_{11} . All of the power is reflected when $S_{11} = 0$ dB. S_{11} should be less than -10 dB for the antenna to function properly, because if it is, 3 dB of the total power is transmitted to the antenna while losing -7 dB as reflected power (Imran et al., n.d.). Figure 2 represents the S_{11} of our proposed antenna. VSWR provides information about an antenna's power reflection in detail. The antenna performs better when the VSWR value is slightly greater than 1. Figure 3 and 4 describe the VSWR and bandwidth curve of the proposed antenna, respectively.

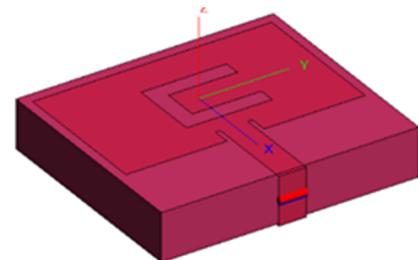
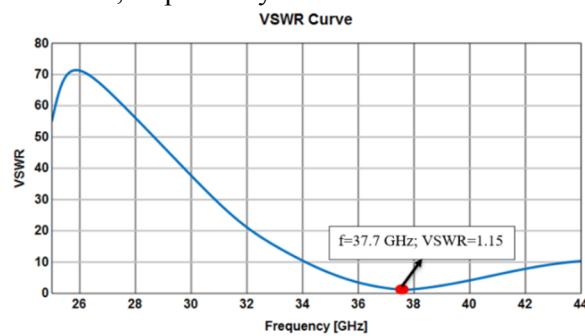
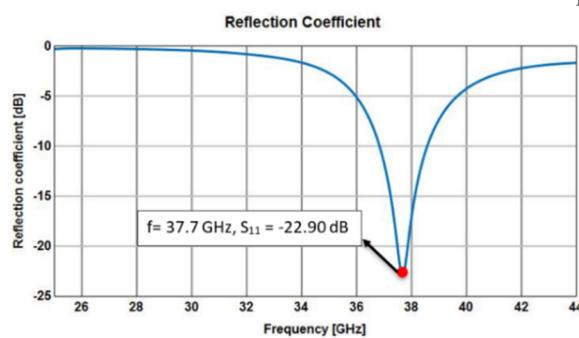


Figure 1: 3D view of proposed antenna





The designed antenna has high bandwidth, measuring 1.74 GHz. Figure 5 shows the far field radiation pattern of the antenna at 0 deg and 90 deg, respectively.

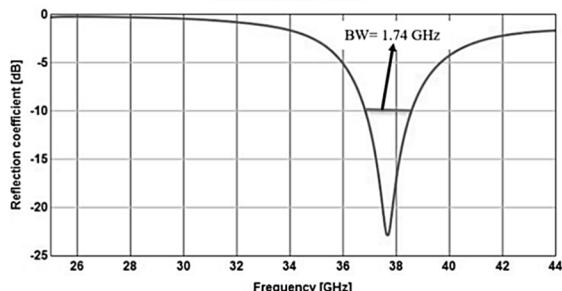


Figure 4: Bandwidth curve.

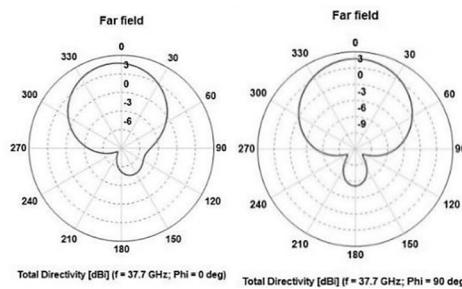


Figure 5: Far field pattern.

Table 1: A comparison of the proposed antenna with earlier models.

References	Resonance frequency (GHz)	Reflection coefficient (dB)	Gain (dBi)	Bandwidth (GHz)
(Waleed Ahmad & Wasif Tanveer Khan, 2017)	38	-18	5.06	1.39
(Abdelaziz & Hamad, 2019)	37.8	-10.5	10	1.48
This Work	37.7	-22.93	6	1.74

Table 1 compares the overall gain, S_{11} , and bandwidth with respect to the resonance frequency between the proposed antenna and other references. This comparison shows that the suggested antenna operates with a wider bandwidth, has a larger reflection coefficient, and has a comparatively better gain when compared to other antennae.

Conclusion: The antenna has an extremely low profile and measures $2.42 \times 2.80 \times 0.66 \text{ mm}^3$. The antenna has a 1.74 GHz bandwidth and is intended to operate at 37.7 GHz. The suggested antenna is a strong contender for 5G wireless equipment. The parameters for return loss and bandwidth have been greatly enhanced. In the future, we will integrate FEKO with Altair Hyper-Study simulation software to optimize the antenna performance.

Acknowledgment: The authors would like to thank Nayan Sarker for providing us with the simulation platform Altair FEKO software.

Keywords: Bandwidth, FEKO, Reflection coefficient, VSWR.

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Design of Rectangular Microstrip Patch Antenna for Detecting Brain Tumor

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Introduction: The brain is the hub of all nerve activities and is one of the human body's most essential and sensitive organs. Brain-related problems (i.e., brain cancer) are the most difficult to treat and, if not caught early enough, can lead to death. According to statistics, 13.2 million people will die from cancer within 2030 (Zhang, 2014). Every year, around 350,000 new brain tumor cases are reported around the world, with a 5 years survival rate of only 36% for those diagnosed with a brain tumor (Rehman et al., 2021). In the United States, for example, brain cancer claimed the lives of 23,800 people in 2017 (Siegel et al., 2017). Brain cancer can be detected in a variety of methods, known as- magnetic resonance imaging (MRI) scanning, X-ray screening, computed tomography (CT) scans, positron emission tomography (PET), and ultrasound imaging are all common imaging modalities used to identify cancer (Mohammed et al., 2014). However, the researchers are motivated to develop a system solution that is more efficient, safe, quick, inexpensive, non-invasive, and highly accurate that uses lower or no ionizing radiation (Dishali et al., 2019; Ostadrahimi et al., 2012). Microwave signals contain non-ionizing electromagnetic waves that can permeate human tissues without causing health problems (Barnes & Greenebaum, 2006). In this work we design a microstrip patch antenna for diagnosing brain tumor.

Materials and Methods: In this proposed work, we design a rectangular-shaped microstrip patch antenna that contains a ground plane and a radiating patch on the opposite side of the dielectric substrate. The ground plane and patch are made of copper (annealed), and FR-4 dielectric substrate is used. Consequently, we designed a human head phantom with and without a tumor inside it and placed it close to the antenna. We compare the E-field, current density, and SAR values by simulating the designed environment (with and without a tumor) with CST Microwave Studio software.

Results and Discussion: The S_{11} value of an antenna must be at least -10 dB for better impedance matching. The return loss of the single-element microstrip patch antenna is -34.35 dB, bandwidth is 78.9 MHz, and the operating frequency is 2.34 GHz. The VSWR of an antenna should be less than 2, which is suitable for most antenna designs. The VSWR value is 1.04, E-field 15323 V/m, H-field 57.45 A/m, current density 143.80 A/m², directivity 6.36 dBi. This antenna is effective for locating tumors. Fig. 1 depicts the simulation environment. This antenna is suitable for tumor detection.

From Table-1, we can simply estimate the modifications of the parameters for recognizing a brain tumor. The specific absorption rate (SAR) and current density values are significant enough to determine the tumor. The values are compared for different distances of the tumor from the antenna inside the human head phantom. "Tz" represents the tumor distance from antenna.

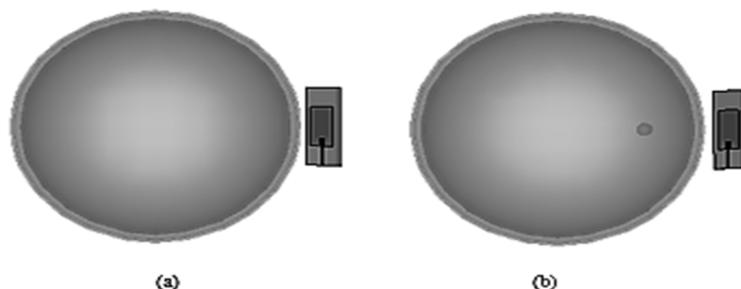


Figure 1: Simulation environment (a) without tumor and (b) with tumor.

**Table 1:** Simulation result for tumor detection.

Parameter	Without tumor	With tumor				
		Tz=30	Tz=40	Tz=55	Tz=80	Tz=110
E-field (V/m)	10975	10970	10972	10977	10976	10976
Current density (A/m^2)	104	456.4	412.3	334.9	212.2	122.4
SAR (W/kg)	1.357	1.631	1.6	1.36	1.355	1.356

Conclusion: We noted the variations in the E-field, current density, and SAR values from Table 1. Using those data, we can ensure the presence of a tumor inside the head. From the differences in the SAR value without and with the tumor, we ensure that the tumor in the head and the tumor is close to the antenna. The value of current density likewise falls when the tumor distance increases. We confirm the presence of the tumor in the head and its location within the head using the SAR and current density values. Even if we rotate the antenna around the head phantom in the absence of a tumor, all parameter values remain constant.

Keywords: CST MWS, FR-4, SAR.

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A Survey on Electronic Healthcare Systems in Bangladesh: Current Consequences and Future Prospects

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Introduction: Bangladesh, being one of the most populous countries in the world, faces numerous challenges in delivering quality healthcare to its citizens, particularly those living in rural areas. Electronic health(Smith et al., 2019) services can bridge this gap by providing access to quality healthcare to all citizens, regardless of their location. But the current e-health systems in Bangladesh face challenges related to interoperability(Al-Shorbaji et



al., 2017). This emphasizes the significance of enhancing the national healthcare system for fast, accessible, and affordable healthcare(Brock, 1995). Multiple studies have been conducted on e-health systems in Bangladesh; however, these studies have limitations. For instance, Challenges and prospects of e-healthcare services in Bangladesh: a scoping review (Islam et al., 2017) provide an overview of the challenges of e-healthcare services in Bangladesh but do not present any empirical evidence to support their claims. The study explores telemedicine's role in reducing healthcare disparities in Bangladesh (Akter et al., 2020), omitting the discussion of challenges. Similarly, the study identify barriers to electronic health records adoption in Bangladesh (Sultana et al., 2017) , but focus on a single hospital. Therefore, the main objective or aim of this survey was to evaluate the current state of e-health systems in Bangladesh and explore the future prospects of these systems, finding that we are still in the early stages with limited impact on patient outcomes due to inadequate infrastructure and standardization.

Materials and methods: The study analyzed the present and future of electronic healthcare services in Bangladesh, surveying 100 healthcare providers and patients using structured questionnaires. Some examples of structured questionnaires: 1. What type of database are you currently using to store patients' information? a. Centralized, b. Distributed, 2. Have you ever saved patient data as a backup for lost data? a. Yes, b. No. The data collection methods are summarized below:

Table 1: Summary of survey data collection

Targeted person	Types of Questions	Numbers of Questions	Collected response	Percentage
Doctors	Online	28	26	92.85%
	Offline	11	11	100%
Medical/Lab assistant	Online	13	11	85%
	Offline	23	23	100%
Database Management Officer	Online	16	15	93.75%
	Offline	8	8	100%
Others	Online	8	6	75%
	Offline	2	2	100%

The survey included online and offline questions targeting doctors, medical/lab assistants, and database management officers, with a high response rate. Good questionnaire quality ensured justified findings through quantity and quality analysis, effectively communicating implications to stakeholders. The data processed in Excel were converted to CSV file format and analyzed in R, a versatile and widely-used open source programming language for statistics and data science. Various plot functions in R were used to analyze the processed data, and the resulting outputs were used to derive the research results.

Result and discussion: A survey on the status of electronic healthcare services in Bangladesh found varying levels of familiarity and necessity in rural areas (10.57% unions, 17.30% thanas, 46.15% upazilas, and 25.96% zillas). Data was collected from 100 diverse healthcare facilities (47 private hospitals, 21 clinics, 15 health complexes, 12 diagnostic centers, and 5 nursing homes) surveyed with 100 professionals (36 doctors, 18 medical assistants, 15 lab assistants, 22 nurses, and others) (Figure 1).Out of the 100 facilities surveyed, 74 collect data electronically, with 53 of them using centralized databases, 12 using distributed databases, and 9 using other technologies. 51% store data on databases, 10% on Excel, 3% on the cloud, 17% on paper, and 19% do not store data (Figure 2).

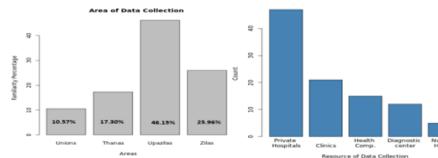


Figure 1: Area of data collection for survey and Resources of data collection for survey

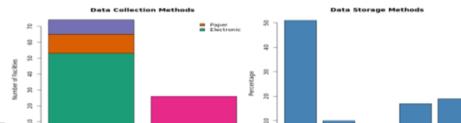


Figure 2: Data collection types and data storage technology

Among surveyed healthcare systems, 29% keep no backup of health records, and 11% use paper for data collection and backup. 74% collect data electronically, but only 4% use Excel for storage, and 2% use other technologies for backup. 54% use centralized databases without proper backup (Figure 3(a)).

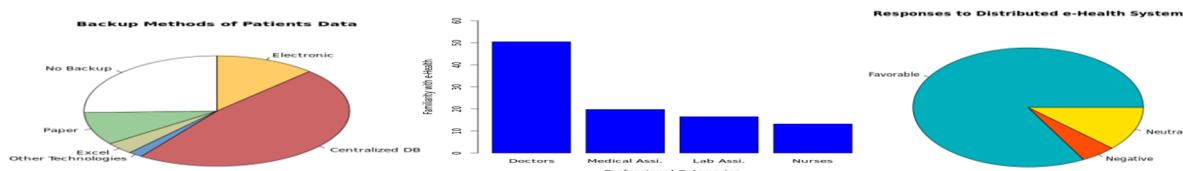


Figure 3: (a) Availability of Data Backup Technology (b) Familiarity with e-health (c) Acceptance of e-health

50.5% of doctors are familiar with e-Health, compared to 19.8% of medical assistants, 16.5% of laboratory assistants, and 13.2% of nurses (Figure 3(b)). 83% of responses to the distributed e-health system are favorable, 5% are negative, and 12% are neutral (Figure 3(c)). The survey of e-health systems in Bangladesh shows challenges due to centralized systems, lack of infrastructure which observed and compared centralized and decentralized systems. Centralized systems store patient information in one location for easy data management, while decentralized systems store information in multiple locations for easy accessibility and quick data retrieval. The e-health systems in Bangladesh face challenges such as limited access, inefficient data management, lack of interoperability, and security risks, impacting healthcare services and patient care. The survey suggests improving the systems for better health outcomes.

Conclusion: Bangladesh faces healthcare challenges due to its large population. E-health services are centralized, hindering data exchange. Investment and standardization are needed to fully realize the benefits. Results offer insights for healthcare providers, and technology companies. E-health has the potential to improve outcomes, but needs further development. Distributed facilities can save time and costs, and thus distributed e-health systems are the solution improving healthcare services.

Keywords: Healthcare systems, Latest technologies, E-health system, Sustainability.

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Optimizing Last-mile Delivery of A Company: A Vehicle Routing Solution

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Introduction: The vehicle routing problem (VRP) is a classic combinatorial optimization problem involved in many applications (Xiao et al. 2012). Although VRP has been extensively studied in the literature, the number of studies where it is applied to real-life problems is limited (Adewumi and Adeleke, 2018). This paper is



distinguished by its use of operations research approaches through Python programming language using embedded local search algorithms to solve the capacitated VRP in the pharmaceutical industry, utilizing real-world data provided by Tabuk Pharmaceutical Manufacturing Company. The objective is to optimize the distribution routes of medical drugs through trucks from the Tabuk-based warehouse to 18 different customer locations in Saudi Arabia. The significance of this study is rooted in the importance of efficient transportation operations in the logistics and supply chain management industry, alongside the challenges that companies encounter in achieving optimization. The study's contribution lies in developing optimization techniques and methods that can serve as a valuable guide for other companies seeking to enhance their supply chain performance through transportation optimization. Furthermore, the optimized routes aid in minimizing highway congestion, sustainability, costs, and utilization of vehicles.

Materials and methods: The methodology used in this paper involves several steps. Firstly, data is collected from the logistics and supply chain management department, including information about the locations of customers (see Figure 1), the capacity of trucks, previous routes, number of vehicles, and pallets demand of each location. Next, the Google Distance Matrix API is used to create a distance matrix between the warehouse and customer locations. The Python programming language is then utilized to optimize the routes based on factors such as distance, time, and vehicle capacity. The optimization process, achieved through Python embedded local search algorithms, involves finding the most efficient routes that minimize costs, and increase vehicle utilization rates. The results of the optimized routes are then compared to the previous routes to determine the efficiency gains, concluding the benefits of optimization for transportation operations in the pharmaceutical industry.



Figure 1: Locations of customers and the warehouse

Results and discussion: After writing the necessary code and running it on the Anaconda interface, the output shows that; Distance of Total Route: The total optimized route distance and the total distance before the optimization. When these two distances are subtracted from each other, it is seen that 11,256.54 km of road distance savings occur. This optimization resulted in a difference of 4,783.23 liters of diesel gasoline. Vehicle Utilization Rate: In this study, it was ensured that the vehicle capacity was full or as close to full as possible. 80% was the lowest truck usage rate of the optimized routes, while the 8% was the lowest truck usage rate among the non-optimized routes which reduces traffic congestion to a minimum. Sustainability: Human activities cause significant and irreparable consequences due to emissions. It is crucial to keep carbon emissions at a minimum for the environment. The average carbon emission rate has been reduced by 25%, contributing significantly to green logistics and supply chain practices.

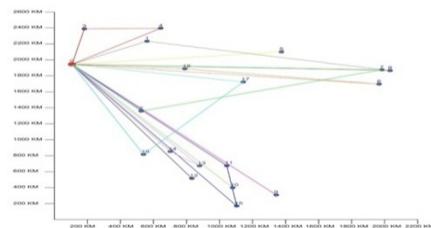


Figure 2: Optimized routes



Table 1: Obtained 11 routes

	Location 1	Location 2	Location 3	Location 4	Distances (km)
Route 1	Tabouk Warehouse → Medical Supply Najran	→ Tabouk Warehouse			3,729.80
Route 2	Tabouk Warehouse → Medical Supply Arar	→ Medical Supply Qurayyat	→ Tabouk Warehouse		1,557.36
Route 3	Tabouk Warehouse → Medical Supply Bisheh	→ Medical Supply Jizan	→ Tabouk Warehouse		3,532.97
Route 4	Tabouk Warehouse → Medical Supply Asir	→ Tabouk Warehouse			3,255.39
Route 5	Tabouk Warehouse → Medical Supply Hufof (Ihsa) → Medical Supply Hail (Masyaf)	→ Tabouk Warehouse			3,196.71
Route 6	Tabouk Warehouse → Medical Supply Qunfudah	→ Tabouk Warehouse			2,683.40
Route 7	Tabouk Warehouse → NUPCO Warehouse Taif	→ Medical Supply Al-Baha	→ Tabouk Warehouse		2,668.40
Route 8	Tabouk Warehouse → Medical Supply Batin	→ Tabouk Warehouse			2,356.36
Route 9	Tabouk Warehouse → Jeddah Warehouse	→ Medical Supply Qassim (Buraydah) → Tabouk Warehouse			2,930.40
Route 10	Tabouk Warehouse → Medical Supply Al-Madinah	→ Medical Supply Damam	→ Tabouk Warehouse		3,531.90
Route 11	Tabouk Warehouse → Medical Supply Skaka-Jouf	→ NUPCO Warehouse Damam	→ Tabouk Warehouse		3,356.82
					Total Distance (km) = 32,799.46

Conclusion: This paper highlights the significance of optimizing the capacitated VRP for companies in terms of logistics and supply chain management. The optimization process involved utilizing the Google Maps API and Python programming language using embedded local search algorithms to find the most efficient routes and vehicle utilization rates and compare them to the non-optimized routes currently used. The project's findings demonstrate the benefits of optimization in terms of cost reduction, distance minimization, higher vehicle utilization rates, and sustainability improvement. However, it is essential to note that there may be exceptions or problems with the principles and generalizations inferred from this study such as country regulations. Lastly, the conclusions drawn from this study can serve as a guide for other companies looking to optimize their transportation operations and achieve similar benefits.

Keywords: Vehicle routing problem, Google Maps API, Python, Cost, Sustainability, Case study

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GPS Tracker for Field Staffs through Application and Authority Monitoring System in Web

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Introduction: Companies all over the world employ a large number of people in various types of jobs, such as desk jobs and field jobs, and each company wants to track their employees and monitor the work that they offer, to measure the company's productivity. Employees who do the desk job are easily trackable. On the other hand, employees who do the field jobs are not easily trackable by the admin (León et al., 2022). A real-time employee tracking and monitoring system transmits employee location data to a central server in real-time for processing and location information extraction. The Global Positioning System (GPS) (El-Rabbany, 2002) plays a vital role in improving this tracking system. With a GPS receiver, GPS technology may locate an object in a satellite-based navigation system (Damani, 2015). GSM and SMS technologies are often utilized in wireless data transport. Therefore, this paper aims to develop a field worker tracking system, which not only makes sure that employees do their field jobs by checking their identification but also constantly monitors their locations using the Global Positioning System, so that it would be nearly impossible for any employee to falsify their attendance because



each employee has a unique employee ID in the system. Then the data is stored in the cloud. By analyzing this data, a company can make any decision or the company can easily evaluate any employee.

Materials and methods: Firstly, the android application needs to be installed on a staff device. This can be done by the office staff or the user himself with the supervision of the staff. Then the employee ID needs to be configured. After this step, there is no work at the front end of the application. This app will collect latitude and longitude during office time. After this step, the location information is collected and saved. For android storage, SQLite is used temporarily. From the local storage, the data is sent to cloud storage, which is a database server through REST API. In cloud storage (Cloud storage is a cloud computing model that stores data on the internet and it operates data storage as a service), MySQL database is used. After completing these steps, data is retrieved through data clustering and plotting. Lastly, the staff is tracked through GIS Map (GIS map is a geographic information map).

Results and discussion: After the employee ID is configured through the help of a monitoring staff, the application starts to take the location of the employees. Here the user can see whether the application is taking the data or not. This is just the use of the application from the user's end. The rest of the work is done by the official authorities from the web panel. The office staff can understand employees' location with the help of this location summary report which indicates user-tracked times in a day. Suppose an employee is not being tracked for the last 4-5 days, then the system will detect them as inactive and the authorities can go for the proper action. On the GIS Map, the location is shown using clustering. Here the data is clustered. Various filtering criteria are set here to identify user locations. With the help of a locator, the exact location of the employer can be known. The location density can also be measured where the user was active many times. In which location a particular employee has visited the maximum time can be seen through this heat map. So, the overall results show the effectiveness of the application and the website for monitoring staff.

Conclusion: This system allows us to track and monitor the locations of field employees, enabling the manager to review each employee individually. It helps businesses produce more, which improves its global standing. Time is wasted less and the company's yearly growth is boosted. It makes it easier to follow when employees log in and exit. The difficulty of maintaining employee information is decreased by being able to see employee details and their actions.

Keywords: GPS Tracker, Authority Monitoring System, Field staff, Application.

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Evaluation of Human Risk of Polycyclic Aromatic Hydrocarbons Produced as a Processes Contaminant

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Introduction: Polycyclic aromatic hydrocarbons(PAHs) are common process and environmental contaminants synthesized by incomplete combustion or pyrolysis of organic compounds (Ishizaki et al., 2010). About 15 PAHs have been identified, such as Fluorene(Fl), Anthracene(Ant), Pyrene(Pyr), Phenanthrene (Phe), Chrysene(Chr), Benzo[a]pyrene(BaP), etc. PAHs are on the priority pollutant lists of European Union (EU) and the Environmental Protection Agency (EPA). These can cause cancer. Inhalation, dermal contact, and eating of contaminated foods, are the three main ways humans are exposed to PAHs. BaP can be used as a marker for the presence and effect of carcinogenic PAHs in food, (Alexander et al., 2008). (Garvin, n.d.) first found that BaP and other related PAHs were present in charcoal-broiled beef. (Chung et al., 2011) revealed that, the kind of heat source and cooking technique is highly correlated with PAH levels. (Tareq et al., 2020) reported that popular ways to cook chicken at home (using a microwave, pan-frying after boiling, and using a gas grill both directly and indirectly) can lead to the formation of PAHs in the meat. (Weisburger et al., 2002) stated that applying tea polyphenols to beef before cooking stops the formation of the mutagens in a dose-dependent way. Nowadays, many people use microwave ovens where they can cook meat at a controlled pre-set temperature. However, most people are unaware of how cooking temperature and time influences the formation of PAH levels. Thus, the objective was to quantify the level of PAHs, carcinogenic risk (CR) and non-carcinogenic risk (NCR) in every time temperature of cooking.

Materials and methods: Pieces of raw chicken meat (only flesh) were bought from a HACCP-certified meat shop in the Sylhet area of Bangladesh. For marination purposes, green tea was also collected from the Sylhet area of Bangladesh.

Green tea marinated chicken meat samples were cooked at 13 cooking conditions varying in time and temperature, provided by RSM. Removal of fat from cooked meat samples is carried out by alkaline hydrolysis. Extraction of PAHs from the sample is done by treating it with cyclohexane. Cleanup of the extract is done by Solid Phase Extraction (SPE). PAHs in the cleaned sample are determined by GC-MS analysis. At last, health risk analysis was determined by calculating Carcinogenic Risk(Xia et al., 2010) and Non-Carcinogenic Risk(Li et al., 2016); of PAHs.

Results and discussions: The correlation coefficients (R^2) for the time-temperature of cooking versus PAHs, BaP, CR, and NCR values in RSM were 98.58%, 91.85%, 92.39%, and 92.94%, respectively. At 220°C and 90 minutes of cooking, the maximum value of total PAHs was 179.78 µg/kg, whereas the minimum value was 56.42 µg/kg at 180°C and 75 minutes of cooking (Table 1). Benzo[a]pyrene, the carcinogenic marker PAHs, was detected in every sample, ranging from 1.83 to 5.22 µg/kg (Table 1). The current study observed the maximum carcinogenic risk (1.14×10^{-5}) and non-carcinogenic risk (5.46×10^{-3}) among the 13 samples when cooked for 90 minutes at 220°C. The calculation was done assuming a person weighs 60 kg and consumes chicken meat at an ingestion rate of 17.4 g/day daily with a lifespan of 70 years. The lowest CR (4.0×10^{-6}) and NCR (1.93×10^{-3}) were obtained by cooking at 180 °C for 60 minutes. In our study, the CR values of all 13 samples of cooked chicken meat were found to be within acceptable ranges. In all 13 samples, the CR and NCR values were gradually enhanced with cooking time and temperature.

Conclusion: This study concludes that the higher the cooking duration and temperature, the higher the PAHs level and BaP. Both the highest CR (1.14×10^{-5}) and the highest NCR (5.46×10^{-3}) were found at 220°C for 90 minutes of cooking, which was the maximum value of temperature and time. The CR values for all the samples



were found within the acceptable limit (between 10^{-4} and 10^{-6}). To get a lower risk, it is recommended to cook chicken below the range of 200°C-75min. Further research should be done to determine the effect of green tea marinade on reducing the health risk.

Table 1: Effect of different time-temperature of cooking on BaP and PAHs generation, Carcinogenic Risk and Non-Carcinogenic Risk

Sample No	Temperature (°C)	Time (min)	BaP((μg/kg)	ΣPAHs (μg/kg)	Carcinogenic Risk	Non-Carcinogenic Risk
1	220	60	2.47	148.47	5.50E-06	2.73E-03
2	220	75	3.19	151.24	7.08E-06	3.43E-03
3	220	90	5.22	179.78	1.14E-05	5.46E-03
4	200	60	1.94	95.5	4.30E-06	2.08E-03
5	200	75	2.02	101.86	4.49E-06	2.17E-03
6	200	90	2.54	111.43	5.62E-06	2.70E-03
7	180	60	1.84	63.6	4.00E-06	1.93E-03
8	180	75	2.04	56.42	4.44E-06	2.12E-03
9	180	90	2.65	79.18	5.75E-06	2.73E-03
10	200	75	2.47	84.09	5.41E-06	2.58E-03
11	200	75	2.03	91.06	4.53E-06	2.15E-03
12	200	75	2.11	88.72	4.67E-06	2.23E-03
13	200	75	1.83	96.85	4.06E-06	1.97E-03

Keywords: Polycyclic aromatic hydrocarbons, Benzo [a] pyrene, Carcinogenic risk, non-carcinogenic risk, GC-MS

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Isolation and Characterization of Entomopathogenic Bacteria (EPB) from Bangladesh Soils

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Introduction: The Entomopathogenic Bacteria (EPB) has been widely used as bio-control agent for insect pest control. Among them *Bacillus thuringiensis* (Bt) is the most well-known. The Bt strains are widely used for lepidopteran and dipteran insect control due to insecticidal toxins. It is targeted to isolate Bt strains from Bangladesh and characterize novel toxicity for future Bt based bio-pesticide development. The overall purpose or aim of this research is to develop bioinsecticide based on native strains of *B. thuringiensis* isolated from Bangladesh. With this aim, the specific objectives are as follows: a) To isolate and characterize of native Bt strains; b) To identify and characterize the diversity of mosquitocidal “cry” and “cyt” genes in the isolated native Bt strains and c) To evaluate the activity of the isolated Bt strains against Lepidopteran and Dipteran insect's pests.

Materials and methods: Nutrient Agar media; GYS (1 g glucose, 2 g yeast extract powder, 2 g NH₄(SO₄)₂, 0.06 g MnSO₄, 0.4 g MgSO₄•7H₂O, 0.08 g CaCl₂, 5 g K₂HPO₄ per liter); LB broth were used to isolate and culturing the bacteria for routine laboratory works. The following research methodology will be followed to achieve the objectives:

- Soil samples collection** A total of 71 soil samples (about 10.0 g each) were collected from potential mosquito breeding places of randomly selected 15 different districts of Bangladesh e.g. Barishal, Chuadanga, Dinajpur, Gaibandha, Jashore, Khagrachori, Khulna, Mymensingh, Natore, Nilphamari, Pabna, Panchagarh, Rajshahi, Rangpur and Thakurgaon
- Bt isolation from soil sample:** There are different methods of Bt isolation. We adopt the enrichment method reported previously (Patel et. al, 2013) for isolation of Bt from soil samples. The inoculum (200 µl) was plated on the NA media (Nutrient Agar) and incubated at 27°C. After 48 hours, CFU (Colony Forming Unit) was measured as follows:

$$\text{CFU} = \frac{\text{No. of Colonies}}{\text{Dilution Factor (DF)}}$$

- Gram staining test:** Morphologically white colored suspected Bt-like colonies were picked, and gram staining was tested. HIMEDIA kit along with protocol were used and then observed at 100X. Isolated colonies were stored in 25% Glycerol stock at -20°C for further molecular analysis and bio efficacy study.
- Molecular identification:** Genomic DNA (gDNA) of the suspected Bt isolates were extracted by heat method (Bravo et. al, 1998). Then the 16S gene was amplified. Then PCR was performed with these conditions: first cycle at 95°C for 3 min; later 35 cycles – 95°C, 30 s; 52°C, 30 s and 72°C, 90 s; final elongation for 7 min at 72°C. PCR products were analyzed in 1.5% agarose gel electrophoresis and DNA sequence was determined. Obtained sequences checked at NCBI database using BLAST tool.

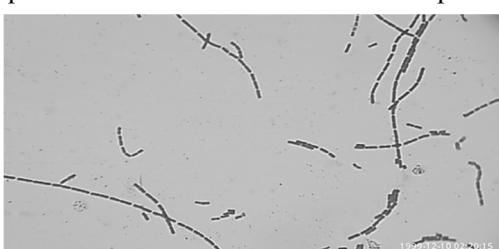


Figure 1: Gram-positive rod-shaped bacteria (D1C5)
(Suspected Bt)

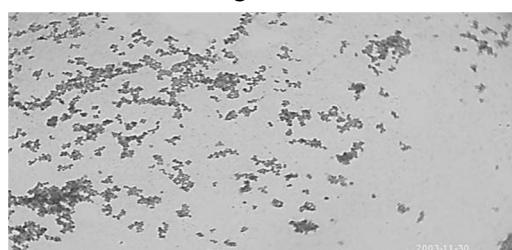


Figure 2: Gram- negative rod- shaped bacteria (G5C11)



Results and discussion:

- a) **Estimation of viable microbial populations in the soils:** The number of microbial cells in a soil sample was determined and expressed as CFU/g soil. The average CFU among all samples in Bangladesh was 7.9×10^7 that proves the abundance of higher microbial present in soils. Soils of Barishal (1.9×10^8) showed highest CFU following Jashore (9.7×10^7), Rajshahi (9.5×10^7) and Gaibandha (9.4×10^7) while the soils of Panchagarh (5.8×10^7) showed lowest CFU (Table 1).
- b) **Gram staining test:** A total of 399 colonies were analyzed from the collected samples and purple colored rod-shaped bacterium observed at oil emersion under microscope at 100X was considered as suspected gram positive Bt. Total numbers of 194 of Bt-like colonies were identified as gram-positive rod (49%) with a range of 86% (in Barishal) to 4% (in Khulna) after gram staining test.

Table 1: CFU/g soil calculation

Sl. No.	Sample	Total colonies	Avg. CFU	Gram (+ve) (rod shaped)	% of gram (+ve) (rod shaped)	Gram (-ve)	% of gram (-ve)
1	Barishal	29	1.9×10^8	25	86	4	14
2	Chuadanga	18	8.3×10^7	9	50	9	50
3	Dinajpur	42	5.4×10^7	17	40	25	60
4	Gaibandha	23	9.4×10^7	11	48	12	52
5	Jashore	11	9.7×10^7	5	45	6	55
6	Khagrachori	16	8.7×10^6	8	50	8	50
7	Khulna	26	5.8×10^6	1	4	25	96
8	Mymensingh	29	6.9×10^5	18	62	11	38
9	Natore	33	7.3×10^7	28	85	5	15
10	Nilphamari	20	3.9×10^6	9	45	11	55
11	Pabna	17	7.0×10^7	8	47	9	53
12	Panchagarh	31	5.8×10^7	12	39	19	61
13	Rajshahi	21	9.5×10^7	7	33	14	67
14	Rangpur	30	3.1×10^7	11	37	19	63
15	Thakurgaon	53	7.0×10^7	25	47	29	53
	Total	399	7.9×10^7	194	49	205	51

- c) **Molecular identification:** PCR analysis of 16S rRNA gene using the universal primers 27F and 1492R (1500bp) and BLAST search of 10 samples were identified. Among them, 3 strains as *Bacillus thuringiensis*, 4 strains as *Bacillus cereus*, one as *Bacillus paranthracis*, one as *Bacillus megaterium*, one as *Bacillus altitudinis* and one as *Bacillus* sp. The identification of other samples and evaluation of their bio efficacy are ongoing. Bio-control tests data will be provided later.

Conclusion: The Barishal district showed maximum viable microbial populations of Bt in the soils following Rajshahi, Chuadanga, Gaibanda whereas the Mymensingh district showed minimum microbial Bt populations. Gram staining and analysis revealed that there's abundant Bt present in Bangladesh soils. PCR analysis of 16S gene and BLAST search these samples identified different Bt strains. Further molecular identification of the rest samples are highly recommended with an aim to identify and characterize the diversity of pesticidal "cry" and "cyt" genes in the isolated native Bt strains and evaluate the efficacy.

Keywords: *Bacillus thuringiensis* (Bt), *Bacillus sphaericus* (Bs), Isolation, biological control, Bangladesh.

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An Analytical Approach to Evaluate Particulate Matter Concentrations in Outdoor Workplace Environments of Dinajpur Municipality in Bangladesh

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Introduction: Air pollution is one of the most pressing environmental problems of the time, and it poses a significant threat to human health and the environment. Specially, outdoor air pollution is one of the world's largest health and environmental problems one that tends to worsen for countries as they industrialize and transition from low to middle incomes like Bangladesh. In 1987, the World Health Organization (WHO) published guidelines for air quality mentioning the limits of all the parameters or substances that remain in the air (WHO, 1987). Air pollutants can take many forms, including gases, such as carbon monoxide (CO), carbon dioxide (CO₂), sulfur dioxide (SO₂), and oxides of nitrogen (NO_x), and particulate matter (PM_{0.3-10}), which consists of tiny particles of dust, dirt, soot, and other materials suspended in the air (WHO, 2018) and again regarded as a complex mixture of solid and liquid particles suspended in the air. Apparently 7.8% of global deaths are attributed to outdoor air pollution; in addition with causing serious cardiovascular risks to human health along with other spectacular environment problems like invisibility, acid rain etc. in many ways by contamination of PM 0.3 – 10 as well. Dinajpur Municipality, the northwestern rapidly growing districts of Bangladesh is the main concerned study area for this respective writeup. It is regarded as a historically and culturally flourished modern city due to its rapid urbanization and industrialization concerns. Hence this rapid growth also triggered its ambient pollution conditions in the air via the massive concentrations of particulate matters. Here the proper analysis and evaluation of particulate matter (PM_{0.3-10}) concentrations in the ambient(outdoor) workplaces of Dinajpur municipality is considered as the focusing objectives of this article where all the sampling locations are further sub-categorized as residential, commercial, roads and sensitive areas with a view to achieving the exact outcomes with better understanding.

Materials and methods: The city of Dinajpur lies between 25°35' N latitude and 88°40' E longitude and is located on the eastern bank of the river Punarbhaba. Approximately 1, 86,727(census-2011) people have their accommodation in this respective municipality while the population density is 7,247/km² of total area about 24.50 km² (GoB, 2023). Though the city is well organized with easy accessibility; the increasing environmental pollution conditions are converting the municipality way susceptible to the city dwellers. The PM_{0.3-10} values from the exterior of the workplace environment of the study locations were obtained by using a dust and particulate matter counter tool: model no Extech VPC300. Particulate matter data were collected from 26 individual sampling locations were selected on the basis of population density, highly accessible or industrially active points of the city or ecologically enriched or frigidity of places with are again sub-categorized by sensitivity, commercial values, industrial conditions, mixed circumstances etc. Data obtained using differential mode by the. Differential means-measures all particles that are greater than or equal to the particle size selected in the Sample Volume field, but less than the next largest particle size. Measurements were recorded over the course of 2 minutes. Statistical analysis was completed by using R 4.2.2 and Microsoft excel.

Results and discussion: The highest value of PM₁₀ is in Dinajpur city is 2507 and lowest value is 52 but medium is 454.5. On the other hand, the highest value of PM_{0.3, 0.5, 1, 2.5, 5} is accordingly 335195, 138118, 37965, 12995, 2087. Their medium value is accordingly 221304, 71873, 16681, 3393, 361. According to EXTEC vpc300 reference format, this medium value shows that most of the locations are polluted. Average temperature (32.30) and Average humidity (75.00) reflected that particulate matter concentrations are higher in dry weather. After the analyzation of measured data, the outcome implies that outdoor air quality status of the workplaces of our study area is highly altered with noxious air particulate as well way mor carcinogenic as well as causes



harmful cardiovascular diseases, asthma problems, respiratory disorders for mankind and many more. According to observations, factors contributing to the high concentration of PM include excessive human movement, combustion byproducts of black smoke, road dust, waste, garages in every possible place, and rice mill emissions etc.

Conclusion: This study highlights the constant upheaval of fine particulate matter concentrations in the ambient workplaces throughout the Dinajpur Municipal areas for the reason of massive construction activities, ongoing modern infrastructural development functions as well as rapidly increasing transportation industry and roadside dust, automobile smog or production pollutions to the air volumes and many more. However, all of these high ranges of fine particulate concentrations have ongoing negative effects on public health and to the extent hinders environmental stability either. The quality of the air is greatly harmed for a lack of frequent monitoring and inspection of car emissions as well as for the lack of management strategies of the traffic system that need to be addressed and evaluated appropriately for sake of early remediation to the harmful continuities of particulate pollution with proper preparedness measures.

Acknowledgment: The authors are grateful to residents of Dinajpur municipality for their kind cooperations.

Keywords: Air quality, Particulate matter, Pollution, Health impact, Bangladesh

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Comparison of Alternative Freight Routes from Turkiye to Europe Under the Green Deal

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Introduction: The EU aims to become a carbon neutral continent in the near future. For this reason, with the European Green Consensus, it offers to its commercial partners its efforts to reduce some global greenhouse gas emissions, such as carbon tax, in order to reduce the carbon emission intensity in international commercial activities (Haas and Sander, 2020). In addition to the Green Deal, after the COVID-19 pandemic, alternative routes compared to standard routes have gained great importance for the logistics sector. Accordingly, intermodal transportation has become a necessity due to the importance that countries give to the environment, cost criteria and geographical necessities. The main purpose of this study is to determine alternative routes for freight goods sent from Turkiye to Europe under these conditions, to compare them with the existing routes and to reveal the environmental impacts of the routes.

Materials and methods: While calculating the cost in the study, different costs were encountered according to each mode of transport. Fuel consumption and highway tolls for the land route, ticket costs for the railway and airway, ticket costs for the seaway and port costs are included in the total account. The calculations made for the seaway were taken from the DFDS agency and added to the account. The carbon footprint calculation of the distance of the train mode on the route was calculated based on the data on the website of the train agency Kombiverkehr. The carbon footprint on the airline route was calculated using the data of the relevant airline company (Li et al. 2015).

- $(\text{The cost of the fuel type for 1 liter}) \times (\text{Total traveled km}) = \text{Fuel fee}$



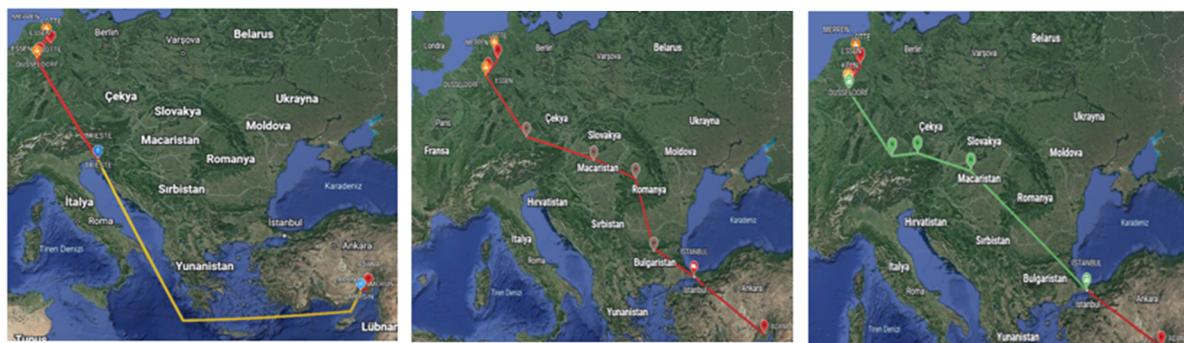
- $(Fuel\ fee + Highway\ fee + Customs\ fee) \rightarrow Cost\ Calculation\ of\ Roadway$
- $(Ticket\ price + Port\ fees) \rightarrow Cost\ Calculation\ of\ Seaway$
- $(Train\ ticket + Customs\ fee) \rightarrow Cost\ Calculation\ of\ Railway$
- $\frac{Fuel\ consumption \times Emission\ factor}{Fuel\ consumption} = Emission\ factor$
- $(Emmisionamount)_i = (Emmisionfactor)_i(Distance)_i * (Numberofvehicles)_i \rightarrow Carbon\ Emission$

Results and discussion: The original routes used in the project are the routes of Eyüp Logistic Company (<https://www.eyup.com.tr/>). Permission has been obtained from the company for the use of the routes. The routes used are based on the general routes imported from Turkey to Europe. The original routes are actively used routes, and alternative routes have also been confirmed and shared in accordance with reality. Cable transportation was carried out on the routes given as examples in the extended abstract. Different products are transported for other routes processed in the entire report.

Original Route-1 (Adana-Essen-Lotte) (Seaway + Roadway): The vehicle carrying 22,300 kg loaded from Adana provides arrival to Mersin port by roadway. Then it arrives at the port of Trieste by seaway. After arriving in Dusseldorf by land and customs clearance, we deliver 4,500 kg to Essen and then to Meppen, the second customs point, and then 17,800 kg to Lotte, the last unloading address, will be delivered by roadway.

Alternative Route-1 (Adana-Essen-Lotte) (Roadway): The vehicle loaded with 22,300 kg from Adana arrived at Germany by roadway via Bulgaria. After arriving in Dusseldorf by land and customs clearance, 4,500 kg is delivered to Essen and then to Meppen, the second customs point, and then 17,800 kg to Lotte, the last unloading address, will be delivered by roadway.

Alternative Route-2 (Adana-Essen-Lotte) (Roadway + Railway): The vehicle loaded with 22,300 kg from Adana reaches Halkalı Railway Station by roadway. From here, the train arrives at Cologne Eifeltor Ubf station. After arriving in Dusseldorf by land and customs clearance, 4,500 kg is delivered to Essen and then to Meppen, the second customs point, and then 17,800 kg to Lotte, the last unloading address, will be delivered by roadway.



Original Route-1

Alternative Route-1

Alternative Route-2

Figure 1: Original and alternative routes

While the illustrations of the existing and proposed new routes are given in Figure 1, the comparison in terms of cost, carbon and time is given in Table 1.

Table 1: Comparison of the routes

Routes	Cost	CO ₂	Traveling Time
Original route	2.030 €	2.988 gr / km	4 days
Alternative route 1	2.477 €	9.928 gr / km	2 days
Alternative route 2	1.562	5.998 gr / km	8 days

Conclusion: As a result, the main purpose of the study is to ensure that routes for the logistics sector are evaluated from different directions and reach the optimal result. The study was evaluated within the framework of time, cost and environmental conditions. Alternative routes were created to the original route taken by an active



logistics company and the necessary comparisons were made. All calculations made have been created by means of the formulas found in the Materials and Methods section. As a result of the calculations, detailed graphs have been designed where we can observe comparisons in general. After the green deal agreement, the transportation industry entered a new era. Through the green deal, companies have become more sensitive and mindful of carbon footprint and environmental issues (Letkiewicz et al. 2022). In addition to cost and time, the carbon footprint criterion is of greater importance in this study. As a result of the study, deciding which route to choose will differ in accordance with the expectations and missions of companies and customers.

Keywords: Green logistics, Carbon footprint, Freight routes, Green deal

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Assessment of Health Care Waste Generation and Management Status in Selected Institutions of Dinajpur City in Bangladesh

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Introduction: Waste is one of the most unnoticed things that increase as the population grows (Gucas et al. 2015). Healthcare waste, also known as medical waste, is classified as general waste (80%) and hazardous waste (20%) (Oduro-Kwarleng et al. 2021). Medical waste management is still inadequate and has received little attention in developing countries such as Bangladesh (Lemma et. al. 2022). The improper management and disposal of medical waste can result in serious and infectious diseases such as mutagenicity, dermatitis, asthma, infertility, genital deformities, cholera, hepatitis, AIDS, and other viral infections (Olit et al. 2016). Apart from the risk of pollution to water, air, and soil, it has a significant impact on human health due to its aesthetic effects. Apart from the risk of pollution to water, air, and soil, it has a significant impact on human health due to its aesthetic effects. Poor scavengers, women and children frequently gather medical waste such as syringe needles, saline bags, blood bags, etc. for resale in healthcare areas, despite the risks to their lives and health. This study assesses the current generation, composition, handling and disposal of medical waste in Dinajpur city. It's included Identifies potential threats to people and the environment with recommends appropriate processes for medical waste management. The safe disposal of medical waste is an important step in reducing injury or infection from hazardous waste and preventing environmental contamination (Hassan et al. 2008).

Meterials and methods:

Study Area: This study was conducted in Dinajpur municipalities' areas, Rangpur Division, Bangladesh where five selected healthcare centers using a structured questionnaire and observation. Mainly two kinds of healthcare centers (public hospitals and private clinics or diagnostic centers) can be seen here. The surveyed healthcare were Abdur Rahim Medical College and Hospital (ARMCH), Dinajpur Diabetic O Swasthoseba Hospital (DDSH), Sadar Hospital (SH), Zia heart Foundation (ZHF), Lab aid diagnostic clinic (LB).



Data collection planning and analysis: To obtain data, numerous formal and informal methods were used. The questionnaire was designed for the medical waste management system, general characteristics of healthcare facilities and their daily amount of medical waste. A mixed method was used to collect all the data from primary and secondary sources. During data collection and waste types weighted we spent a lot of time with sweeper, cleaners, ward master and healthcare authorities. The waste generation rate in various healthcare settings was calculated in terms of Kg/day and Kg/patient/day using a mathematical approach. Statistical analysis was completed by MS Excel.

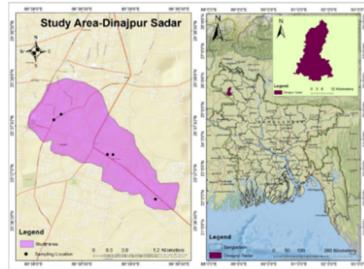


Figure 1: Healthcare location of Dinajpur municipalities using Base map.

Result and Discussion: Waste trolley available for transporting waste bin 4 healthcare centers without Sadar hospital, and waste bin covered with a lid during transportation. However, the waste from ARMCH and Sadar Hospital is not covered by the lid, and the van that transports all medical waste from each healthcare center is also left open during transportation. The drainage system in selected healthcare remained in average condition overall and there is enough water supply for cleaning purposes at each healthcare center.

Table 1: The generation rates of medical waste in surveyed healthcare institutions, Dinajpur

Healthcare Name	Dependency	Total waste (kg/day)	Generated waste (Kg/patient/day)	Average patient
ARMCH	Public	2250	2.81	802
SH	Public	42.10	.34	125
DDSH	Public	50.07	0.83	65
Lab aid	Private	3.915	0.196	200
ZHF	Private	60	4	15
Total		2409	8.176	1207

In the surveyed healthcare waste generated total is 2409 kg/day and a significant portion of medical waste is generated in ARMCH. ARMCH produce 2250 kg per day of which 2.81 kg/patient/day is healthcare waste. Every day they are carried 30-35 waste bins. On the basis of the daily patient, the highest rate of waste is generated by the Zia heart foundation. It is observed that cleaners were not much conscious of proper waste management practices.

Table 2: An analysis of correlation coefficient matrix between patient and generation of waste

	Average patient	Total waste (kg/day)	Generated waste (Kg/patient/day)
Average patient	1	0.97	0.22
Total waste (kg/day)	0.97	1	0.40
Generated waste (Kg/patient/day)	0.22	0.40	1

However, Average patient vs total waste (kg/day) correlation value = 0.97 that means patient number has a strong positive relation with medical waste generation. The more the patient size increases the more the medical waste generation increases. In addition, Average patient vs waste generation (kg/patient/day) Correlation Value = 0.40 that means patient size has a positive relationship with medical waste generation per day per patient.

Conclusion: The hazardous waste of Dinajpur healthcare is highly risked to public health and the environment. The dumping site of the cities is dangerous for the local community and surroundings. Most healthcare



institutions did not manage properly general waste and hazardous waste. The studied institution has no facilities for modern medical waste management options like incineration, pit method or autoclave. The study found that there was critical management of medical waste in Dinajpur healthcare institutions.

Keywords: Medical waste, Hazardous waste, Management system, Public health, Bangladesh

Acknowledgment: We are grateful to healthcare staff, Cleaners, Hospital managerial teamand residents of Dinajpur city.

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Solid Waste Management Practices in Mymensingh City Corporation Areas, North-Central Bangladesh

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Introduction: Solid waste is the useless, unwanted, and discarded material generated by day-to-day community activities (Mishra et al. 2014).Solid waste management in a city is a complex activity that entails the collection, transportation, recycling, resource recovery, and disposal of solid waste (Schubeler et al. 1996).Solid waste becomes a serious problem in urban areas, especially in where the large and rapid population growth occurs. Mymensingh City Corporation (MCC) is very densely populated area in Bangladesh. There are around 4.87 lakhs of peoples live in here (Macrotrends, 2023). The study area is considered a major financial center and educational hub of north-central Bangladesh, and is the second-most densely populated ($\sim 44,458$ inhabitants/km 2) and rapidly growing modern cities of Bangladesh.

Noted that Mymensingh city corporation area produced 541.27 tons of solid waste per day (personal communication with city corporation authority). About 95% of the area of this dumping site is already being covered by solid waste but most of them are not managed properly. For unplanned solid waste management practice causes various problems in human life and environment. Inherent human desire in resources consumption governs the waste generation capacity. The major purpose of the study was to address the present solid waste composition and quantity in Mymensingh City Corporation and identify the solid waste management practices.



Material and methods:

Location of the study area

Mymensingh is the 8th city corporation of Bangladesh and it is situated behind the Old Brahmaputra River. The study area lies between $24^{\circ}41'$ to $24^{\circ}48'$ N latitudes and between $90^{\circ}20'$ to $90^{\circ}26'$ E longitudes. It is one of the largest municipal areas in Bangladesh with an area of 91.60km^2 (BBS, 2008).

Data collection and analysis

Primary data was collected from numerous categories of individuals and therefore the respondents were selected indiscriminately. Data was collected through survey from day labor, rickshaw and van-puller, businessman, student, job holder and homemaker to assess the precise state of affairs of waste management with direct field observation. Secondary data regarding the waste management department, population, volume of waste generation, activities exiting on solid waste management in elect study space were collected. It has been collected from Mymensingh City Corporation. In this study the data was collected from the municipality wards no. 2,3,4,7, 9,13,14,15 and 18. Data has been estimated approximately in 27th of different locations. However, questionnaires were surveyed with 50 different classes of respondents in the area studied. We were also collected the data from the different Community-Based organizations as well. Collected data were analyzed by MS Excel and R programming.

Firstly, we calculate the average of solid waste generation by per capita in Mymensingh City Corporation. Approximately we calculate the total volume of solid waste generation per day in the Mymensingh City Corporation by a simple equation.

$$\text{TW} = \text{PCW} \times \text{TP}$$

Where TW= Total waste, PCW= Per capita waste generation, TP= Total Populations

Results and discussion: Fifty's respondent on those comes from fifteen families and knowing the amount of solid waste generation from each of them. Fifteen respondents told that they have generated 0.5 kg solid waste per day and twenty-five respondents are 1kg, six respondents are 2 kg and four respondents have produced 3 kg/day. We found that there was 348.88 tons of food waste, 16.10 tons of paper waste, 57.33 tons of plastic waste, 1.77 tons metallic waste, 3.55 tons of cloth waste, 5.36 tons of medical/hazardous waste, 13.41 tons glass waste, 3.55 tons of wood waste and 91.24 tons others waste produced in Mymensingh City Corporation daily. Hazardous waste was found in the whole city corporation in Mymensingh. Especially Chorprara, Shehora road, Dhopakhal and Durgabari road is the major places for hazardous waste. On top of that Chorpara region is the main source(s) of hazardous waste. Because about 90% of health care institutions are situated in Chorpara areas. On the other hand, food waste is a very common type of waste which was found in every location of the study area. In this study, about 11 % of waste was plastic waste (Fig.1). According to total waste from Mymensingh City Corporation, this amount is 42.8 tons/day. Food waste should go waste to bio fertilizer plant, plastic, paper and glass waste should go recycle industry and hazardous should go landfilling/incineration process. In case of, there is a huge opportunity to make bio-fertilizer from food waste.

Table 1: Waste generation (amount) from households per day

Waste amount (kg)	Number of respondents	Percent of the respondents	Average per capita solid waste
0.5	15	30	1.13kg
1	25	50	
2	6	12	
3	4	8	
Total=50	100%		

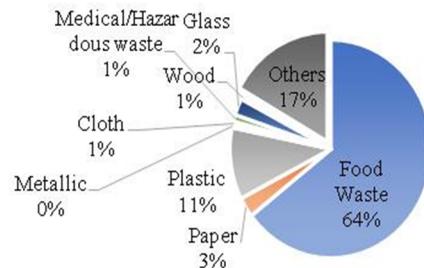


Figure 1: Solid waste production scheme per day according to its type of solid wastes in the MCC area.

Conclusion: Solid waste management in Mymensingh City Corporation is perceived to be inadequate and it ought to be improved. Every day 541.27 tons of solid waste are produced in MCC. But only 300 tons of solid waste is collected by municipal authorities through traditional management processes. In this study, about 65.1% of solid waste is food waste. We have seen a lot of lacking in solid waste management practices by Mymensingh



City Corporation. The authority has much needed to improve its waste management practices. Each respondent should separate their solid trash into bins that are yellow, red, green, and black.

Acknowledgement: We would like to thank Md. Rased Hasan Sajib for his helpful and cordial cooperation. Special thanks are due to Authority, Mymensingh City Corporation for providing the essential data.

Keywords: Solid waste, Hazardous waste, Management practices, Mymensingh city

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Floral Biodiversity Depletion in the Bakkhali River Estuary, Cox's Bazar, Chattogram

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Introduction: The study area, the Bakkhali River estuary is situated in Cox's Bazar Upazila of Chattogram district (Figure 1). The physiography, climate, environment, biodiversity, and socioeconomic aspects of the Chattogram district play vital roles to achieve the Sustainable Development Goal (SDG) in Bangladesh. The Bakkhali River estuary, located along the Chattogram East Coast was once rich in terrestrial, avifaunal, and aquatic biodiversity. The area is a part of the 'Bio-Ecological Zone 8a' (Nishat, et al., 2002) (Figure 2). However, at present the floral biodiversity of the Bakkhali River estuary has been observed to be depleted at an alarming rate which has been causing rapid deterioration of the Terrestrial ecosystem of the area. Hence, the 'Vegetation Coverage', one of the vital components of the Terrestrial ecosystem of the Bakkhali River estuary has been investigated to find out the floral biodiversity situation of the study area for two different years such as 1990 and 2015. The study also attempted to investigate the ways to conserve floral biodiversity.



Figure 1: Bakkhali River Estuary

Source: Bio-Ecological Zones of Bangladesh, Nishat, et al., 2002

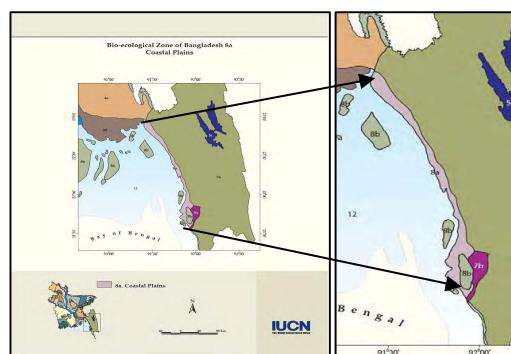


Figure 2: Bio-Ecological Zone (8A)Chattogram East Coast

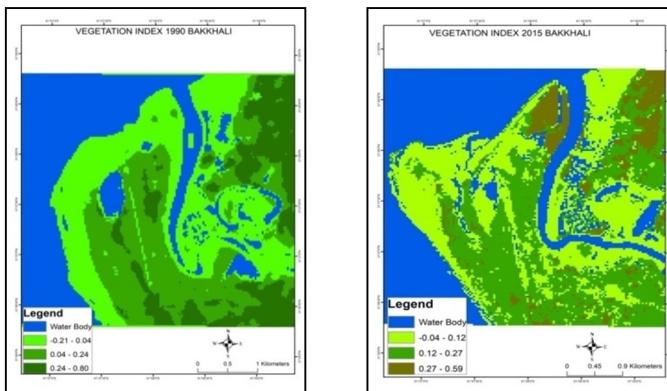


Figure 3: (a, b): Vegetation Coverage of Bakkhali River Estuary, 1990 and 2015

Materials and methods: A total of 22.74 km^2 area (Arc/GIS attributed data for present study) along the Bakkhali River estuary has been selected as the study area, which is a significant component of the Terrestrial ecosystem of the Chattogram Coastal Plain (CCP) (Banglapedia, 2021). A total of six ‘Radiometrically Corrected Temporal Landsat Images’ has been analyzed with ‘Arc/GIS’ and ‘ERDAS Imagine’ software to create maps for the Bakkhali River estuary for the years 1990 and 2015. These maps were used to measure the vegetation coverage situation in the study area by using the ‘Normalized Difference Vegetation Index’ (NDVI) method. The NDVI process creates a single-band dataset that mainly represents greenery (Weier, et al., 2000). The NDVI values vary between -1.0 and +1.0 which quantifies vegetation coverage by measuring the difference between near-infrared (which vegetation strongly reflects) and red light (which vegetation absorbs).

Results and discussion: The floral biodiversity along the Bakkhali River was once quite ample and diversified. The mangrove forest, namely the ‘Parabon’ accommodated various kinds of mangrove trees. Moreover, diverse species of seaweeds grew at the roots of the mangrove trees in the tidal zone of the study area (Bangladesh Fisheries Research Institute, Cox’s Bazar, 2018). According to Weier, et al. (2000), an NDVI value close to +1 (0.8-0.9) indicates the highest possible density of green Leaves. On the other hand, an NDVI value close to zero stands for ‘No Green leaves’ or ‘No Vegetation’. During the survey in 2018, the NDVI value for the Bakkhali River estuary has been found to decline from +0.02 (1990) to -0.03 (2015) which shows significant vegetation coverage depletion in the study area as shown in Figure 3 (a) and Figure 3 (b). The field survey in 2018 accentuated the drastic vegetation coverage depletion. About 90% of the mangrove trees and seagrass beds have been found to be depleted on the west bank of the Bakkhali River estuary. The vegetation coverage depletion in the study area is the consequence of climate change and sea level change-induced disasters, soil and water pollution, plantation of many exotic and non-native invasive plant species, commercial shrimp cultivation, over-exploitation of floral species, illegal encroachment by household and industrial garbage dumping, and unplanned Land use change, agricultural expansion, and shifting cultivation.

Conclusion: The Cox’s Bazar district holds a very important strategic location from socioeconomic, physiographic, climatic, and environmental aspects. The proper conservation of its terrestrial ecosystems and floral biodiversity has to be ensured to achieve the SDG in Bangladesh. Hence, creating awareness through generating a relevant knowledge pool, building strong linkages among different government and local stakeholders, and ensuring implication and full functionality of the existing ‘Integrated Coastal Zone Management Plan’ (ICZMP), and the ‘Delta Plan 2021’ with a view to floral biodiversity conservation in the study area is needed. Moreover, further studies have to be conducted to emphasize the inclusion of floral biodiversity conservation strategies for the Chattogram coastal zone development plans in a sustainable way.

Keywords: Bioecological zone, Delta plan 2021, Floral biodiversity, ICZMP, NDVI



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Seawater Quality of the Coastal Regions of the Sundarbans Mangrove Forest of Bangladesh

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Introduction: The Sundarbans, a sanctuary for animals, are particularly affected by both human pollutants and changes in the climate. The flow of freshwater declines as well as the amount of silt and saltwater in rivers increases in the forest, despite the fact that the Sundarbans are higher above sea level and have a lower elevation than the sea. Otherwise, this area is losing land because of erosion as a result of heavy floods that occur throughout every year. In addition to climate change, humans are responsible for a variety of pollution in the rivers, canals, and streams that flow through the amazing forest. The amount of oil and salinity in the river water are rising as a result of development and ship pollution, endangering both human life and the environment at large. As a result, biodiversity is facing severe loss and the habitat of the animals is shrinking. Various works have been done for the seawater quality of the different areas around the Sundarbans mangrove forest. However, the calculation of the water quality index (WQI) through the measurement of physicochemical properties, the correlation between the water quality parameters, and the comparison between water quality parameters as well as with standard values of different areas of the Shundarbans were not still reported collectively. So, in this study, extensive work has been made to measure the physicochemical properties as water quality parameters. Additionally, these mentioned parameters were also correlated as well as compared with each other to give a clear indication of the recent pollution status of different areas of the Sundarbans mangrove forest.

Materials and methods: The seawater samples were collected from 10 stations of coastal water in six areas including Dhimercor, Jamtola, Shoronkhola, Kotka, Kacukhali, and Alibanda of the Sundarbans mangrove forest using a water sampler during January 2023 and sampling locations were determined using a Global Positioning System (GPS). The water quality parameters of these collected samples were studied by measuring ten physicochemical properties like temperature, pH, conductivity, turbidity, salinity, TDS, density, viscosity, refractive index, and DO using different methods. Temperature, pH, Salinity, EC, DO, and TDS were measured by WTW inoLab Multiparameter 9310 IDS (P) in the electrometric method. Density, viscosity, refractive index,



and turbidity were measured using AntanPaar vibrating tube density meter DMA 4500 ME in Oscillating U-tube method, AntanPaar-Lovis 2000 M/ME micro viscometer with rolling ball method, Nepthelometric method by EPA Compliant Benchtop Turbidity Meter - HI88703, HANNA and Abbemat 300 refractometer including high-resolution optical sensor with a resolution and limit error ± 10.5 , Range nD: 1.26 to 1.72, respectively. The marine environmental pollution scenario of the Sundarbans mangrove forest was calculated by the Canadian Council of Ministers of the Environment (CCME) water quality index (WQI) method. Additionally, the spatial distribution of different water quality parameters was monitored through Inverse Distance Weighted (IDW) interpolation method. Finally, these parameters also correlated based on statistical analysis: Pearson and linear correlation method.

Results and discussion: All physicochemical properties of seawater samples collected from the Shundarban forest provide information on the seawater quality, source(s) of the variations, and their impacts on the aquatic environment during January 2023. The values of surface water temperature ranged from 18.2 to 23.5 °C with a mean value of 21.4 °C. The average values of pH, salinity, TDS, and conductivity were 8.61, 5.00 ppt, 4.26 mg/L, and 8.5 mS/cm respectively, which might be due to the discharge of water from different rivers and canals throughout the mangrove forest. Almost all of the studied parameters are within suitable ranges for aquatic organisms but have a little concern about DO values. The highest (10.2 mg/L) and lowest (7.2 mg/L) values of DO were found in Shoronkhola and Kotka, respectively. During study time high level of DO value in Shoronkhola indicates that the organic waste pollution was insignificant in the seawater of Sundarbans. And the presence of more primary productivity in these mangrove areas might be responsible for this DO level. Furthermore, CCME WQI of seawater samples was calculated for pH, DO, salinity, conductivity, and TDS with the category of the pollution status reported as "Fair". The average values of density, viscosity, refractive index, and turbidity of collected water samples from different areas of the Sundarbans mangrove forest were also interrelated with values of TDS, salinity, and conductivity. The spatial distribution of different water quality parameters with IDW interpolation showed the information about the station where the water quality parameter was higher or lower in different areas. Finally, all the water quality parameters were correlated with Pearson and linear correlation. The values of the correlation coefficient (CF) ranged in between 0.86 to 1.00 resulting in excellent correlation with each other. Thus, water quality parameters in this study have been critically analyzed; correlated and important findings were noted.

Conclusions: It was observed that human activities in the region have a significant imprint on seawater samples collected from the Sundarbans mangrove forest. Some physicochemical parameters of the water of the Sundarbans are approaching the healthy value for the survival of different aquatic organisms. The obtained results from the study highlight variations in most of the water quality parameters in various areas of the Sundarban mangrove forest and have a good correlation with each other. This study also gives an idea about the pollution status of different areas of the Sundarbans mangrove forest with the category "Fair". So, it is important to monitor regularly considering the rapid industrial and agricultural development around the forests for pollution in seawater. And this research work may help to design a management program to combat pollution due to Mongla Port adjacent to the Sundarbans mangrove forest.

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Keywords: Water quality parameters, water quality index, correlation



Assessment of Surface Water Quality in Karnaphuli Estuary

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Introduction: Karnaphuli river, one of the major rivers in Chattogram, serves as a valuable ecological and economic resource for Bangladesh. The estuary is home to a diverse range of aquatic species and supports various economic activities such as shipping, port operation, and industrial activities. However, the quality of seawater in the estuary has been deteriorating due to anthropogenic activities, including the discharge of untreated industrial and domestic effluents, solid waste disposal, and agricultural runoff. The index of water quality (WQI) is a numerical mechanism through the measurement of physicochemical properties on the characterization of water into a single number that indicates the level of water quality. The process of determining WQI includes a standardization step where each parameter is transformed into a scale of 0-100, with 100 representing the highest quality. Only a few works have been done based on the water quality of the Karnaphuli estuary. Despite different works, there have been no reports on spatial distribution and statistical correlation. Also, comparison between different water quality parameters has not been well explored. Thus, the main goal of this study is to measure the water quality parameters, the pollution status based on WQI, and the correlation factor for assessing overall surface water quality in Karnaphuli estuary.

Materials and method: The present study was conducted in the Karnaphuli estuary, by assessing the water quality parameters of different samples collected from 10 stations, at around ~1.5 km intervals, using a water sampler during February 2023, and sampling locations were determined using a Global Positioning System (GPS). Water quality parameters were studied by measuring ten physicochemical properties i.e. temperature, pH, conductivity, turbidity, salinity, total dissolved solids (TDS), density, dissolved oxygen (DO). Among them, temperature, pH, salinity, EC, DO, and TDS were all measured by WTW inoLab Multiparameter 9310 IDS (P) following the electrometric method. Density and viscosity were measured using AntanPaar vibrating tube density meter DMA 4500 ME based on the Oscillating U-tube method and AntanPaar-Lov is 2000 M/ME micro viscometer through rolling ball method, respectively. Turbidity and refractive index were measured using the Nephelometric method by EPA Compliant Benchtop Turbidity Meter-HI88703, HANNA and Abbemat 300 refractometer including a high-resolution optical sensor with a resolution and limit error $\pm 10^{-5}$, Range nD: 1.26 to 1.72. Spatial distribution of different physicochemical properties was monitored using Geographical Information System (GIS) based Inverse Distance Weighted (IDW) interpolation to find out the unknown values.

Result and discussion: The values of different water quality parameters have been critically analysed through GIS based water quality information system and temperature was found to vary from 24.6-25.6 °C. TDS and EC increased as the station moved towards the sea, which varied respectively from 5-13 mg/L and 7-25 mS/cm. As the sampling station moved towards the sea, salinity increased, ranging between 6-16 ppt while the average pH and DO values range between 8-8.5 and 3.5-8.0 mg/L. The values of density and viscosity also increased around the sampling station due to the presence of more solids in the seawater than river water as there are probable chances of mixing of these two sources. Spatial distribution analysis with IDW interpolation based on different water quality parameters showed excellent interrelation between each other. Furthermore, the pollution status of collected water samples from Karnaphuli estuary was also observed through the calculation of the WQI. The results might vary from station to station which may indicate the seawater quality of Karnaphuli estuary was severely affected by anthropogenic activities with high levels of suspended solids and organic matter. In this study, the results have also been critically analyzed through statistical correlation factor, compared with standard



values, and essential findings were noted. Thus, the obtained findings highlight variation in most of the water quality parameters of Karnaphuli estuary that have a practical correlation with each other.

Conclusion: From the analysis of all the water parameters of collected water from Karnaphuli estuary, it was observed that all the parameters were within standard value except DO during February 2023. The DO level of Karnaphuli estuary was a very concerning issue for aquatic and human life. This low value of DO in the Karnaphuli River was possibly due to the Karnaphuli paper mill which discharged its effluent into the river without any treatment. The release of untreated effluent, sewage, unplanned waste dumping, and unplanned chemical management is making the situation more critical day by day. Thus, the study might highlight the need for policymakers to recommend possible pathways to control pollution sources and improve the water quality of the Karnaphuli estuary, which is crucial for the sustainable development of the region.

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Keywords: Physicochemical parameters, Water quality index, Karnaphuli estuary, Correlation

Solid Fuel Use in the Household Elevates Blood Pressure of Reproductive-aged Married Women in Bangladesh

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Introduction: Bangladesh is experiencing rapid increase in hypertension prevalence, particularly in socio-economically disadvantaged communities. The higher use of solid fuel in these communities may be contributing to this trend, evidence supporting this hypothesis is limited in Bangladesh. Therefore, this study aims to investigate the associations between household solid fuel use and its exposure level with systolic and diastolic blood pressure and hypertension.

Material and methods: We analyzed 7,320 women's data from 2017/18 Bangladesh Demographic and Health Survey. We considered three outcome variables: (i) systolic blood pressure (continuous response), (ii) diastolic blood pressure (continuous response), and (iii) hypertension status (yes, no). Our primary exposures of interest were fuel type (clean vs solid) and the potential level of household air pollution exposure (HAP) through solid fuel use (unexposed, moderately exposed, highly exposed). We used a multilevel mixed-effects Poisson regression model with robust variance to determine association between exposure and outcome variables while adjusting for confounders.

Results: The prevalence of hypertension standardized for age was found to be 28%. Individuals who reported using solid fuel were 1.44 times more likely to develop hypertension than those who used clean fuel, with a 95% confidence interval of 1.04-1.89. Additionally, the likelihood of developing hypertension was 1.61 times higher (95% CI, 1.07-2.20) in the moderately exposed group and 1.80 times higher (95% CI, 1.27-2.32) in the highly exposed group, as compared to the non-exposed group. These associations were also observed for both systolic and diastolic blood pressure.



Conclusion: The use of solid fuel increases the risk of becoming hypertensive and elevates systolic and diastolic blood pressure. Policies and programs are necessary to increase awareness of the adverse effects of solid fuel use on health, including hypertension. Efforts should be made to reduce solid fuel use and ensure proper ventilation systems in areas where solid fuel is used.

Keywords: Solid fuel, Household air pollution, Hypertension, Bangladesh

Exploring the Factors that Influence Contraceptive Use in Mymensingh Division, Bangladesh: A Cross-Sectional Study

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Introduction: Contraception is a crucial component of family planning and reproductive health, allowing individuals to control the number and spacing of their children. Access to contraceptives is a basic reproductive right and is vital for individual, family, and community well-being. This study aimed to determine the prevalence of contraceptive use among married women and identify the factors influencing its use in the Mymensingh Division.

Materials and methods: Primary data from a cross-sectional study were used; comprising 1200 married women aged 15-49 years who had delivered a child in a hospital. The dependent variable was contraceptive use (yes or no), and independent variables were socio-demographic factors, categorized as individual, household, and community-level. Chi-square test was used to assess the association between the variables, and binary logistic regression was employed to identify the most significant determinants of contraception use.

Results: Highest prevalence of contraception use was reported by the women aged 25-34 years old and women with 1-2 children. The likelihoods of contraception use was found 1.95 (95% CI, 1.50-2.55) and 3.30 (95% CI, 2.02-5.40) times higher among women aged 25-34 years and 35 years old, respectively, as compared to the women aged 15-24 years old.

Conclusion: This study indicates that contraceptive use is influenced by various factors. These findings could guide the planning, policy-making, and development of future public health efforts.

Keywords: Contraceptive, reproductive-aged women, primary data, Mymensingh

Women's Decision-Making Power and Its Association with Contraceptive Use in Bangladesh: Evidence from a Cross-Sectional Survey

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Introduction: Insufficient contraceptive use is a critical public health issue in low- and middle-income countries (LMICs) like Bangladesh. The most effective method of reducing fertility is contraception; therefore, women's participation in household decision-making can be crucial. Numerous factors influence a woman's decision to use



contraception, which is essential to improve the quality of life among reproductive-aged women. In this study, we aim to evaluate the decision-making power of reproductive-aged women in Bangladesh concerning contraception use and the associated factors.

Materials and methods: We analyzed data on 900 women who were sexually active and fecund, collected through a cross-sectional survey. The survey was conducted from October 2022 to March 2023 with married women of reproductive age (15-49 years) in five divisions of Bangladesh. Data were collected using structured questionnaires and STATA 14.2 version was used for all analyses. Contraceptive use was the outcome variable, while the primary explanatory variable was women's decision-making power in this study. We fitted binary logistic regression models to identify the association between contraception use and women's decision-making power, adjusted for socio-demographic factors.

Results: Contraceptive use was reported by approximately 80% of the total respondents. The likelihood of contraception use was higher among women with primary education (adjusted odds ratio (aOR): 1.23, CI: 0.60-2.52), secondary education (aOR: 1.35, CI: 0.62-2.94), and higher education (aOR: 1.06, CI: 0.40-2.80) compared to those with no formal education. Women whose partners had attained secondary (aOR: 3.08, CI: 1.58-6.03) and higher educational levels (aOR: 2.73, CI: 1.20-6.25) were more likely to report contraceptive use than those whose partners were uneducated. Women who made joint decisions (aOR: 2.75, CI: 1.64-4.63), had increased mass media exposure (aOR: 1.92, CI: 1.27-2.92), and had increased knowledge about contraceptive use (aOR: 1.28, CI: 0.76-2.13) were also found to be significant factors of contraception use.

Conclusion: Our findings indicate that increased decision-making power among women is associated with higher levels of contraceptive use. Therefore, policies and programs aimed at increasing women's empowerment in terms of contraception use should be implemented.

Keywords: Decision-making power, Married women, Family planning, Bangladesh

Availability and Readiness of Healthcare Facilities and Their Effects on Antenatal Care Services Uptake in Bangladesh: Evidence from Household and Health Facility Level Surveys

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Introduction: Sustainable Development Goals 3.7 targets to ensure universal access to sexual and reproductive healthcare services, where antenatal care (ANC) is a core component. This study aimed to examine the influence of health facility availability and readiness on uptake of four or more ANC in Bangladesh.

Materials and methods: The 2017/18 Bangladesh Demographic and Health Survey data were linked with the 2017 Health Facility Survey and analysed in this study. The associations of health facility level factors with recommended number of ANC uptake were determined. Multilevel mixed-effect poison regression model was used to determine the association adjusting for potential confounders.

Results: Nearly 44% of mothers reported four or more ANC uptake with significant variations across several areas in Bangladesh. The average distance of mothers' homes from the nearest health facilities was 6.12 km, which was higher in Sylhet division (7.90 km) and lower in Dhaka division (4.01 km). The overall uptake of the



recommended number of ANC visits was positively associated with higher scores for the management (adjusted prevalence ratio (APR) 1.85; 95% CI, 1.16-2.82) and infrastructure (APR, 1.59; 95% CI, 1.09-1.82) of health facilities closest to mothers' homes. The APRs for mothers reporting using the recommended number of ANC were increased to 3.02 (95% CI, 2.01-4.19) and 2.36 (95% CI, 2.09-4.16) times for each unit increase in the availability and readiness scores to provide ANC services at the closest health facilities, respectively. Every kilometre increase in the average regional-level distance between mothers' homes and the nearest health facilities reduced the likelihood of receiving the recommended number of ANC visits by nearly 42%.

Conclusion: The availability of healthcare facilities closer to residence as well as their improved management, infrastructure, and readiness to provide ANC play crucial role to increase ANC services uptake. Policies and programmes should prioritise to increase availability, accessibility, and readiness of health facilities to provide ANC services.

Keywords: Antenatal care healthcare facility level factors, linked data, Bangladesh

Factors Affecting the Cost of Antenatal Care in Bangladesh: A Cross-Sectional Study in Mymensingh Division

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Introduction: Higher costs to access antenatal care (ANC) services can hinder its access, which could increase the risk of pregnancy complications as well as maternal and child mortality in low-and middle-income countries (LMICs), including Bangladesh. However, there are limited studies exploring the costs of accessing ANC services in LMICs, and none in Bangladesh. The aim of this study was to determine the average cost of ANC healthcare service use in Bangladesh and its associated individual, household, and community-level characteristics.

Materials and methods: A total of 1200 women's data were analyzed, collected through a cross-sectional study conducted in several hospitals in Mymensingh district. The cost of ANC healthcare services was the dependent variable, classified as low (0 to <1700 BDT), medium (1700 to 9000 BDT), and high (> 9000 BDT). Several individual, household, and community-level characteristics of the respondents were explanatory variables. The chi-square test was used to identify the factors associated with the cost of ANC. A multinomial logistic regression model was used to explore the effects of explanatory variables on the dependent variable.

Results: Around 48% of the total respondents reported that they received at least four or more ANC healthcare services. The mean cost of ANC healthcare service use was 6865 BDT, which was further higher in private healthcare facilities. Nearly 24% of the total women reported that they faced difficulties bearing the associated costs of ANC healthcare services. We found that the likelihood of the cost of ANC healthcare services use was 23.19 times (RR, 23.19; 95% CI, 13.65-39.41) higher in private healthcare facilities compared to government healthcare facilities. Higher educated women, working women and urban women were also more likely to spend a high cost of ANC healthcare services use.

Conclusion: One in four women in Bangladesh faces difficulty paying the cost of ANC healthcare services use. This may reduce ANC healthcare service utilization, which can contribute to rising pregnancy complications and other adverse outcomes, including maternal mortality. Policies and programs need to ensure that ANC healthcare services are easily accessible from government healthcare facilities.

Keywords: Antenatal care, cost, reproductive-aged women, associated factors, Mymensingh



The Prevalence of Self-reported Mental Disorders (Depression and Anxiety) and Its Association with Socio-demographic Factors among the Adolescents Aged 15 To 21 in Bangladesh

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Introduction: Adolescence (aged of 15 to 21 years) is an eventual period for developing social and emotional habits important for mental well-being which includes adopting healthy sleep patterns; exercising regularly; developing coping, problem solving and interpersonal skills; and learning to manage emotions (WHO). Although adolescents are considered as healthy population, they seem to be at risk in terms of mental health disorder. Depression and anxiety are the most common mental disorders among the adolescence worldwide, with more than 264 million people affected globally. Depression is one of the most important causes of morbidity and disability in developing countries. Bangladesh ranks fourth position in terms of percentage of population with depression and third position in terms of the number of cases with depression in the Southeast Asia region. Though mental health disorder is a considerable public health issue in developing countries, this is still ignored in Bangladesh. The purpose of this study was to assess the prevalence of depression, anxiety and its related socio-demographic factors among the adolescents in Bangladesh.

Material and methods: This cross-sectional study was conducted among 400 adolescent aged 15 to 21 years and living in Mymensingh division. A self-reported questionnaire including socio-demographic and lifestyle related information was conveyed to the study respondents. The PHQ-9 and GAD-7 scales were used in developing the questionnaire to assess depression and anxiety among the respondents. Statistical analysis was performed with calculating descriptive statistics and chi-square test by utilizing SPSS version 26.0.

Results and discussion: The prevalence rates of moderate to severe levels of depression and anxiety were 74.3% and 32.8%, respectively. Based on the descriptive statistics, fathers' level of education, sleeping satisfaction and anxiety were associated with depression. Anxiety was associated with sleeping satisfaction, health satisfaction and depression. The proportion of moderate to severe depression and anxiety was higher in 19-21 age groups than others age groups, males than females, unmarried than married, mobile phone users than non-mobile phone users, rural adolescents than urban adolescents, those mothers with no education than graduate.

Conclusion: Depression and anxiety were prevalent among the adolescents in Bangladesh which were also related with their socio-demographic backgrounds. This current study finding emphasizes the need for screening the depressive and anxiety disorder symptoms among the individuals from the selected areas to reduce their mental disorders. The national policy makers would consider this research results to incorporate adolescent mental well-being in the ongoing and future projects and programs regarding evaluation, prevention and intervention of mental health conditions among the adolescents of Bangladesh.

Keywords: Depression, Anxiety, Adolescents, Cross-sectional study, Bangladesh



**Extended Abstracts
on
Business**



Sustainable Strategy and Socially Responsible Human Resource Management in Predicting the Sustainable Performance

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Introduction: To protect the ecological environment and internalization of the environmental management system, sustainable strategy (SS) is accustomed to understanding and predicting the employees' perception towards green organizational performance and several research findings claimed that both SS and performance accelerate the effort to initiate the activities for corporate social responsibilities (CSR). Socially Responsible Human Resource Management (SRHRM), which originates from CSR, HRM ethics, and various employee-focused HR practices, requires a close connection between sustainable performance (SP) or behavior and green HRM to be effective. In 2017, Bangladesh earned \$800 million by exporting ICT products and servicing in more than 50 countries worldwide and focuses on raising the software export earnings to \$ 5 billion by 2025. To achieve this target, IT firms of Bangladesh need to focus more on environmental sustainability supported by SS and SRHRM, which means IT products and services required to be more environmentally friendly like less consumption of paper and energy, less carbon emission, and renewable, reusable, and resilient products and services, etc. SS from IT firms will not be enough to put employees at environmentally friendly in production and process unless the HRM fails to integrate human and the internal process to minimize energy over-use and carbon emissions. It is implausible to respond to the workforce to the environmental demands without environmental consideration in planning for the required talented people in the IT firms. In addition, there observed exponential growth of studies of CSR for influencing employee performance, shockingly, there is a dearth of studies on SS and SRHRM affecting SP by mediating the role of SRHRM in the IT industry of Bangladesh. Therefore, the present study has inspired the researchers to address the gap in the field of IT in Bangladesh. Considering the gravity of the research problem, we constructed these research questions:

RQ 1: Does SS matter for SP? RQ2: Does SRHRM mediate the relation of SS on SP?

Although there is an incremental growth of research works on environmental initiatives, it is found that studies on SS and SP are still at a fancy level. Meanwhile, very little is uncovered in the studies relating SS to SP. Thus, more attention and focus must be the prerequisites to pay on IT products and services for ensuring their survival in the wake of hyperactive competition and the short span of their products and services life cycle. Consequently, this industry requires creative talents to put people at work who are environmentally aware and conscious apart from to be ecologically responsible production and process for the organization's sake. Therefore, the main objective of this study is to unearth the impact of organizations' SS on their SRHRM, and its subsequent impact on SP, and to explore the mediation effect of SRHRM in the relationship between SS and SP.

Materials and methods: This study draws on the deductive reasoning approach to collect data from the respondents, i.e., the chief executive officer and heads of the human resources division of the IT firms listed in the Bangladesh Association of Software and Information Services (BASIS) through self-administered survey questionnaires following the random sampling technique. This study uses the partial least square-based structural equation modeling (PLS-SEM) to analyze the data. We delivered 513 survey questionnaires and received 307 questionnaires from the respondents within the specified time. The response rate was 59.84, which was quite high considering other similar studies. Repeated visits, self-addressed envelopes, and assurance of anonymity and confidentiality were the factors for the satisfactory response rate. We finally found 292 responses, leaving defective responses with outliers, missing data, and unmatched cases.

Results and discussion/ implication: Table 1 reported the estimates of the direct effects. In hypothesis 1, the study hypothesized that the SS has an influence on SP and the result showed that the influence is significant ($\beta=0.375$, $t\text{-value}=5.128$, $p<0.001$). Thus, hypothesis 1 is supported. In hypothesis 2, the study proposed that SS influences SRHRM, and the estimates showed that the influence is significant ($\beta=0.750$, $t\text{-value}=16.332$, $p<0.001$). Hence, hypothesis 2 is supported. Finally, in hypothesis 3, the study proposed an influence of SRHRM



on SP and the results showed that the influence is also significant ($\beta=0.308$, $t\text{-value}=3.022$, $p=0.003$). Therefore, hypothesis 3 is also supported.

Table 1: Hypothesized relationships (Direct effect)

Hypothesis	Path relations	β	Standard error	t-estimates	p-value	Decision
Hypothesis 1	SS → SP	0.375	0.073	5.128	0.000	Significant
Hypothesis 2	SS → SRHRM	0.750	0.046	16.332	0.000	Significant
Hypothesis 3	SRHRM → SP	0.308	0.102	3.022	0.003	Significant

SRHRM=socially responsible human resource management, **SL**=Sustainable leadership, **SP**=Sustainable performance, **SS**=Sustainable strategy

In hypothesis 4, the present study posited that the SRHRM mediates the influence of SS on SP. In table 2, we reported the estimates of the specific indirect effect (SS → SRHRM → SP), and the results showed that the indirect effect is significant ($\beta=0.231$, $t\text{-value}=3.046$, $p=0.002$). Thus, hypothesis 4 is supported, stating that there is a mediating influence of SRHRM on the relationships between SS and SP. To examine the extent of the mediating effect, we conducted a variance accounted test. The estimates revealed a partial mediation since the calculated score (37.79) for variance accounted for ranges from 0.20 to 0.80.

Table 2: Indirect effect (Mediating)

Path relations	B	Standard error	t-estimates	p-value	VAF	Decision
SS → SRHRM → SP	0.231	0.076	3.046	0.002	37.79	Partial mediation

SRHRM=Socially responsible human resource management, **SP**=Sustainable performance, **SS**=Sustainable strategy, **VAF**=Variance accounted for

The result indicates that SS directly expedites SRHRM practices and both SS and SRHRM together contribute to achieving firms' long-term SP through promoting long-term well-being and sustainable growth. However, the mediating effect unearths the fact that to become a sustainable performer in the industry, the organization's top level not only requires to initiate SS but also it is necessary to ensure the employees' proper understanding and execution of the responsible HR practices to accomplish SP.

Based on research findings, entrepreneurs, top management, and policymakers may feel encouraged to cultivate a participatory management system to initiate and implement SS that takes into account the needs of the business and its communities. In addition, to achieve SP, top management may find an impactful insight to pay greater attention to tying their commitment to SRHRM practices prompted by SS. Managers should be aware that the implementation of SRHRM practices will be successful if senior management is committed to establishing an SS, which will ultimately pave the way for SP.

Conclusion: The core theoretical contribution of this study is the demonstration of the role of SRHRM in building a bridge between SS and SP. Importantly, no study implies the essence of SRHRM that integrates the alignment between SS and SP in a mediated mechanism. By adopting SS, IT firms can adopt responsible corporate mission, vision, and policies that may protect our environment from continuous environmental degradation through minimizing e-waste and also encourages employees towards ethical HR practices through incorporating CSR activities. Sequentially, all kinds of environmental business policies may create a strong sense of obligation among the employees towards a pollution-free society. Finally, the findings of the study may encourage entrepreneurs, policymakers, marketers, and manufacturers to sense, seize and reconfigure IT products and services in a way that may discourage the excessive use of technologies and inspire to implement the concept of reuse and recycle of IT products and services for better ecological balance on earth. Finally, one of the most significant drawbacks is the use of cross-sectional data, which prevents the findings from being exhaustive. To confirm the generalizability of the results, it is recommended that future researchers utilize longitudinal or multi-wave data.

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Keywords: Sustainable Strategy, Socially Responsible Human Resource Management, Sustainable Performance, IT Industry, Bangladesh.



Sustainability Performance and Decision Usefulness of Sustainability Disclosures: Moderating Effect of Corporate Governance Quality

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Introduction: Sustainability is one of the key goals of the modern world wherein business firms are being held equally responsible. Investors are growing increasingly concerned about business' sustainable practices. They prefer to invest in firms with a more sustainable orientation while preferring to divest from firms with low sustainability (Bolton & Kacperczyk, 2021). Firms with sustainable business practices outperform other firms in diverse ways, such as higher market value, better financial performance, low cost of capital, and higher stock returns (Azimli, 2023; Bui et al., 2020; Choi & Luo, 2021; Choi et al., 2021). Consequently, sustainability disclosures are important for investors to make better investment decisions. To that end, a decision-useful sustainability disclosure is, *prima facie*, a precondition. The readability of sustainability disclosure is one of the key criteria for it to be decision-useful to investors (Mateo-Márquez et al., 2022). Prior studies provide evidence that stock market investors in Bangladesh don't have sufficient formal education: a major portion has a lower than a bachelor's degree (Miazee et al., 2014; Ullah et al., 2012). Against this background, how easy it is for investors in Bangladesh to comprehend the sustainability disclosures, is an open empirical question wherein extant literature provides limited evidence.

Several studies examining the readability of sustainability reports in the context of the U.S. provide evidence that the readability of sustainability disclosures (RSD) is sorely low, meaning the presence of highly complicated and advanced language not suitable for average investors (Muslu et al., 2019; Nazari et al., 2017; Wang et al., 2018). Furthermore, RSD is significantly affected by sustainability performance (Clarkson et al., 2020; Muslu et al., 2019). Considering its significance in the context of Bangladesh, we undertake a textual analysis of the RSD of listed private banks in Bangladesh. Furthermore, we investigate how sustainability performance affects such readability and we explore whether or not firms' corporate governance quality (CGQ) alters this effect.

Materials and Methods: This study develops a hypothesis based on theories and tests the hypotheses using archival data. Therefore, it adopts a deductive approach and counts a quantitative study. This study collects the required data from the annual reports of listed commercial banks in Bangladesh for the period 2016-2021. We choose 2016 as the sampling window because we find that most of the listed banks had sustainability disclosures in their annual reports. We select banking firms since they can be the lead global sustainability agenda by leveraging their role as a financier to other firms (Carney, 2015).

Decision Useful of Sustainability Disclosures: This study measures the decision usefulness of sustainability disclosures using their readability as a proxy, based on Gunning (1952)'s Fog Index(GFI) (Bushee et al., 2018; Wang et al., 2018). It is a comprehensive measure of readability based on the average number of words per sentence and the proportion of complex words in a text. The implication is that the higher the value of the Fog index, the more complex a text is to read and comprehend (Wang et al., 2018). In a nutshell, it is a measure of linguistic complexity in a text (Bushee et al., 2018). We manually calculate the fog score using the following formula.

Sustainability Performance and Corporate Governance Quality: We measure a bank's sustainability performance by their CSR expenditures since they can signify a firm's commitment to and initiative for achieving sustainability goals. To measure, corporate governance quality, we create an index based on sample mean, and we use the indicator variable 1 for firms with over mean score; 0 otherwise.

Empirical Model: To investigate the impact of a firm's sustainability performance on the decision usefulness of sustainability disclosures, we use the following baseline panel regression model.

Baseline Model: $\text{Fog}_{it} = \gamma_1 \text{CSREX}_{it} + \gamma_k \sum \text{CONT}_{kt} + \text{Firm} + \text{Year} + \mu_{it}$ (1)

Moderating Effect: $Fog_{it} = \beta_1 CSREX_{it} + \beta_2 CGQ_{it} + \beta_3 (CSREX \times CGQ)_{it} + \beta_4 \sum CONT_{kt} + Firm + Year + \mu_{it} \dots (2)$

Where Fog refers to the Gunning Fog's readability score; CSREX_{it} stands for CSR expenditure; $\sum \text{CONT}_{kt}$ refers to the host of control variables; Firm and Year refer to the entity and time fixed effects and $(\text{CSREX} \times \text{CGQ})_{it}$ is the interaction term between firms' CSR expenditure and corporate governance quality. γ_1 and B_3 are the key coefficients of our interest and we expect a negative sign for them.

Findings and discussion: From our analysis, we find that the readability of sustainability disclosures in the banking firms of Bangladesh is sorely low. On average, 24 percent of words in their disclosures are complex. Moreover, they have an average fog score of 19.90, whereas a fog score of 17 means a reader must have a graduate degree to understand the text. That is, RSD in the banking firms in Bangladesh does not correspond to the average understandability of investors.

We find that sustainability performance is negatively correlated with our measure of firm size, leverage, and return on assets which are inconsistent with our expectations. One possible explanation might be that firms' concern for growth and profitability might cause disengagement from sustainability performance. However, sustainability performance has a positive correlation with CGQ which is consistent with general wisdom in the literature. They are no multicollinearity among the dependent variables.

We find that sustainability performance is negatively associated with RSD, albeit insignificant. This finding is counterintuitive to our initial conjecture that good sustainability performers should be more stakeholder-oriented, and hence their disclosure language should correspond to the average wisdom of investors. However, our finding is consistent with Clarkson et al. (2020) that good CSR performers use more advanced language. In favor of our position, we find that CGQ improves the impact of sustainability performance on RSD. However, this impact is not statistically significant. Furthermore, in none of the models, did we find CGQ to significantly affect the RSD. Similarly, none of the firm size, profitability, and leverage are found to affect such readability. These findings implicate that sustainability expenditures and corporate governance quality in terms of sustainability in the banking firms in Bangladesh are rather symbolic than substantive (Haque & Ntim, 2018). However, an intriguing finding in our analysis is that in both cases one-year lagged CSR performance is found to significantly improve the RSD. One possible explanation might be that in their disclosure decisions, banking firms are focused more on their historical sustainability performance rather than current ones. We call for further investigations for a better explanation of this association. Finally, we find that our results are free from possible panel data. Specifically, we find that our data is normally distributed and free from serial correlations.

This study contributes to the growing literature on the decision-usefulness of sustainability disclosures(Clarkson et al., 2020; Gosselin et al., 2021). Furthermore, investigating the RSD in the context of Bangladesh where investors have low formal education, brings literary contributions in a real urgent context. In doing so, this study enables the management and policymakers to initiate actions to enhance the decision usefulness of sustainability disclosures. Moreover, it will help investors to better manage their investment by distinguishing a more decision-useful disclosure from the ones less useful.

Conclusion: In answering a critical research question of how decision-useful the sustainability disclosures of the banking firms in Bangladesh based on textual analysis of the readability of disclosures. Using a panel data analysis model, we find that the decision-usefulness of sustainability disclosure is too poor, as measured by their readability. Furthermore, we find current sustainability performance has virtually no impact on such decision-usefulness. Despite our findings confirming the earlier studies on RSD, we argue that sustainability performance in the banking firms of Bangladesh is more symbolic than function since their impact is limited to the decision-usefulness of disclosures.

Keywords: Sustainability performance, Sustainability disclosures, Corporate governance quality



The Impact of Corporate Social Responsibility on Cost of Debt: An Empirical Study of Political Institutional Setting

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Introduction: Corporate Social Responsibility (CSR) has a diverse impact on the firm financial decisions. CSR performance aggressively promotes equity and debt financing. It is very necessary to know the role of CSR in financial decisions. Till now there is no research on CSR and cost of debt (CoD) financing in Bangladeshi financial firms made the magnitude of the study. The objective of the study is to know the relationship between CSR and CoD in a politically motivated institutional environment. To accomplish the research objective the study considered the financial sector-listed Banks and non-banking financial institutions.

Materials and methods: The study accommodated institutional theoretical understanding to find the relationship between CSR and CoD. Moreover, the research used secondary data sources mainly from annual reports and the OSIRIS database to manage financial and non-financial data. Finally, the study collected 366 firm's year observations from 53 listed firms during 2012-2021. The empirical study used ordinary least square techniques to prove the hypothesis.

Results and discussion/ implication: The correlation matrix indicated that there is no multicollinearity issue in this study. Further, the variance inflation factor (VIF) didn't exceed the value of 5 also confirmed the data validation of the study. The unbalanced panel data model suggested that there is no endogeneity problem in the model. The hypothesis result documented that CSR is negatively and significantly associated with CoD in a political institutional environment. It pointed out that socially responsible firms are managing external financing at a lower cost. The result also posits that the CSR performance of an organization effectively helps to reduce the cost of debt as well as collect external finance. The study further used the alternative model to check the rigour of the model. Sensitivity analysis along with the 2SLS model confirmed our main model is valid and rigorous. The study has a significant implication for corporate policy levels and regulators. Regulators and corporate managers can use the results of the investigation to make a holistic approach to the promotion of CSR and external debt financing. The result of the study has very effective policy implications in the developing countries' CSR and debt financing perspectives.

Conclusion: The study strongly encourages CSR execution for better financial policy regarding the debt structure of the firm. The study clearly pointed out that better CSR engagement and CSR performance promotes lower cost of collecting debt (external) finance. The study also posits that the political institutional environment has a significant role in CSR policy and regulations.

Keywords: Corporate social responsibility, Cost of debt, Socially responsible investment, Political environment, Bangladesh

Blockchain-based KYC Framework for Banks: A Study on Bangladesh

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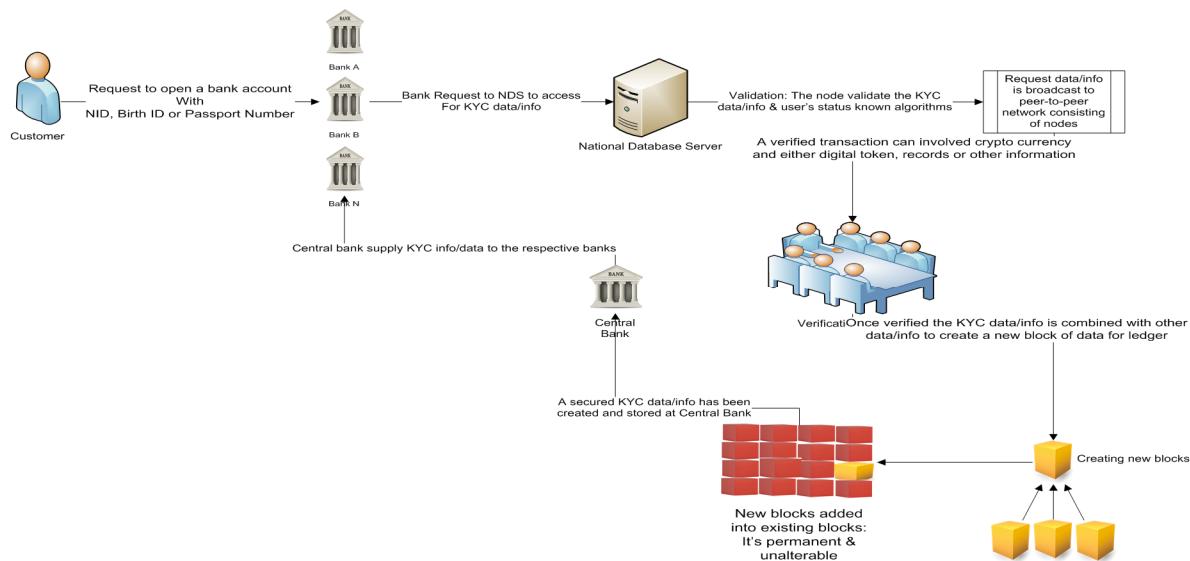
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Introduction: Know Your Customer (KYC) is the regulatory and compliance obligation for the banking system to capture customer information before onboarding and providing any banking services in Bangladesh. KYC is

obligatory for all banks to maintain their customer databases and is embedded into the account opening forms, which mandate customers to provide accurate information. This study tries to find out the easiest way to integrate and maintain KYC for all banks in a secured database controlled by the Central Bank of Bangladesh. A very few studies have been done on those issues, but there have been no consistent findings for adapting block chain technology for banks. Our banks are spending a significant portion of their customer acquisition costs opening KYC databases and attempting to keep them updated and accurate on a regular basis, but this process is extremely difficult to maintain properly. On that basis, this study has developed a blockchain-based KYC framework for all banks that would be efficient and effective. The study also finds out how blockchain technology has introduced a solution to establish trust, transparency and provided a secured, publicly verifiable KYC for all banks in Bangladesh. Finally, this paper introduces a secured, cost-efficient, trusted platform based on a blockchain-based KYC model to enhance customer privacy through consent-based access, featuring regulator governance, and helping banks use trusted and accurate customer data. This will help to minimize the gap left by other studies regarding blockchain technology for banks.

Materials and methods: The study is conceptual in nature. This paper develops a model for developing a blockchain-based KYC framework for banking systems in Bangladesh. Moreover, this paper has collected data for adapting a blockchain-based KYC framework from the executives of different banks and policymakers. A questionnaire has been developed for collecting data to make the best model of blockchain-based KYC. The sample size was 50 participants, among whom 40 were high officials of different banks (20 banks) and 10 were policymakers (including Bangladesh Bank and the Ministry of Planning).

Figure 1: Model of Blockchain based KYC framework for banking systems in Bangladesh.



The main objective of this study is to develop a blockchain-based KYC framework for the banking systems in Bangladesh. The study also reviews the current KYC mechanisms of banks in Bangladesh and assesses the potential benefits of blockchain and KYC systems for bankers.

Results and discussion: KYC is a potential and obligatory requirement for all banks and financial institutions. As a result, maintaining and updating KYC is also a costly and time-consuming process for customers and banks. This paper tries to minimize the process and cost of maintaining KYC by adapting blockchain technology with high security (mamun & yousuf, 2020). The major findings of this paper are: minimizing the cost of maintaining the KYC database of banks (Ferdous & Ahmed, 2020),(Hussain, 2022), (Cunha,2021); establishing an universal KYC for all banks (Sazu & Jahan,2022) ; selecting the best potential customers for banks (Saha, K. K. ,2021) ; establishing trust and transparency in opening bank accounts for new customers (Vial, G., 2019); and setting up full control and monitoring processes for the Bangladesh Bank by adapting the blockchain-based KYC framework



in banks and financial institutions. This model of a blockchain-based KYC framework will be a win-win model for all related stakeholders in this process.

Conclusion: The government and monitoring authority easily monitored all the customers of banks. On the other hand, banks can update their KYC with just one click because Bangladesh Bank stores and maintains all the data of individual customers. Rather than getting all the potential benefits, banks will face a problem regarding the updating of their customer databases. Ignoring this particular problem, this blockchain-based KYC model will be an excellent and efficient model for banks and financial institutions. The success of this model will depend on how the government and Bangladesh Bank maintain it.

Keywords: Blockchain, KYC, Banks, Banking systems, Bangladesh

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Fintech Credit Using CBDC: Transformation of Lending Market in Asia Pacific

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Introduction: Asia Pacific is a region with diverse economic conditions and a common challenge of a credit gap, particularly for small and medium-sized enterprises (SMEs) and individuals. The emergence of FinTech credit has provided a new alternative to traditional lending channels, leveraging technology to streamline the lending process and provide access to credit for underserved segments of the market. However, the use of traditional currencies, such as cash or bank deposits, still presents challenges for FinTech credit providers, such as high transaction costs and risks. The use of CBDC, which is a digital form of fiat currency issued by central banks, has the potential to address these challenges and further transform the lending market in Asia Pacific. This research paper aims to examine the potential impact of FinTech credit using CBDC on the lending market in Asia Pacific, analyse the benefits and challenges of this model, and provide recommendations for policymakers and market participants to foster its adoption.



The advancement of financial technology (FinTech) and the development of Central Bank Digital Currency (CBDC) are transforming the lending market. FinTech credit and CBDC have disrupted traditional lending practices, providing new channels of financing for borrowers and increasing access to credit.

Overall, this research work on FinTech credit using CBDC in the Asia Pacific region is to advance our understanding of the potential of this innovative financial technology to transform the lending market and promote financial inclusion, regulatory oversight, and financial stability in the region.

Materials and methods: The research employs a qualitative approach through a literature review of existing studies, reports, and articles related to FinTech credit and CBDC in Asia Pacific. A comprehensive literature search was conducted using online databases such as Google Scholar, ScienceDirect, and JSTOR. The search terms used included “FinTech credit”, “CBDC”, “digital currencies”, “lending market”, “Asia Pacific”, “financial inclusion”, “efficiency”, “transparency”, “cost reduction”, “risk reduction”, “regulatory challenges”, and “policy implications”. The articles were screened based on their relevance to the research topic, and only articles published between 2016 and 2022 were considered. The articles were also screened based on the quality of the research, the credibility of the authors, and the relevance of the findings to the research questions.

Results and discussion/ implication: Financial inclusion is a major challenge in many countries in the Asia Pacific region, particularly for SMEs and individuals with limited credit history. FinTech credit platforms have helped address this challenge by leveraging technology to streamline the lending process and reach underserved segments of the market. However, the use of traditional currencies still presents challenges, such as high transaction costs and risks. The adoption of CBDC can address these challenges by providing a digital form of fiat currency issued by central banks, which can reduce the costs and risks of cash transactions and provide access to banking services to unbanked and under banked individuals.

The findings suggest that FinTech credit using CBDC has the potential to increase financial inclusion, reduce costs and risks, and improve the efficiency and transparency of the lending market. However, its adoption is not without challenges, such as regulatory complexity, infrastructure readiness, and privacy and security concerns.

Conclusion: The paper concludes with recommendations for policymakers, regulators, and market participants to promote the successful adoption of FinTech credit using CBDC in the Asia Pacific. The potential benefits of CBDC in FinTech lending include faster and cheaper transactions, increased financial inclusion, and greater efficiency and transparency in financial transactions. However, the adoption of CBDC in FinTech lending also poses several challenges, such as regulatory issues related to data privacy, cyber security, and consumer protection.

Keywords: FinTech credit, CBDC, Lending market, Asia Pacific, Financial inclusion

The Financial Technology (FinTech) in Bangladesh: A Journey towards Complete Financial Inclusion

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Introduction: Financial technology (FinTech) refers to the use of software and hardware to speed up, simplify, and increase the security of financial services and operations. The whole FinTech industry is perfectly poised at the core of the fourth industrial revolution since it is at the epicentre of so many different sectors. Its mastery will be creating a sustainable future for finance (Pandey, 2016). When it comes to promoting financial inclusion in developing nations, FinTech is frequently viewed as an important catalyst (Senyo & Osabutey, 2020). Owing to



mobile money (m-money) facilities, peer-to-peer (P2P) lending structures, and mobile insurance, unbanked people may now take advantage of traditional banking privileges and affordable digital financial solutions (Vasiljeva & Lukanova, 2016).

In Bangladesh, FinTech has completely altered the financial ecosystem. As the pandemic has encouraged individuals to be dependent on cashless transactions, the FinTech businesses such as mobile financial service (MFS) providers, payment service providers (PSP), and payment system operators (PSO) in Bangladesh have embraced immense prospects to create a significant and notable influence in the country's financial landscape. The existing FinTech services like Bkash, Nagad, and UPay are laying the foundation for the achievement of the 'Smart Bangladesh Vision 2041' declared in 2022 by the government. With its remarkable progress toward becoming "Digital Bangladesh", the banking sector's rapid growth, the long history of microfinance, the exceptional success in embracing digital banking, and the growing mobile financial services, Bangladesh is a forerunner in the realm of financial inclusion, which has a positive impact on social and economic outcomes at both household and corporate levels. However, according to the Global FinTech Index 2021, Bangladesh holds the 78th position amongst 83 nations (Demirguc-Kunt et al., 2021). As almost one-third of the population of the nation remains unbanked or underserved (World Bank Group, 2023), this paper aims to investigate the prospects provided by full-fledged FinTech services. Due to Bangladesh's heavy reliance on remittances, there is also a significant opportunity for a comprehensive inclusion of this sector into the formal platform to make the process simple and cost-effective for migrant workers. Apart from this, the FinTech platform also has the potential to incorporate the small savers who do not opt for traditional bank services as the amount and tenure of their savings are not very large. In this regard, this study will focus on the potential and benefits of incorporating remittance services, and micro-saving services in the FinTech platform to ensure complete financial inclusion. It further develops a micro-saving framework to make it possible for household residents to get the utmost benefits from the FinTech platform.

Materials and methods: This study is based on secondary data. The application of FinTech in other developing countries is evaluated through the review of existing literature and the analysis of the reports of the World Bank and Asian Development Bank. This would help to compare and suggest the most appropriate practices that can be implemented in Bangladesh. For the analysis of the current situation of Bangladesh in terms of FinTech operations, the reports of Bangladesh Bank, the central bank of the country, and Aspire to Innovate (a2i) - a multinational digital transformation organization from the government of Bangladesh – are considered. The "National Financial Inclusion Strategy-Bangladesh (NFIS-B)" has also been taken into consideration. Finally, to diversify the usage of FinTech services and encourage the marginal savers, a savings framework will be suggested which will accommodate their needs through easy accessibility to any FinTech platform.

Results and discussion/ implication: Due to a sizable unbanked population, a developing internet system, and rising mobile phone usage, FinTech has immense potential in Bangladesh. According to the data from Bangladesh Telecommunication Regulatory Commission, the number of smartphone users was 184.44 million in 2021 which grew by 4.80% in between as compared to the previous year. Moreover, the average transaction has grown by 3.08% during the same time period (Hassan et al., 2022). Many people prefer to pay their utility expenses through FinTech services. In addition, the government has offered a good number of benefits including discounted tax payments and reduced corporate tax rates by 10%. The growth of the sector has also been aided by financial support programs in the form of a \$100 million technical facility provided by Bangladesh Bank. As remittances become faster, safer, and easier to access, FinTech has the potential to alter how they are distributed throughout Bangladesh. FinTech companies provide lower prices and faster transactions than traditional methods of remitting money, with recipients receiving cash in only several hours via mobile and web-based platforms.

A Micro-saving Framework for the FinTech Platforms

The proposed framework focuses on financial inclusion by empowering people from every level of society to fulfil their small needs with easy access to savings. It will not only empower people who are financially excluded but also digitalize savings and offer custom solutions, which in turn contribute to the financial



deepening of Bangladesh. Therefore, policymakers can assess the feasibility of adopting the proposed framework for the financial sector so that the desired outcomes can be obtained for complete financial inclusion.

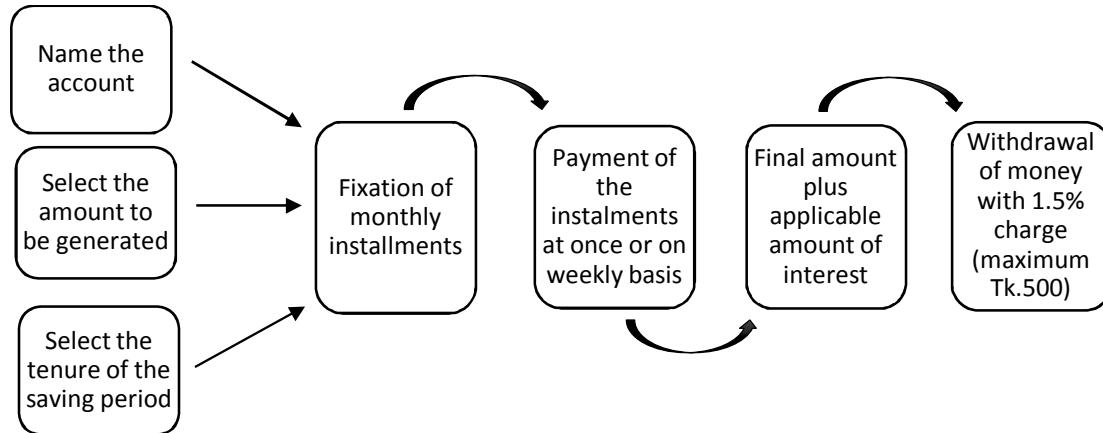


Figure 1: The Framework of Dreamcatcher Account

Conclusion: We have reviewed current studies on the FinTech revolution and how the nation's future may be moulded by guaranteeing widespread financial inclusion through the use of FinTech firms and their services. It is clear that FinTech companies in Bangladesh are not displacing commercial banks; rather, they coexist with them and may eventually resemble banks (Murinde et al., 2022). Our research shows that combining micro-savings and remittance programs will incorporate more people to take advantage of this sector. The government may play a crucial role here by encouraging the existing mobile financial service providers to adopt micro-saving models like the "Dreamcatcher Account", which would help to realize the government's goal of fully ensuring financial inclusion and the financial deepening of the country.

Keywords: Financial Inclusion, FinTech, Micro-saving, Mobile Financial Services, and Remittance

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Role of Technology on Depositors' Bank Selection Decision

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Introduction: Bangladesh is likely to be the fastest mover in the global gross domestic product (GDP) rankings in 2030, becoming the 26th largest economy from the current position of 41st (HSBC Global Research, 2018). The real growth in the economy has been boosted by the banking sector of Bangladesh. The banking industry can be termed the lifeblood of the economy. Currently, the banking sector of Bangladesh consists of six state-owned



commercial banks, three specialized banks, forty-three private commercial banks, and nine foreign banks. Because of continuous liberalization, the openness of the economy and the deregulation banking sector of Bangladesh is becoming highly competitive (Ahmed, 2012; Fatima & Razzaque, 2013). Moreover, banks of the banking industry are not only competing among themselves but also with non-banks and other financial institutions (Kaynak & Kucukemiroglu, 1992 and Hull, 2002). The evolving competition in the banking industry made it important for banks to identify the determinants of depositors' decisions (Sayani & Miniaoui, 2013). There are numerous factors that can contribute to the depositors' bank selection decision. The purpose of this study is to identify the role of technologies adopted by commercial banks in depositors' bank selection decisions. Numerous studies have been carried out on this issue around the globe over the ages. However, in the context of Bangladesh, the number of such inquiries is insignificant. Furthermore, researchers are unsuccessful to find any earlier research studies that focus on only the role of technology in depositors' bank selection decisions.

Materials and methods: In carrying out this study researchers adopted a hybrid approach where a combination of qualitative and quantitative methods have been applied to articulate the phenomenon of interest. In the qualitative phase of the research, focus group discussion was conducted on two heterogenous groups, each entitling ten participants. Further, the recorded audio of the focus group discussion has been transcribed into text form using speech-to-text modules. Lexical search using a natural language processing tool has been used to identify words or phrases that are semantically related or have similar meanings to depositors' sentiment analysis. In the quantitative phase of research, primary data have been collected using a structured questionnaire from 430 depositors applying a convenience sampling method. Descriptive statistics, principal component analysis, and regression analysis have been attempted to explore insight numerically.

Results and discussion/ implication: In the qualitative phase of the research, it is divulged that respondents hold an overall positive sentiment toward the use of technologies in banking which contribute to their bank selection decision. In principal component analysis, 23 banking technology-related items were reduced to 6 factors that can influence the depositors' bank selection decisions. Further, regression analysis of the study disclosed that the identified 6 factors significantly predict the depositors' self-decision evaluation. From the overall evaluation of the result, it can be presumed that technology is a prominent phenomenon in banking service delivery and customer satisfaction. Thus, it can extensively influence depositors' bank selection decisions. It can be ascertained from the findings that the reflection of the qualitative approach is clearly projected in the outcome of quantitative approaches. The outcome of this study will enable the policy-makers in the banking industry to adapt, innovate and fine-tune the use of technology in the banking sector to attract, retain and grow their depositors base.

Conclusion: Depositors play a significant role in banking. Developing and maintaining a large depositor base is crucial for ensuring the success of the banking industry. To attract new depositors in a competitive environment, it is important to identify the underlying factors that they consider in their bank selection decision-making. Though this is not a novel phenomenon in the academic research arena, focusing on the role of only the technological aspects in bank selection decisions is fairly new. Recent transformation in information and telecommunication technology and the wave of the fourth industrial revolution has boosted the urgency of such type of studies. The findings suggest that a bank's virtual presence on the web and social media, advertisements enable depositors to familiarize themselves with the features of the bank and thus contribute to decision-making. Depositors also look for whether the banks are offering innovative, user-friendly, latest technologies in banking services in their decision-making. Depositors believe that technology is important but when it is secured. Thus, they are concerned about the security issues of technologies in banks. Depositors stated that technologies can facilitate convenience for attaining banking services. Moreover, technological infrastructures in banks can contribute to customer relationship management and cash transactions and these aspects are thoroughly considered by the depositors in their bank selection decision.

Keywords: Depositors, Bank selection, Sentiment analysis, Natural language processing

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Technological Transformation in Audit: An Evidence from Auditing Practice in Bangladesh

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Introduction: Big data refers to a large data set that is analyzed to find out different trends, results etc. In this report, the authors have tried to notice the implication of Big Data in the auditing sector of Bangladesh. It is considerably a new concept in this sector with huge opportunities and threats.

Materials and methods: Primary data has been collected through the distribution of questionnaires among CA articleship students, accounting professionals working in the Audit industry and accounting students studying in universities. Exclusive interviews have been taken with Managers, Directors and Partners of the top audit firms in Bangladesh including the big 4. A five (5) point Likert scale questionnaire has been developed and the interview questions are in line with (Salijeni, Samsonova-Taddei, & Turley, 2018). The data has been run in SPSS to analyze descriptive summary statistics like mean, median, standard deviation etc. and regression analysis.

Results and discussion/ implication: A clear lack of knowledge of the concepts of big data was found among the professionals working in the audit industry of Bangladesh. The positive significant relationship between the variables suggests that as these professionals get more acquainted with big data, the more they understand its importance. Benefits such as good audit quality, improved client service, and increased effectiveness can be found. On the other hand, challenges like training the professionals, mandating standards, and improving technology came up in the interviews with the selected Chartered Accountants of Bangladesh.

Conclusion: This study brings out the actual potential and implementation challenges of big data in the audit industry of Bangladesh. This research finds out that big data is not yet in practice in the auditing sectors of Bangladesh but it has a lot of opportunities and challenges. If we can come up with better techniques and plan the audit likewise, we may see the emergence of a better audit report in the future with detailed reviews and countless analytical reports. But that too comes with the risk of data exploitation which may hamper the confidentiality of individuals and companies.

In order to make the big data system applicable in Bangladeshi auditing practice it is important to make the professionals in this sector aware of this concept and make the most of it through various training programs. Trainers who are experienced in big data should be invited to train the CA professional. Besides that, the companies need to be cooperative enough to help in this matter. If everyone practices this system, sooner this



concept will be popular among people and auditors, companies and investors will be benefitted to the fullest. But for that safe keeping of this data is important. The Big Data concept could also be introduced in higher education in universities through various courses which will allow the students to get themselves introduced to this emerging concept. This will help them to cope with the practical implementation in their job life.

Keywords: Big data, Audit, Big4, Challenges, Benefits, Acquaintance

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Regulatory Technology (Regtech) Landscape of Bangladesh: Policies and Practices

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Introduction: In response to the escalating complexity and volatility of regulatory requirements in the aftermath of the 2008 global financial crisis (GFC), the development of regulatory technology (RegTech) has emerged in different parts of the world (Teichmann et al., 2023). The financial sector has been confronted with a plethora of regulatory changes that have generated an increased compliance burden, particularly concerning the ever-evolving anti-money laundering (AML) and know-your-customer (KYC) regulations (Utami & Septivani, 2022). These regulatory requirements present formidable challenges to businesses as traditional regulatory compliance methods become inadequate, resource-intensive, and costly. To address this gap, RegTech solutions have been developed by capitalizing on cutting-edge technologies such as artificial intelligence, machine learning, and blockchain to automate compliance procedures, oversee regulatory changes, and furnish real-time assessments of compliance risks (Gurung & Perlman, 2018). The incorporation of these advanced technologies highlights the commitment of financial institutions in developed countries to improve their regulatory compliance processes through the adoption of such innovative technologies. The current state of RegTech adoption in developed countries is termed RegTech 3.0 by the existing literature.

The development of RegTech solutions in developing countries is still in its nascent stages (Gurung & Perlman, 2018). Seemingly, Bangladesh is no exception since the majority of the financial institutions continue to rely on manual processes to comply with the regulatory requirements. However, there has been a growing awareness of the potential benefits of RegTech, and some institutions have already started to embrace these solutions. RegTech in Bangladesh has primarily focused on AML and countering the financing of terrorism (CFT) compliance. A few financial institutions have incorporated software solutions for customer due diligence (CDD) and transaction monitoring. Similarly, various RegTech solutions, including E-KYC verification and online payment processing systems, have also been implemented recently in Bangladesh. Keeping all of these in mind, this study aims to evaluate the landscape of RegTech policies and practices in Bangladesh to identify the current state of RegTech adoption as compared to the global perspective. Furthermore, potential opportunities and challenges will be highlighted considering the burgeoning state of financial technology (Fintech) implemented by the financial sector.

Materials and Methods: This study employs a research design based on secondary data collected from the annual reports of the Bangladesh Financial Intelligence Unit (BFIU) of Bangladesh Bank, as well as from various private commercial banks, spanning the period of 2017 to 2021. The descriptive statistics, circulars, and publications of Bangladesh Bank are analyzed, followed by the graphical representations to highlight the trends and patterns observed. To identify the development of Fintech, various indicators such as the number and amount



of transaction growth, number of active accounts, growth of new account opening, and sectoral fund disbursement ratio are used. Several RegTech variables, including reporting of E-KYC compliance, software used to detect non-compliant transactions, AML compliance, employee training, suspicious transactions reporting (STR), cash transaction report (CTR), system check inspection of banks, and statistics of court case handled by BFIU are adopted for assessing the effectiveness of the RegTech policies and the corresponding practices.

Results and discussion/ implication: The Fintech sector in Bangladesh is experiencing rapid growth since the number of registered users increased by 657% between 2022 and 2014, along with a notable surge in total transaction amount from BDT104,83 billion to BDT961.33 billion during the same period.

After analyzing the scenario of regulatory guidelines related to the RegTech, it is found that Bangladesh has demonstrated its commitment to combat money laundering and terrorist financing through the passage of the Money Laundering Prevention Act (MLPA), 2012, which was amended in 2015, and the Anti-Terrorism Act (ATA), enacted in 2009 and amended in 2012 and 2013. These legislative frameworks have laid the foundation for the RegTech regime that empowers the BFIU to play the central role. The BFIU has also issued several instructions and directives for financial institutions which include the AML/CFT circulars for MFS providers and agent banking operations, the MFS Guidelines initiated in 2011 and amended in 2015, the Prudential Guidelines for Agent Banking in 2017, and the MFS Regulations introduced in 2018 and amended in 2022. These regulations have added new dimensions to the field of MFS regulation in Bangladesh.

The recent publication of E-KYC guidelines represents a significant step forward for the country in strengthening its regulatory environment. However, in terms of innovative technologies initiated in developed countries, Bangladesh is still lacking behind. This lag may hinder Bangladesh's ability to keep pace with evolving global regulatory standards.

Upon analyzing the annual reports of various banks, it has come to light that all state-owned commercial banks have duly reported their AML and CFT activities. However, 10 of 43 private commercial banks have not disclosed their AML-related activities. Notably, after the publication of the E-KYC guideline, insufficient compliance of banks and other financial institutions has been observed since 33 banks have reported their compliance with the E-KYC guideline as of 2021. Before initiating the E-KYC guideline, the number of reporting banks in 2017, 2018, and 2019 was 29, 31, and 32 respectively. Similar findings are also observed in terms of STR and CTR. Furthermore, the number of STR and CTR reported by commercial banks is substantially higher than non-bank financial institutions (NBFI) and insurance companies.

19 banks have taken steps to train their employees to comply with the reporting requirements and to increase awareness between 2017 and 2021. It is also revealed that the number of system check inspections made by BIFU decreased to 66 in 2021-2022 from 114 in 2016-2017. In the same way, the number of court cases handled by BIFU was 17 in 2021-2022, as compared to 2 in 2018-2019, which indicates the existence of a greater extent of AML activities in Bangladesh. Although all financial institutions, including MFS providers, are registered with the goAML system, a fully integrated software solution developed by the United Nations Office on Drugs and Crime (UNODC) for reporting financial activities, only a few possess strong technical support and database systems that enable complete RegTech compliance. Overall, based on the analysis of the current state of RegTech, it can be inferred that Bangladesh has progressed beyond RegTech 1.0 and is currently positioned in the initial stage of RegTech 2.0. Nevertheless, the adoption of RegTech in the country remains limited and offers significant potential for growth.

Conclusion: RegTech is a rapidly evolving, constantly advancing and developing in response to the changing regulatory landscape and emerging technological advancements. In a dynamic regulatory environment, companies need to effectively use technology to tackle the challenges of compliance, including complexity and cost. RegTech solutions can help companies stay ahead of new regulations and cyber threats(KPMG, 2022). In this regard, this study aimed to evaluate the landscape of RegTech policies and practices in Bangladesh for identifying the current state of RegTech adoption as compared to the global perspective. To achieve this goal, a number of RegTech variables are used in this study. From the findings of the study, it has been revealed that regulatory compliance in Bangladesh is gradually improving. However, the greatest challenge in adhering to RegTech compliance lies in the inadequacy of technology adoption. Furthermore, in today's intricate Fintech landscape,



detecting money laundering and suspected transactions can prove to be a formidable task. Consequently, it can be inferred that Bangladesh belongs to the early stage of RegTech 2.0, which is primarily focused on regulatory compliance. Finally, it is recommended that the regulatory authority needs to take the effective initiative to develop advanced RegTech to keep pace with the growth of FinTech otherwise it will be difficult to detect non-compliant financial activities in the coming days.

Keywords: Anti-money laundering, Global financial crisis, Know your customer, RegTech 3.0 and suspicious transactions reporting

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The Influence of Subordinates' Strength-based Leadership on Creative Process Engagement in A Moderated Mediation Mechanism

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Introduction: Incessantly, the restive competitive market demands creative and innovative movement from an organization. The creativity and innovation of an organization have become a cause of either survival or extinction in the very dynamic environment (Ding & Yu, 2020a). Henceforth, subordinates' strength-based leadership (SSBL) can mold the vibe of employees' internal needs and provide them with the right support so they can rise above themselves (Burkus, 2011). When leaders focus and invest in the strength of their employees, the response of each person hired increases eight-time (Ding & Yu, 2020a).

Ample studies have shown a very impactful role of creativity and innovation (Kiveu, Namusonge, & Muathe, 2019) but very little is known about how SSBL transform creativity and creative process engagement (CPE) directly or indirectly via moderators and mediators. So, there is still a great scope to further study on the association between subordinates' strength-based leadership and creativity with different moderated and mediation mechanisms. The lack of adequate literature on subordinates' strength-based leadership drives the researchers for more exploration (Ding & Yu, 2020b; Ding, Yu, & Li, 2020). Globally, no study is yet found on the proposed model mentioned herewith (figure 1). Using the doctrine of the interactionist perspective theory of creativity, the present research endeavors to explore the influential role of SSBL on CPE via creative self-efficacy (CSE as mediator) and creative identity (CI as moderator) in the context of Bangladesh.

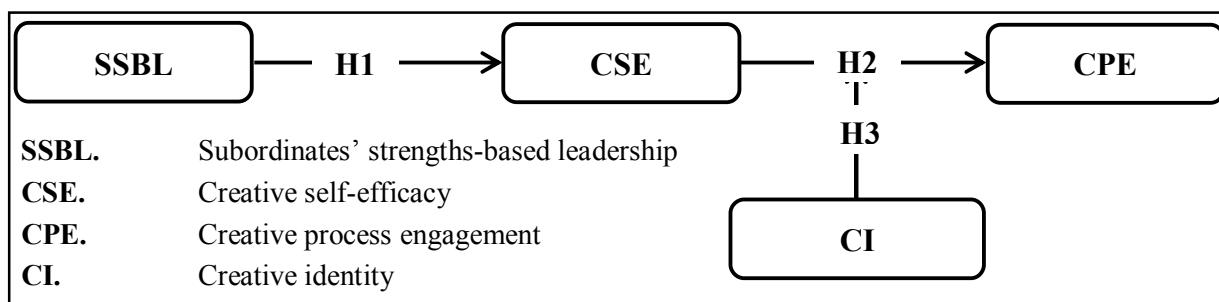


Figure 1: Hypothesized research model

Materials and methods: The present study finally used 227 replies via multi-item survey questionnaires from a variety of local organizations from Bangladesh using a self-administered questionnaire and the response rate was 47.79%. The deductive reasoning approach was followed, the convenience sampling method was applied, and



quantitative analytical choice was employed. The survey measures of estimating the latent variables, such as SSBL (Ding & Yu, 2020a), CSE (Karwowski, 2014), CI (Jaiswal & Dhar, 2015) and CPE (Zhang & Bartol, 2010), were collected from prior studies.

Results and discussion/ implication: The present study used Smart PLS-based structural equation modeling as the purpose of the present study is to predict the hypothesized relationships. Composite reliability and average variance extracted (AVE) are 0.80 and 0.50, respectively, and the square root of any latent variable's AVE is higher than its correlations with other latent variables. Thus, convergent validity and discriminant validity have no issues (Hair Jr, Hult, Ringle, & Sarstedt, 2021). *Table 1* showed that hypothesis 1 and hypothesis 2 were supported whereas hypothesis 3 on moderated mediation is not supported.

Table 1: Estimates of hypothesis testing

Hypothesis	Path relations	β	Standard Error	p-value	95% CI		Decision
					LL	UL	
Hypothesis 1	Influence of SSBL on CSE	0.507	0.031	0.000	0.005	0.135	Supported
Hypothesis 2	Influence of CSE on CPE	0.311	0.078	0.007	0.019	0.213	Supported
Hypothesis 3	Interaction effect on CPE with CI	0.073	0.061	0.232	-0.047	0.193	
	Index of moderated mediation	0.047	0.051	0.358	-0.060	0.139	Not supported

This research attempts to provide a theoretical model by critically examining the integrated relationship among SSBL, CSE and CPE with the lens of the interactionist perspective of creativity and innovation, and then explaining the moderating role of CI from the perspective of multiple industries. The findings of this study demonstrate a positive relationship between SSBL-CSE and CSE-CPE respectively. In contrary to the hypothesis, the moderated mediation role of CI is being proved insignificant. As the research on SSBL is still embryonic, there is immense scope to contribute to the formation and development of literature in this aspect.

Conclusion: Using the narrative of the interactionist perspective theory of creativity, this study purported to examine the influence of SSBL on CPE in a moderated mediation mechanism. Both the direct effects of SSBL on CSE and CSE on CPE are found significant, and however, the moderated mediation nexus does not exist. The present study provides important insights for practicing professionals to engage employees to CPE via CSE without depending on confounding factors.

Keywords: Subordinates' strength-based leadership, Creative self-efficacy, Creative process engagement, Creative identity, Moderated mediation

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Effects of Business Environment on Social Entrepreneurship

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Introduction: Social entrepreneurship is a different form of business model from traditional business entrepreneurship. As a practice and area of academic study, social entrepreneurship offers an opportunity to question, criticize, and reevaluate ideas and presumptions from many management and business research domains. This paper aims to identify the effects of external factors in the business environment on social entrepreneurship. How do the business environment factors affect social entrepreneurship to ideate, form, organize & operate? However, the business environment in which social entrepreneurship companies operate has a significant impact on their level of success. The term "business environment" refers to a group of external elements, such as social and cultural standards, legal and regulatory frameworks, and economic conditions that have an impact on how well and long-term a corporation may operate. The impact of the business environment on social entrepreneurship has been highly discussed in academic literature, with some researchers arguing that successful social entrepreneurship initiatives require a supportive business environment.

Materials and methods: Data for this study were collected through a survey question and an in-depth interview with social entrepreneurs in the Mymensingh division. There were 200 participants from 50 social organizations that were conveniently selected and included in the sample. The convenience sampling method was used in this study. Descriptive statistics, factor analysis, and correlation analysis were used to find out the result. The data were analyzed in SPSS 25.

Results and discussion/ implication: Social entrepreneurship is an outgoing sector that aims to trace social and environmental challenges with innovative business models. On the other hand business environment defined as the economic, political and social context in which social enterprises operate can have an important impact on the prosperity and sustainability of this business. One of the main findings of the research is that a supportive and stable business environment can simplify the growth and sustainability of social enterprises. Additionally, the research suggests that the strategic direction of social entrepreneurship might be influenced by the business environment. The research also shows social enterprise challenges in an unstable business environment. For example, government policy, regulatory barriers, lack of financing and markets, and social stigmatization can hinder the growth and sustainability of the social enterprise. Understanding the business environment helps social entrepreneurs discover opportunities and create ventures that have an impact on society. A good business environment influences the availability of investment capital for social entrepreneurship. For sustainable development, the business environment helps social entrepreneurs create products and services that address social and environmental issues. The business environment helps social entrepreneurs collaborate and network with other entrepreneurs, investors, and other stakeholders that support their business. This study was conducted only in Mymensingh Division, which was our limitation. In future research, we will extend our study area to the whole of Bangladesh to see the actual effects of the business environment on social entrepreneurship.

Conclusion: The study comes to the conclusion that social entrepreneurship is significantly impacted by the business environment, which affects its sustainability, development, and continuity. A variety of elements, including governmental regulations, economic conditions, social conventions, and cultural values, have an impact on a social enterprise's ability to succeed. The nature of the business environment may positively or negatively impact social entrepreneurship's ability to develop and survive. The results underline how crucial it is to comprehend the numerous elements that influence social entrepreneurship and how they affect the business environment. It is impossible to overestimate the influence of the business environment on social entrepreneurship. Policymakers, investors, and other stakeholders can support social entrepreneurship's growth and sustainability and its capacity to bring about meaningful social and environmental improvements by creating a supportive atmosphere.

Keywords: Social entrepreneurship, Business environment



Impact of Technology and Social Capital on Women Entrepreneurship Development in Bangladesh

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Introduction: Academics, practitioners and policymakers in the field of entrepreneurship have especially been emphasizing women entrepreneurship considering its impact on women's empowerment (Ali and Salisu, 2019) and economic development (Bertaux and Crable 2007). In the development of entrepreneurship especially women entrepreneurship, Information and Communication Technologies (ICT) plays a significant role in the country. In today's digital Bangladesh, E-commerce, F-Commerce and other use of ICT in businesses have grown significantly (Sultana & Akter, 2021) therefore technological know-how is an important factor to raise the competitiveness of SMEs (Aruna & Sunil, 2020). As technological advancement and the information technology explosion have reduced the problems of women entrepreneurs, it is important to discover if this advancement has any impel on women entrepreneurs' business development. Another important factor in women's entrepreneurial activities is social capital, which serves as a network of relationships that help impoverished female micro-entrepreneurs become more successful by establishing relationships with various business and non-business institutions to facilitate an increase in sales volume and access to resources (Haque & Itohara, 2009). Researchers suggest that women have stronger social kinship relations than men and they successfully utilize their kinship ties in dealing with family matters, but rarely do they do this in business transactions (Bjerke, 2007). Therefore, this study's aim was to explore the status of technology usage and the condition of social capital of women entrepreneurs in Bangladesh for creating a favourable entrepreneurial climate for women. Insights from the study would be beneficial for the relevant policymakers and government/non-government organizations involved in women's entrepreneurship development by exploring the reasons behind the low sustainability of women entrepreneurs.

Materials and methods: This research was an exploratory study and utilised a mixed-method approach. The researchers used both quantitative and qualitative approaches. In the first stage of the data collection, a qualitative approach was adopted as a first step to gain a deep understanding of the research setting. Later, a structured questionnaire was developed consisting of open-ended and close-ended questions with a 5-point Likert scale. The sampling frame is the list of available women entrepreneurs provided by Women and e-Commerce Forum (WE). The study collected a total of 2003 responses, including the pilot survey responses. After data clearing, 1789 data were confirmed for data preparation and analyses. In the survey, the responses were collected by using google forms. MS Excel and R software has been used to prepare and analyze the final data. The main outcome variable of interest "Entrepreneurial Development" is constructed based on the level of agreement (self-reported) which is measured on an ordered Likert scale from 1 to 5. The control variables include division of residence, age, marital status, education, and experience of running a business. First, a bivariate analysis is used for the selection of important predictors of entrepreneurial development. By running the Chi-square test of independence, Variables with a p-value < 20% for the test are selected for consideration in the following multivariate analysis. Since our outcome variable 'Entrepreneurial Development' is dichotomous, we perform a binary logistic regression.

Results and discussion/ implication: According to the division, the capital city of Bangladesh, Dhaka carried 45.7%, and the other two major divisions Chattogram and Rajshahi hold the second highest number of respondents that is 16.5% and 16.4% respectively. The age group between 31 to 40 carried 45.2% and 21-30 carried 38.3%. So, it is evident that the young women between 21 to 40 years old carried 83.5%. For the marital status of the women entrepreneurs, 83% were married women and 12.4% were single women. 73.8% of the



women entrepreneurs have an education at the undergraduate and graduate levels. The entrepreneurs having experience of 3 years, hold 83.1%, indicating that new businesses were thriving. In the study, women entrepreneurs use information and technology generally for promotional activities. 42.7% of women entrepreneurs used social media marketing. In addition, 21.9% of women had their own websites and web pages, and 12.2% promoted their businesses through mobile phones. The binary logistic regression model is as follows:

$$\text{logit}(P) = \beta_0 + \beta_1 \text{AGE} + \beta_2 \text{MAR} + \beta_4 \text{EDU} + \beta_5 \text{EXP} + \beta_{10} \text{KNOW} + \beta_{11} \text{TECH} + \beta_{14} \text{INFRA} + \varepsilon$$

Results of the logistic regression showed that older entrepreneurs are more likely to report development than their younger counterparts. Women entrepreneurs who have 4 or more children are about 60% less likely to report development than women who do not have any children. Importantly, the technology-related factors appeared to be important determinants of entrepreneurial development even after controlling for demographic and socio-economic variables. Women who agree and strongly agree on the usefulness of knowledge of technology for their business growth are 4 and 4.5 times more likely to agree on development than those who strongly disagreed on the importance of technology. Also, women who reported strong agreement to access to technology for their business growth are 2.5 times more likely to agree on development than those who strongly disagreed on this issue. Finally, women who agree and strongly agree on the importance of favourable infrastructure for entrepreneurship are 2.7 times more at odds to agree on development than those who strongly disagreed on the importance of such infrastructure. In the case of informal and formal relationships, women mostly get motivation (> 28%) from their surroundings. This indicated that women entrepreneurs are having a positive ambience that inspired them to continue work. Conversely, they are not having sufficient financial and business-related assistance (close to <30%).

Conclusion: This study suggests, a holistic approach among stakeholders is needed for the sustainable development of women entrepreneurship in Bangladesh; a skill learning environment especially technoknowledge must be developed and upgraded regularly to aspire to creativity and innovativeness; a balance social capital (formal and informal relationship) environment must be maintained to gain financial and non-financial support and facilitate entrepreneurial innovations; and an empowered local institution in the value system of women entrepreneurship environment by utilizing local (Thana, Union level) government and non-government organizations. Findings from this study contribute to the existing literature on entrepreneurship besides, the study paved the way to explore approaches to improve government-level institutional support in favour of women entrepreneurs for skill development, especially in technology. The findings identified why rural women are still lagging behind in entrepreneurial activities even after significant growth in the female education rate in Bangladesh. This study faced challenges including time, spatial and resource constraints. As the questionnaires were distributed only through google forms, the women entrepreneurs with no internet connection couldn't participate in the survey.

Keywords: Women entrepreneurship, Social capital, Information and technology, Formal & informal relationship, Logistic regression

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Influence of Corporate Governance on Firm Value: Evidence from Bangladeshi Manufacturing Industry

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Introduction: The study is aimed to investigate the influence of corporate governance practices on enhancing firm value in reference to manufacturing industries in Bangladesh. During the last decade, Bangladesh witnessed several corporate collapses and scams like the Hallmark scandal (2012), the BASIC Bank scandal (2015). The failures of companies as a result of a poor corporate governance system have emphasized the need to enhance and restructure the governance system. Bangladesh's economy is expanding, and the lack of suitable governance-performance literature in the country's context has led to a desire for understanding local governance characteristics and their influence on enhancing firm values. Interestingly, there is a lack of research on identifying the impact of corporate governance on firm value from the perspective of manufacturing industries in Bangladesh. This study considered the ownership structure, board structure and audit committee structure as corporate governance attributes whereas, very few studies considered the audit committee structure in earlier. To reduce the research gap and enhance the literature, the current study is designed. Such new intuitions provide necessary information to academicians, researchers, government, policymakers and other stakeholders.

Materials and methods: The data set of the study comprises 131 manufacturing companies under 10 industries enlisted in the Dhaka Stock Exchange of Bangladesh over the period 2012- 2021. The study considers 1207 firm-year observations for conducting the research. The study is explanatory in nature and explores the influence of corporate governance on firm value. Data were collected from a number of sources including the annual reports of the sampled companies. The macro-economic and industry-level data were collected from the World Bank database. The study conducted different tests namely, serial autocorrelation test, multicollinearity test, heteroskedasticity test, endogeneity test, Shapiro-wilk test, data stationary etc. to check the suitability of data. A correlation test was done to investigate the association between corporate governance practices and firm value. Furthermore, the regression analyses were employed to identify the influence of corporate governance on firm value by applying Pooled Ordinary Least Square (OLS), fixed effect and random effect methods. The robustness of the result was also checked by running regression considering Return on Assets (ROA) as a proxy of firm value.

Results and discussion/ implication: The study found managerial ownership, foreign ownership, ownership concentration, board size, board diligence and auditor quality have a significant positive influence on firm value whereas, board independence is negatively correlated with firm value and no significant relationship was found between audit committee size and firm value. The researchers tested endogeneity concerns but no issue was found. The practical implications of the current study demonstrated that good corporate governance creates value and must be invigorated for the interest of all stakeholders. Policymakers should formulate policies for attracting foreign investors, and concentration ownership to reduce agency problems. The focus might also be given to enhancing the board size and number of meetings conducted by the board members and to conducting the audit by the big four firms.

Conclusion: The findings of the study highlighted that good governance practices have a significant influence on enhancing the firm value of the studied firms. The findings of this study support the idea that manufacturing companies can expect to perform better and attain more firm value if they adhere to excellent corporate governance principles. It suggests, theoretically, that effective corporate governance processes result in lower agency costs which lead to increased firm value.

Keywords: Manufacturing industry, Corporate governance, Firm value, OLS



The Impact of Document Verification System on Audit Fees in Banks: An Empirical Study in Bangladesh

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Introduction: “If you think nobody cares about you, try missing a couple of payments.” Steven Wright. An external audit gives financial statements legitimacy, which provides credibility to shareholders and investors. It is not free; they get paid accordingly. According to the Institute of Chartered Accountants of Bangladesh (dated July 1, 2022), there are 167 Chartered Accountants firms with 358 Fellows and 15 Associate Members in practice in Bangladesh. They all have the motivation to provide quality financial services. Auditors were appointed with low fees, which influence audit quality. As a result, investors distrust audits. On the other hand, auditors rarely sign questionable accounts. They assess client size and green field status, not only business history, to fix audit fees (Karim *et al.*, 2013).

According to a study by Haque *et al.*(2019), Bangladeshi insurance companies' audit fees were well below the Institute of Chartered Accountants' minimum. Several studies show that corporate governance (Athavale *et al.*, 2022; Beisland *et al.*, 2015), risk, firm size, the redisclosure information environment, growth and persistence (Teoh & Wong, 1993), audit committee revelations (Xue & O'Sullivan, 2022), and leverage positively affect both audit fees and quality. The Public Company Accounting Oversight Board (PCAOB) registration also improves audit quality and raises audit fees (Mohapatra *et al.*, 2022).

For RJSC return submission, shareholder disclosure, and other purposes, companies' financial accounts are audited. According to Alrashidi *et al.*(2021), audit and non-audit fees show high-quality audits that boost financial statement credibility and corporate financing. A corporation needs a fresh audit report to obtain financing from a financial institution. Some reporting companies were found to be fraudulently preparing different versions of audit reports to gain an advantage (Amin, 2022). To combat these fraudulent activities, ICAB has issued a circular referring to 1/1/ICAB-2020/DVS/001 dated November 24, 2020 to all practicing members, requesting them to generate a Document Verification Code (DVC) using the Document Verification System (DVS) and put the DVC along with their signature when signing any audit report other than management audit and internal audit from December 1, 2020 with the motto “Secure your documents & make trustworthy.” The National Board of Revenue (NBR) can verify audit reports filed by reporting corporations using the DVS (Report, 2022).

From the prior literature, it is almost clear that several factors influence audit fees. Audit fees were not satisfactory before 2018 (Amin, 2022). When Bangladesh adopted IFRS in January 2018, this profession emerged with a broad scope. IFRS standardizes reporting and disclosure across most nations. Bangladeshi audit practices improved with adoption. However, the International Financial Reporting Standards (IFRS) require auditors to spend more time and effort on financial statements(Amin, 2022). The auditor's report format changed under the Financial Reporting Act, 2015 which created the Financial Reporting Council (FRC).

Hence, the study proposes DVS as a factor influencing audit fees in Bangladesh. So, the study aims to identify the impact of DVS by ICAB on audit fees in Bangladesh. The study also aims to fill in the literature gap on the impact of DVS by ICAB on audit fees in Bangladesh. It will help the policymakers review audit fees based on the situation revealed by the DVS. The following hypothesis can be developed:

H_0 : There is no impact of DVS by ICAB on audit fees.

Materials and methods: The study employed a mixed-method approach to identify the impact of DVS on audit fees based on hand-collected data from the financial statements of Dhaka Stock Exchange (DSE) listed banks (n=28) in Bangladesh. The main objective of the study is to observe the relationship between the DVS (an



independent variable) and audit fees (a dependent variable). The total turnover and total assets (control variables) have been taken into consideration to demonstrate the firm size (Haque et al., 2019). The hand-collected data from the DSE-listed banks in Bangladesh from the period 2016–17 to 2021–22 was collected from the annual reports of the respective banks. Data reliability test using SPSS was conducted. To test the hypothesis, a paired sample t-test was applied to the average audit fees before the DVS (three years until 2019) and the average audit fees after the DVS (three years until 2022) using IBM SPSS Statistics 20. The Spearman correlation between the DVS and audit fees was also tested. The descriptive statistics can provide us with an at-a-glance picture of the audit fees before and after DVS.

Results and discussion/ implication: Descriptive statistics show that there is an upward trend, which indicates a significant rise in audit fees after 2020 due to the introduction of DVS by ICAB. According to the Spearman correlation analysis, there is a strong and positive association between the DVS and audit fees at the 5% level of significance. The result is supported by previous studies where firm size, the redisclosure information environment, growth and persistence (Teoh & Wong, 1993), audit committee revelations (Xue & O'Sullivan, 2022), etc. were found to have a positive effect on audit fees. The paired sample t-test, applied to the average audit fees before the DVS (three years until 2019) and the average audit fees after the DVS (three years until 2022), rejects the null hypothesis. One conclusion that might be drawn from this is that the DVS has substantially raised the audit fees. It improves the income opportunities available to the members who are actively practicing Chartered Accountancy in Bangladesh. Because the audit report plays such a significant role in the decision-making process of the stakeholders of each company.

Conclusion: It is possible to draw the conclusion that the DVS improves the financial facilities of practicing members of the Institute of Chartered Accountants of Bangladesh since inferential statistics demonstrate that there is a substantial and positive connection between the DVS and audit fees. This correlation exists between the two variables. Because the audit report plays such an important role in the decision-making process, the fellows and associate members should focus their attention on improving the quality of the audit in order to enhance the services. If the audit report is of sufficient quality, the company's stakeholders will be able to be confident that the audited financial statements will serve as the foundation for the formation of appropriate financial choices. Despite the fact that the research was conducted using a sample drawn exclusively from the banking industry, the findings are applicable to a wide range of other fields as well. If the research takes into account additional variables that have an aggregate effect on the audit fees, there is a possibility that some of the conclusions will not hold true. Therefore, additional research can be conducted to accumulate other factors in order to find the aggregate results.

Keywords: Document Verification System, DVS, Audit Fee, Global Reporting Initiatives (GRI)

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Determinants of Corporate Governance and Its Effect on Credit Risk: A Study on Commercial Banks in Bangladesh

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Introduction: Good governance is the key element to the success of banks. Commercial banks in Bangladesh are severely affected by weak governance, and as a result, banks suffer huge default loans. As per Bangladesh Bank's statistics up to 2021 around Tk. 1,03,273.78 crore of default loans are bear by commercial banks, it's about on average 9.73% of gross loans and advances. The main purpose of the study is to identify the causes of weak corporate governance and its effect on credit risk (non-performing loans) by using the Ordinary Least Square (OLS) estimator.

Materials and methods: Correlational research strategy of 'quantitative method' procedures was used in this study. Quantitative data were collected from primary and secondary sources. The secondary data were collected from annual reports for 19 years, from 2000-2018 of SCBs and PCBs. Primary data was collected through an opinion survey with a close-ended structured questionnaire. The survey sample size has been limited to 100 respondents with rational proportion from each category of banks based on stratified random sampling technique by using the formula of Anderson, (1996), p820. To know the respondents' attitudes the researcher used 5 points Likert-type Scale.

Results and discussion/ implication: The study found that the leading causes of weak corporate governance from empirical evidence are inadequate to use of laws regarding corporate governance; status of directors, number of directors in the board meeting, increased institutional ownership, audit committee and gender effects, and external undue pressure. The study also directed that weak corporate governance has a significant influence on the credit risk of commercial banks.

Research limitation: The current study does not include all possible causes of weak corporate governance. Only 38.3% variation can be explained by credit risk by the identified causes of weak governance factors. Further study might incorporate the remaining factors of weak governance to explain the outcome variable.

Originality/Value: The matter explores the probable influence of weak corporate governance on credit risk which has acknowledged considerable responsiveness from an academic study that has mostly motivated on reviewing the publications of corporate governance in Bangladesh and developing economies perspective.



Conclusion: It can be concluded that weak governance causes credit risk for commercial banks. Inversely, better governance banks enjoy lower credit risk of banks. The study found that most of the corporate governance indicators have a significant influence on credit risk. So it can be concluded that weak corporate governance enhances credit risk and good governance maintain credit risk at an optimum level.

Keywords: Corporate governance, Credit risk, Commercial banks, Factor analysis, Bangladesh

Impact of Demographic Variables on Investor's Risk Tolerance: Empirical Study from Bangladesh

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Introduction: The pattern of risk preference of an individual investor stimulates to invest in the capital market. The study is mainly focusing the impact of demographic situation on the risk absorption in asset allocation. People invest their surplus amount in the capital market with the hope of earning handsome returns compared to that of the money market. But sometimes, their actual earnings vary from the expected earnings due to market anomalies. The choice of risk preference might be determined by some demographic factors. Investors who have different demographic conditions exhibit different risk preferences while making investment decisions. The willingness to enter an investment where the attainable goal can be achieved but has the chance of loss is called risk tolerance (Kogan & Michael, 1964). Different types of risk preference behaviour are found in the market such as risk averse, risk neutral, risk lover etc based on their unique demographic factors such as age, gender, income, marriage, occupation etc. Risk tolerance is a key determinant that has a vast impact on the investment decision-making of an individual (Roszkowski & Snelbecker, 1990). Demographic variables such as gender, age, marital status, education, occupation, income level, living area etc are considered as an atmosphere where individuals make every decision including the financial decision. The demographic factors may have influenced the risk tolerance of the investor.

The core objective of this study is to find out the impact of demographic factors on the risk tolerance of investors. For achieving the objective, primary data has been collected from the investors for concluding the influence of demographic variables on risk tolerance. Risk is an important determinant for the investment decision-making of investors and investment firms. Investment experts such as fund managers need to know the risk preference of the investor before preparing a portfolio for him/ her. This research is significant for financial advisors and investors to accommodate the risk tolerance of an individual investor based on his/her demographic factors. They may also suggest financial instruments that might match their age, level of income, education and risk preference. There is a lot of research work in foreign countries where the capital market is structured but little study has been done on this topic, especially on risk tolerance of the investors. Policymakers can adjust the risk and return of the market based on the risk tolerance of the investors in Bangladesh. This study will recognize the key demographic factors that affect the risk tolerance of the investor in a developing capital market like Bangladesh. They may also suggest financial instruments that might match their age, level of income, education and risk preference. Besides, policymakers can consider the demographic factors and risk tolerance for developing new policies in the financial sector. Moreover, the finding can be supportive to the research fields for further research in future.

Materials and methods: For this study, data is collected from primary sources through a structured questionnaire survey. The questionnaire includes the question regarding demographic factors of an investor and his/ her risk



tolerance. Respondents answered the question through face-to-face interviews and online media with the assistance of Google Forms. The study targets to collect 500 responses from the investor in different areas in Bangladesh but some respondents return the questionnaire by partial fill-up. So, only fully filled-up replies are considered for this study and the sample size is 436. The study has been done on the qualitative method but for generalization, the qualitative information is converted into the quantitative method by using the sequential number. A model has been developed for concluding the relation and impact of demographic factors on the risk tolerance of an investor. Six demographic factors such as gender, age, marital status, profession, income level, and education are considered independent variables and risk tolerance is considered as a dependent variable for the analysis. The regression method doesn't provide a good direction for this study as it is qualitative research and the data has been sorted in sequential numbers for analysis. For this type of analysis, the chi-square test is fruitful. SPSS 16 statistical tool is used to analyze the data.

Results and discussion/ implication:

Table 1: Chi-square test results

Demographic factors	Decision
Gender	Reject null hypothesis
Age	Reject null hypothesis
Marital Status	Reject Alternative hypothesis
Profession	Reject Alternative hypothesis
Income Level	Reject null hypothesis
Education	Reject null hypothesis

Source: SPSS-16 output

Cronbach's Alpha is used to check the data's reliability and validity. The alpha value of this study is 0.813 which is greater than the minimum alpha value (0.70) for the data reliability check. So, the dataset is valid and reliable for finding conclusions regarding the impact of demographic variables on investors' risk tolerance. From the hypothesis testing of the study with the support of the statistical tool of SPSS, four demographic factors except for marital status and profession of an investor are statistically significant and those demographic factors such as gender, age, income level and education have a significant impact on the risk tolerance of an individual investor. Moreover, risk tolerance has a positive relation with the profession, income level and education whereas gender, age and marital status have negative relation as has been found from the correlation analysis. So, it can be concluded that demographic factors have influenced risk tolerance during investment decision-making of an investor.

Conclusion: Risk is considered a key determinant of investment decision-making in the capital market. Investors must consider risk tolerance before taking an investment decision. Demographic variables of investors play a vital role in risk tolerance. The study from Bangladesh has found that the selected six demographic factors have positive and negative impacts on the risk tolerance of an individual investor. The findings of the study have fulfilled the core research objective. Although marital status and profession are not statistically significant for this study, these two demographic factors have a significant influence on the investment decision-making of an investor. The profession might play a key role in investment because the profession determines the income level of an investor. Therefore, the demographic factors of gender, age and marital status hurt the risk tolerance of an individual investor because older age people ensure the investment and return in a safe position and married people behave like the older aged investor for ensuring safe income for the family. This study will help the investor as well as the financial experts in decision-making in the market. The further researcher should use secondary data and also collect more samples from different regions of Bangladesh, and different residential areas of investors to do such a study.

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Keywords: Demographic variable, Risk tolerance, Investment decision, Investor.

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The Impact of Interest-free Islamic Microfinance on the Wellbeing of the Borrowers in Bangladesh: A Qualitative Investigation

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Introduction: The purpose of the study is to investigate the impacts of Interest-free Islamic microfinance on the wellbeing of borrowers in Bangladesh. Article 25 of the Universal Declaration of Human Rights states, “Everyone has the right to a standard of living adequate for the health and well-being of himself and his family, including food, clothing, housing, and medical care, necessary medical services and the right to security in the event of unemployment, sleekness, disability, widowhood, old age or other lack of livelihood in circumstances beyond his control” (Yunus, 2007a, p. 10). Poor people do not always require charity or donations to survive; rather, they require a proper financial solution that helps enhance their potential to improve their lives and establish identity, dignity, and respect in society. An effective policy is thus necessary that concentrates on eradicating poverty of the people who live at the bottom of the pyramid. Professor Muhammad Yunus, the founder of Grameen Bank and a recipient of the Nobel Peace Prize, launched a microfinance program with a modest loan of USD 27 to a small group of poor individuals in 1976. Later, he realized that the poor people are trustworthy, as evidenced by the fact that they repaid the loan amount. Professor Muhammad Yunus founded Grameen Bank in 1982 intending to assist the poor people with a microcredit scheme. Initially, the fundamental goal of microcredit was philanthropic, and it was established to eliminate poverty from society. However, over time, the noble goal of microcredit to assist the impoverished has been replaced by the concept of microfinance organizations' profitability and financial sustainability (MFIs).

The profit-making tendency of MFIs enhances competition that forced them to reconsider their strategy to remain sustainable in the market. These financial providers are described by Professor Yunus as the rise of new loan sharks. The profit-making tendency of MFIs enhances competition that forced them to reconsider their strategy to remain sustainable in the market. Furthermore, donors have questioned the need for ongoing subsidies, leading to many Non-Governmental Organizations (NGOs) focusing on financial sustainability ignoring the social goal to assist the poor. MFIs have recently shifted their focus to high-income borrowers to increase their portfolio yield (Mia and Rana, 2018). The commercialization of MFIs has suffocated microfinance borrowers. Furthermore, MFIs charge high-interest rates because they expect a large portfolio yield. Microcredit has become a trap for the poor, and the interest on repayments starts at around 15%, but it is a flat rate that may swiftly increase to anywhere between 40% and 100% (BBC World Service, 2010). Thus, the function of microfinance has recently become an issue of debate.

The purpose of microfinance both conventional and Islamic is the well-being of poor people. Both financing model has contributed to reducing poverty in different countries of the world. Yet the conventional mode of microfinancing has been unable to serve a considerable number of Muslims. Islamic MFIs have



expanded significantly in recent years. Despite its growing popularity, the impact of interest-free Islamic microfinance on the wellbeing of its borrowers remains largely unexplored. Islamic MFIs are financial organizations that operate under Islamic principles and offer financial access to underprivileged people in rural areas. Islam forbids the transaction of interest and offers financial goods that comply with the sharia that meet the needs of rural Muslim households who rigidly adhere to Islamic practices (Ahmed & Ahmed, 2009). The impact assessment of Islamic microfinance on the wellbeing condition of poor borrowers in Bangladesh is barely found in the existing literature. Hence, this study likely be a good source of knowledge for scholars and academics.

Materials and methods: This study adopts a qualitative approach to find out the impacts of Islamic microfinance on the wellbeing condition of poor borrowers in Bangladesh. This study has collected primary data through 23 in-depth interviews with microfinance borrowers and practitioners. Moreover, this study reviewed relevant documents and reports of international organizations. The interview data are transcribed, categorized and finally obtained themes.

Results and discussion/ implication: Islamic microfinance plays a crucial role in encouraging the socio-economic growth of the poor and small business owners without the use of interest. Micro-entrepreneurs will be inspired to succeed because of the moral and ethical characteristics of Islamic financing schemes. Islamic microfinance also provides an alternate paradigm for disadvantaged people who have been turned off by traditional microfinance. It is found in this study that Islamic microfinance significantly contributes to the subjective and objective wellbeing of the borrowers. Since Muslim borrowers do not need to compromise with the *riba* or interest in the Islamic microfinance system, they remain mentally comfortable which is also the confirmation of the subjective wellbeing of the borrowers. Moreover, as part of objective wellbeing, the majority of respondents in this study confirm that Islamic microfinance has become an effective mechanism to increase their household income, ease the education of their children, receive social recognition and respect, remain mentally sound, and do not feel pressure to repay their debt since the cost of capital is comparatively low.

Conclusion: Although Shariah-based financial systems are a relatively young industry, it has been receiving growing popularity and providing financial services to those who do not accept the interest-based conventional microfinance system. Islamic microfinance contributes significantly to eradicating poverty ensuring wellbeing conditions, promoting financial development, and inclusion of the borrowers more efficiently and humanely since it contains unique characteristics and high moral values. Moreover, it is evident that over-indebtedness and high-interest rates cause many financial, social, psychological, and moral problems. Islamic or Shariah-based microfinance, on the other hand, can be an alternative source of financial support for poor people in Bangladesh. As part of the limitation, a mixed-method approach applying both the qualitative and quantitative methodology would provide a better measurement of the impact of Islamic microfinance on the wellbeing condition of the borrowers.

Keywords: Interest-free Islamic microfinance, Wellbeing, Borrowers, Bangladesh

Impact of Dividend Policy on Stock Price: A Study on Pharmaceutical and Chemical Companies Listed in DSE

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Introduction: A company's dividend policy is a crucial aspect of corporate finance and has strong significance for shareholders, investors, and the stock market. Although it is one of the most researched topics in Financial Management, there remains a lack of consensus among scholars and practitioners about its impact on stock prices



(Masum, 2014). The impact of corporate dividend policy on the market price of the stock is controversial, mysterious, and a puzzle in corporate finance (Easterbrook, 1984).

This study aims to investigate the impact of dividend policy, breaking up into cash and stock dividend, on the stock price of the pharmaceutical and chemical companies listed in the DSE of Bangladesh. The study has also used Earning Per Share, Net Asset Value, Dividend Yield, and Price-Earnings Ratio as control variables.

Dhaka Stock Exchange (DSE) is one of the major stock exchanges in South Asia, with over 500 listed companies, and has grown rapidly in recent years. Again, the pharmaceutical and chemical industry is one of the largest sectors in Bangladesh, and its role in Bangladesh's economy is very significant. This industry meets around 98% of the total demand for medicines in the Bangladeshi market as well as exports medicine to about 150 countries in Europe, America, the Middle East, and Central Asia, worth approx. \$189 million in FY2022.

To our knowledge, no earlier study has, however, evaluated specifically, how cash dividends and stock dividends, affect the stock price of the companies in this large industry. By analyzing the effect of cash dividends and stock dividends on the stock price of DSE-listed pharmaceutical and chemical companies, and by comparing their significance, this study seeks to narrow this knowledge gap. And thus the study will contribute to the existing body of information on the topic and provide valuable information to investors, policy-makers, and DSE-listed companies on how to make informed decisions regarding dividend policy.

Materials and methods: To achieve the objective of the study, panel data of 14 A-category companies in the Pharmaceutical and chemical sector listed in DSE for the period of 2018-2022, among a total of 20 A-category companies in this sector, have been used. The samples have been selected through the non-probability purposive method based on the availability of data. The A-category companies have been selected as they regularly pay dividends, either in cash or stock form; hence the impact of cash and stock dividend on stock price can be measured.

The sample data have been collected from secondary sources, and the sources that have been used are: 1. The DSE website, and 2. The annual reports of the selected companies from 2018 to 2022.

Inferential statistics, such as Pearson correlation, Pooled OLS Model, Fixed Effect Model, and Random Effect Model, have been used to investigate the impact and significance of dividend policy on stock price and to compare the significance of stock and cash dividends in influencing stock prices. Redundant Fixed Effects Tests-Likelihood Ratio and Hausman Test have been used to compare the effectiveness of different models. IBM SPSS 27th Version has been used for correlation analysis. E-views 10th version has been used to conduct the Pooled OLS Model, Fixed Effect Model, Random Effect Model, Redundant Fixed Effects Tests- Likelihood Ratio, and Hausman Test.

Results and discussion/ implication: Based on the Redundant Fixed Effects Tests- Likelihood Ratio and Hausman Test, Random Effect Model has been found to be the best fit for the study.

The findings from Pearson Correlation and Random Effect Model show that cash dividend significantly impacts positively on share prices. On the other hand, stock dividends have an insignificant positive impact on share prices. Furthermore, Net Asset Value and Earnings Per Share are found to have a significant positive impact on the market price of shares.

Such studies are very significant for developing countries setting like Bangladesh where the stock market is. The result of this study may contribute to the effective decision-making of both investors and companies.

Conclusion: The major findings of the study suggest that cash dividend has a significant positive impact on stock price while the stock dividend has an insignificant positive impact on the stock price of the pharmaceuticals and chemical companies listed in DSE of Bangladesh. Based on the result of the study, it is recommended that

1. Companies should consider increasing their cash dividends as it has a positive impact on their market price.
2. Companies should also consider paying stock dividends as a way to reward their shareholders, but they should not rely solely on stock dividends as a means of increasing stock prices.
3. Companies should focus on increasing their Earnings Per Share and Net Asset Value to increase their market price, as they are positively and significantly correlated with the Market Price of Shares.



Overall, the findings of this research provide valuable insights for companies and investors on the impact of dividend policy on stock prices. It has the potential to contribute to the field of finance and inform investors and policymakers of companies on how to make informed decisions regarding dividend policy. Companies listed in DSE can also use the findings to formulate appropriate dividend policies that can create value for their shareholders and maintain their competitiveness in the market.

Keywords: Dividend policy, Cash or stock dividend, Stock price, Fixed or random effect modelHausman test

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Enablers and Inhibitors of Mobile Financial Services (MFS) in an Emerging Economy: A Dual Factor Theory Perspective

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Introduction: In this day and age of continuous advancement of science and technology, Information Technology (IT) based solutions to business problems are in abundance. Throughout the last decade, several tech-based solutions emerged that have already changed or are in the process of changing the economic landscape. Mobile Financial Services (MFS) is one such platform. Bangladesh, an emerging economy, has seen the advent of various MFS in the last decade. The introduction of such financial services as opposed to the traditional ones has had a significant impact on how people approach financial transactions nowadays. To understand what causes people to resort to the MFS in an emerging economy like Bangladesh, this study employs the Technology Acceptance Model (TAM)(Davis, 1989). Also, the study attempts to reveal some of the enablers and inhibitors that form the users' attitude toward MFS. In this regard, the study uses the dual-factor theory (DFT) perspective (Cenfetelli, 2004).

There have been several studies in the areas of Mobile Payment (m-payment) adoption, users' attitudes and intentions to use Mobile Financial Services (MFSs) in the context of Bangladesh (Khalid et al. 2020, Himel et al., 2021, Saha et al. 2022). In the global context also, there are several studies that investigated similar issues. In Pakistan (Ali et al., 2022), Malaysia (Abdul-Halim et al., 2022), China, America, Belgium (Wu & Liu, 2022), Indonesia (Sari et al., 2022) there are studies that investigated issues such as what causes people to adopt mobile payment, determinants of continued usage of mobile payments, and so on. Still, there is a dearth of research that investigates the MFS phenomenon from the dual-factor theory perspective. In India, Sharma & Mishra (2022) used DFT in the rural setting to identify the enablers and inhibitors of mobile payment. The originality of our study lies in the fact that this would be the first that will explain the MFS phenomenon in Bangladesh using DFT.

Materials and methods: For this study, a research framework was developed based on dual-factor theory as the overarching concept. Users' perceptions of various enablers and inhibitors of mobile financial services were considered in the framework. Gender, age, education, and location were used as control variables. The selected enablers and inhibitors were taken from existing literature with some necessary adaptations by the authors. These

enablers and inhibitors contribute to the formation of Attitude Toward using MFS (mediator) which consequently causes Continuance Intention.

To test this conceptual research framework, a structured-questionnaire survey was conducted throughout Bangladesh. The questionnaire comprised two segments. Through the first segment, demographic information about the MFS users was collected. The later segment used a 5-point Likert scale to measure the various dimensions of MFS users' perceptions. We received 228 responses, out of which 23 responses were discarded due to failure in answering attention check questions correctly. Finally, a total of 205 usable responses were considered for analysis. In addition to the survey, a focus group interview was arranged in which 8 users of MFS having diverse backgrounds participated.

The data collected through the survey was analyzed using partial least squares (PLS)-SEM. To clean the data MS Excel was used whereas to analyze the data SmartPLS was applied.

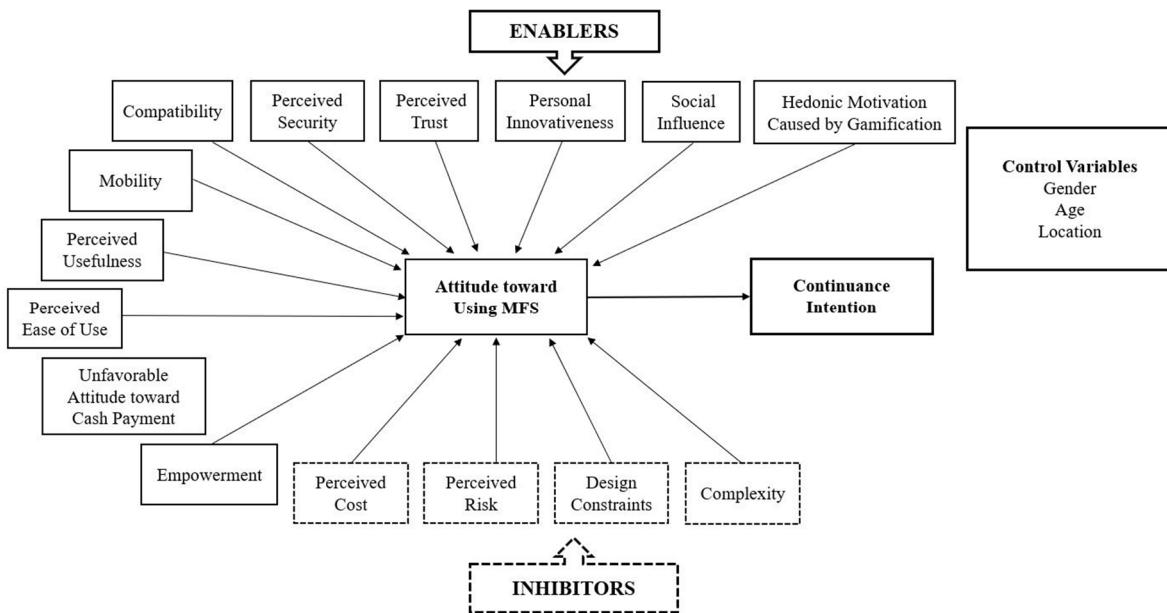


Figure 1: Research Framework

Results and discussion/ implication: The model was tested for reliability and validity. The measurement model's fitness indices were within acceptable bounds, ensuring the suitability of the research model. The collinearity statistics (VIF) were within tolerance limits. We found out that all the enablers except for three contribute positively to the creation of a favorable attitude toward the usage of MFS. Especially Social Influence, Unfavorable Attitude toward Cash Payment, and Compatibility had significant influence over the formation of favorable attitudes. On the other hand, Perceived Risk and Perceived Cost had significant influence as inhibitors and negatively affected the attitude of the users. None of the control variables had a significant influence. We calculated R^2 to evaluate the variance in the dependent variable that is explained by independent factors. The research model accounted for 48.8% of the variation in respondents' attitudes toward using MFS and consequently, it explained 38% of the variation in the continuance intention of the users of MFS. These findings are expected to add to the body of knowledge in the MFS literature. Also, the use of DFT in this context is expected to extend the applicability of the theory further. Finally, the empirical findings of the study can assist policymakers in focusing on the issues that influence the users' attitude toward and continuance intention for MFS.

Conclusion: The MFS market in Bangladesh is widening day by day and therefore more research into this area is warranted. The findings of this study may render insights to the MFS industry as well as to the research community. Further research venture into the MFS arena may delve into issues like drivers of MFS aversion, cross-country attributes of MFS adoption, comparative analysis of urban and rural usage of MFS, and so on.



Keywords: Dual Factor Theory, Technology Acceptance Model (TAM), Mobile Financial Services (MFS), FinTech, Bangladesh.

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Determining the Factors Affecting the Usage of the Online Food Delivery App of Pathao Food in Bangladesh: The Moderating Effect of Post Covid-19 Impact

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Introduction: This study aims to determine the factors affecting the usage of the online food delivery app of PathaoFood in Bangladesh resulting from the post covid-19 impact on customer behavior.

Materials and methods: This study is constructed around a review of previous studies and 390 useful data that were gathered from respondents who had previously used online food delivery (OFD) services at least once in Bangladesh's different areas. Structural equation modeling is utilized to analyze the subsequent data using Smart PLS 3.3.3. Baron and Kenny's classic causal steps approach has been considered to test the moderating effect of post covid-19 impact in this study.

Results and discussion/ implication: The findings suggest that the usage of the Pathao mobile app is highly impacted by perceived usefulness (PU), ease of use, convenience, attitude, and fear as post-COVID-19 impacts.



Moreover, attitude partially mediates the relationship between attitude and PU, ease of use, convenience, and intentions to utilize the Pathaofood mobile app. In addition, the intensity of the link between attitude and the usage of the OFD app is moderated by the dread of COVID-19. It has two-fold implications. The study's findings will figure out the vital factors affecting the usage of the online food delivery app of Pathao food in Bangladesh and these findings may be beneficial to OFD service providers in creating business strategies for increasing customers of the Pathao food app and handling the competitive business environment of the sharing economy sector.

Conclusion: The study illustrates the factors impacting customers' intentions toward OFD services in the COVID-19 environment using a specific example. In order to determine the factors affecting the usage of the OFD app of Pathao food in Bangladesh- The moderating effect of post Covid-19 impact in COVID-19 conditions, the current study integrates PU, ease of use, convenience, attitude, and fear of COVID-19, offering crucial insights for business leaders.

Keywords: OFD app, Pathao food, Determining factors, Post-covid-19, Bangladesh

Level of Acceptance of Mobile Banking at Rajshahi City in Bangladesh

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Introduction: The delivery of services in the banking sector has historically followed the brick-and-mortar model in which customers have to visit a physical branch and wait in order to access some financial services (Sulaiman et al., 2007; Awadhi, 2013). The banking industry has evolved from traditional banking to modern or branchless banking, in which banks can be addressed for services at any time and from any location (Saleem and Rashid, 2011). The expansion of information technology has had a significant impact on the creation of adaptable and user-friendly banking services (Dixit and Datta, 2010). Although technology has changed the design and distribution of financial services and the way customers communicate with their financial service providers, the growing usage of wireless telecommunications such as cell phones, internet-enabled smartphones, and PDAs (personal digital assistants) has also largely contributed to this shift. Despite the rapid rise of several commercial wireless networks, the use of the mobile banking service is considerably lower than desired (Cruz et. al, 2010) and still underused (Huili, and Chunfang, 2011), and lower than expected (Luarn, P. and H. H. Lin 2005). The mobile banking market remains very limited in this field compared to banking transactions (Yang, 2009). Authors have found numerous studies on mobile banking but have limited studies on its acceptance to customers and no study is found relating to Rajshahi district in Bangladesh in particular. With this respect, the authors have conducted this study aiming to explore the current level of acceptability of mobile banking to customers in Rajshahi City in Bangladesh and to identify the factors affecting its acceptance of it.

Data and methods: A convenience sampling technique is used to select the institution and respondents of the study. A seven-point Likert scale survey structured questionnaire covering four phases is prepared and used in collecting data. The 7-point Likert scale made the following choices possible: '1' (strongly disagree), '2'(disagree), '3' (somewhat disagree), '4' (neutral), '5' (somewhat agree), '6' (agree) and '7' (strongly agree). After getting satisfactory results on reliability from the pilot test, the researchers delivered and collected the data physically and using an online-based Google form for almost four months. A total of 295 questionnaires were distributed to the potential respondents. Out of 295 questionnaires 35 were distributed electronically using Google form links to respondents' email, WhatsApp and Facebook Messenger and a total of 260 questionnaires were distributed face-to-face. We got a valid 200 questionnaires as useable for analysis purposes and structural equation modelling (SEM) using a PLS instrument is employed to analyze the data to achieve the objectives of the study.



Findings and discussion/ implication: The findings of the research project are noteworthy. Firstly, the grand mean of service quality theme is 5.598214 with a standard deviation of 1.80406. Among the seven items of the service quality dimension, the average value of the speed of transactions is at the top. Secondly, under the perceived ease of use dimension, it is found that saving time is at the top followed by paying bills, serving anywhere, using easily, useful for specific needs. Thirdly, customers are much more satisfied with the use of mobile banking because of the reduction of transportation costs whereas much more dissatisfied with the cost involved in credit card transactions. Fourthly, customers are concerned about the possibility of hacking and careless transactions activities of mobile banking. Fifthly, the living environment of the customers influences them to use mobile banking services as the average value (5.9747) is the highest than others. Average values of other factors also indicate that customers are influenced by social factors to use mobile banking services positively. Sixthly, Perceived ease of use and trust significantly and positively influence customer satisfaction and loyalty of customers at Rajshahi City in Bangladesh one hand, service quality, social influence and security and privacy of mobile banking do not significantly impact on satisfaction and loyalty of customers at Rajshahi city in Bangladesh, on the other hand. Seventhly, Cost is negatively associated with customer satisfaction and loyalty of customers at Rajshahi City in Bangladesh. The technology acceptance model (TAM) has been seen to be sufficiently robust in explaining the usage and acceptance of mobile banking in Rajshahi district in Bangladesh.

Conclusion: The findings of the study have significant theoretical and practical implications. The study makes a theoretical contribution by unfolding the complex articulation of the factors that influence the acceptability of mobile banking in the existing literature and knowledge. This study advances the mobile banking literature stream in general business discipline as well as information technology area. On the other hand, the findings suggest that managers should reconsider the level of service price, and they may want a positive outcome on acceptance in the long run. If firm stakeholders participate in social events, they will be better informed of the company's policy and actions. As a result, managers must maintain accountability and justice in the management process, as well as provide complete and relevant financial and non-financial information to all stakeholders, particularly customers. System overload, Specific needs of customers, fixing the amount of service charges and hacking and carelessness transactions issues should be addressed with due care. But this research work is also confined to some limitations such as a small sample size, covering only a small town, using primary data only with a cross-sectional design etc.

Exploring the Cost and Accessibility of Delivery Healthcare Services in Mymensingh Division, Bangladesh

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Introduction: Higher costs of delivery care services can hinder access and increase home delivery rates, leading to higher maternal mortality rates in low- and lower-middle-income countries, including Bangladesh. However, there is limited research on the cost of accessing delivery healthcare services in these settings. The aim of this study was to explore the cost of delivering healthcare services in Bangladesh and the socio-demographic factors associated with it.

Materials and methods: A cross-sectional study was conducted in the Mymensingh division of Bangladesh, and a total of 1200 women who had given birth within one year of the survey were included. The cost of delivering healthcare services was the dependent variable, classified as low (0 to 13170 BDT) and high (more than 13170). Several socio-demographic characteristics of the respondents were considered as explanatory variables. Chi-square tests were used to identify factors associated with the cost of delivering healthcare services, and



multivariate binary logistic regression analysis was used to explore the effects of explanatory variables on the dependent variable.

Results and discussion/ implication: Approximately 53% of the total women reported they gave their most recent birth at home. Among those who gave birth in a healthcare facility, the majority had a caesarean section. The average cost of delivering healthcare services was 13170 BDT. The cost of delivery care was higher among women who gave birth in private healthcare facilities, followed by those who gave birth in upazila healthcare complexes and district healthcare facilities. The cost of accessing delivery healthcare services was 9.31 times higher (95% CI, 4.17-20.17) for women who had a caesarean delivery compared to those who had a normal delivery. Higher delivery care costs were also found among urban residents, women whose husbands had higher education levels, first-time mothers, and those who received at least four antenatal healthcare services.

Conclusion: The cost of delivering healthcare services in Bangladesh is very high, despite the government's target of ensuring access at the field level with minimal costs. This high cost may be associated with the current low rate of delivery of healthcare services in the country. Policies and programs should be implemented to ensure that the government's arrangement for providing delivery of healthcare services is functional and that the costs are affordable for everyone.

An Empirical Study on Patients' Satisfaction with Community Clinics Healthcare Services: Based on Exploratory Factor Analysis

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Introduction: Analyzing patient satisfaction is crucial for assessing the performance and accessibility of health services in light of the rising demand for healthcare. The opinions of patients are becoming more and more weighted in the formulation of policies. Therefore, it is important to regularly assess patient satisfaction because it is a useful indicator of healthcare quality. Even though health care management in developing countries appears to have mainly disregarded patients' opinions of their countries' health care systems. In order to improve healthcare service delivery in developing countries patients' voices must start to be heard more. Therefore, this study is patient-centered and identifies the aspects of service quality that are significant to patients. It also looks at how these aspects relate to patient satisfaction in the context of Bangladesh. The aim of the present study is to examine the factors influencing patients' satisfaction with healthcare services provided by community clinics in rural Kapasia.

Materials and methods: A cross-sectional survey was conducted from February to April 2019. In order to measure patients' satisfaction among randomly chosen samples in 11 unions of Kapasia upazila in Gazipur. The study was carried out using a pre-structured survey with 434 samples resulting in a 78.98% response rate. The questionnaire was designed as a 5-point Likert scale, with ordinal scores ranging from 1 = strongly disagree to 5= strongly agree. The content validity was used to determine the questionnaire validity. Using Cronbach's alpha coefficient, the questionnaire's reliability was examined. Exploratory factor analysis and correlation analysis were used to find the potential factors that might influence patient satisfaction.

Results and discussion/ implication: Health staff explanation about medicine and dosages received the highest rating from respondents ($3.86 \pm .39$) while meeting all my expectations received the lowest rating ($2.16 \pm .49$). The study has revealed that the 3 factors that affect the satisfaction of patients are health staff service attitude, basic amenities in waiting area, and overall impression by using Exploratory Factor Analysis (EFA). The three factors accounted for 25, 14, and 14 percent of the variation respectively. The Kaiser-Meyer-Olkin measure of sampling adequacy value of 0.73 shows that factor analysis is effective in identifying the potential factors influencing patient satisfaction. On all scales, only health staff service attitude earned mean scores of 3.02. Basic amenities in



the waiting area, and overall impression earned mean scores of <3. The study also found a significant interaction between the socio-economic variables and satisfaction in regard to community clinic services. That showed patients with higher education, higher income categories and service holder were dissatisfied with the community clinic services ($\chi^2 = 67.137$, p-value = .000; $\chi^2 = 67.564$, p-value = .000; and $\chi^2 = 63.442$, p-value = .000 respectively).

Conclusion: The three most affecting factors are health staff service attitude, basic amenities in the waiting area, and overall impression. To increase patient satisfaction, health administrators should prioritize the three aforementioned factors and put the right plans into action. The strategic steps required to address the demands of patients in the government healthcare sector are also discussed in the paper's conclusion.

Keywords: Community clinic, Factor analysis, Healthcare service, Patients' satisfaction, Rural Kapasia

Exploring the Impact of E-Business Deals on Cost and Client Service in the Healthcare Industry of Bangladesh

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Introduction: Bangladesh's healthcare industry has experienced significant changes in recent years due to the growth of the electronic business. Electronic Business (E-Business) refers to the use of electronic systems and technologies for the conduct of business online. These businesses have helped to reduce costs and improve customer service, as evidenced by a study showing a 20% reduction in administrative costs and a survey revealing that 82% of patients reported an improved experience with healthcare providers (BASIS, 2020; Hossain *et al.*, 2019). The implementation of electronic health records and telemedicine services has been particularly beneficial, as it has enabled healthcare providers to streamline their operations and offer remote consultations, thereby reducing the need for physical visits and saving time and money for both patients and providers (ITU, 2020).

Despite the various advantages of implementing electronic health systems, there are still obstacles to overcome. The implementation of electronic transactions in the Bangladesh health industry also poses challenges, such as the lack of IT infrastructure and digital literacy of health professionals. A study conducted by (Ahmed *et al.*, 2021) found that the lack of computer infrastructure and digital literacy among health professionals is a significant obstacle to the successful implementation of electronic business transactions. Moreover, there are concerns regarding data privacy and security, as electronic health records may be vulnerable to cyber-attacks and data breaches (Islam *et al.*, 2019).

This paper aims to assess the impact of business in the healthcare industry in Bangladesh, with a particular focus on costs and customer service. Through the analysis of scholarly articles and industry reports, it seeks to gain a greater understanding of the potential benefits and challenges of electronic business and their implications for policy and practice in developing countries. Ultimately, it seeks to provide insights that can inform decision-making in the healthcare industry in Bangladesh and beyond.

Materials and methods: This research conducted a comprehensive analysis of both primary and secondary datasets on the effects of e-business deals on cost and client service in the healthcare industry of Bangladesh. A mixed-methods approach was used to collect data for this study. The primary dataset included direct responses from consumers through an online questionnaire to better comprehend their behavior. A carefully crafted questionnaire was distributed to those surveyed. Firstly, a comprehensive literature review was conducted to identify the key factors that impact the adoption and effectiveness of e-business deals in the healthcare industry.



Secondly, data was collected from 400 online and 250 physical customers of healthcare services in Bangladesh and 10 major pharmaceutical companies through a structured questionnaire. The data collected from the questionnaire were analyzed using statistical methods to identify trends and patterns with factor analysis using SPSS. The data was analyzed using Descriptive Data Analysis to summarize and depict it. The main focus was to determine the factors that influence the effectiveness and acceptance of e-business deals. A KMO analysis was conducted to check the adequacy of the sample size for factor analysis. To investigate the correlation between the impact of e-business deals on cost and client service in Bangladesh, a correlation test was conducted.

Results and discussion/ implications: The findings of this study suggest that e-business deals have a positive impact on the cost and client service in the healthcare industry of Bangladesh. The analysis of the data revealed that e-business deals can help to reduce costs, improve service quality, increase transparency, and enhance customer satisfaction. The validity of the data was confirmed by the KMO measure of 0.601, which indicates sufficient information for analysis and Bartlett's test of sphericity resulted in a significant outcome ($p < 0.001$), suggesting that the data is suitable for further factor analysis.

The study also identified some challenges associated with the adoption of e-business deals. The main challenges identified were a lack of awareness among customers and healthcare providers, resistance to change, and security concerns. These challenges need to be addressed to fully realize the benefits of e-business deals in the healthcare industry of Bangladesh.

Conclusion: This study confirms the positive impact of e-business deals on cost and client service in the healthcare industry of Bangladesh. During the study, both empirical and theoretical contributions were significant. Empirically, the study provides evidence of the positive influence of e-business deals on cost reduction, improved service quality, and increased customer satisfaction. The findings contribute to the existing literature by addressing a gap in research specific to the healthcare industry in Bangladesh. Theoretical implications are derived from the study's identification of the key factors influencing the effectiveness of e-business deals. This study also highlights the importance of addressing the challenges associated with the adoption of e-business deals to fully realize the benefits of these technologies in the healthcare industry of Bangladesh.

Keywords: E-business, Cost, Customer service, Healthcare industry

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Analysis of Trade of Fertilizer Products of the BIMSTEC Member Countries

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Introduction: The main goal of the WTO is “to ensure that trade flows as smoothly, predictably, and freely as possible” (WTO, 2020). Here, the regional agreements can give further trade opportunities for the participating countries. The impact of these agreements on agricultural trade is strong as BIMSTEC (Bay of Bengal Initiative



for Multi-Sectorial Technical and Economic Cooperation) members maintain a healthy market protection level for agricultural products (Febriningtyas et al., 2018). BIMSTEC is a regional organization comprising seven member nations around the Bay of Bengal in South Asia and Southeast Asia comprising Bangladesh, India, Myanmar, Nepal, Bhutan, Sri Lanka, and Thailand. The organization aims to increase regional cooperation among its member countries in various areas such as trade, investment, technology, energy, tourism, and cultural exchange. The organization aims to enhance economic growth and development in the region through increased cooperation and integration. BIMSTEC consists of just seven member nations but holds a population of around 1.5 billion, nearly 24 percent of the world's total population. Moreover, these people of the BIMSTEC region are heavily reliant on agriculture, and their main foods are also inextricably linked with agriculture, like rice, wheat, fish, meat, and so on. BIMSTEC is strengthening the trade network among the member nations to ensure food security and overall regional development.

Fertilizers have a significant role to increase production and it has become a crying need as our population is growing rapidly and cultivable lands are decreasing day by day. There comes the need for the advancement and availability of fertilizers throughout the BIMSTEC region. Regarding fertilizer production, use, import, and export, countries are taking various approaches based on their specific needs and circumstances. Some countries produce fertilizer in a quantity that meets their demand and necessity where some nations have surplus production and can export it to countries heavily reliant on imports. Thus, BIMSTEC can play its dynamic role in ensuring higher fertilizer availability in terms of increasing food productivity around the member nations of BIMSTEC. As BIMSTEC consists the nations that are heavily reliant on agricultural foods and the significant role of fertilizer is acknowledged for ensuring higher food security and agricultural development, this paper focuses on how BIMSTEC nations are coming forward to increase the trade network of fertilizers among them and later with the other regions all over the world.

The study has attempted to analyze the export network of fertilizer products of BIMSTEC member countries. The specific objectives are: to examine the comparative advantage of fertilizer among the BIMSTEC countries using the Balassa Index, to investigate the intra-industry trade using the Grubel-Lloyd Index, and to determine the Centrality and Community structure of fertilizer export and import by the BIMSTEC member countries.

Materials and methods: For the study, the secondary data has been extracted from the OEC database (Accessed from: <https://oec.world/>) at the country level for the sample period of years 2000, 2005, 2010, 2015, and 2020. It has taken the fertilizer commodity [HS Code: 31(Harmonized System 1992 for 2-digit)] of BIMSTEC. Assuming the BIMSTEC nations as the source, the destination countries are grouped at the continent level. Only the continent Asia is subdivided into two groups: BIMSTEC and other than BIMSTEC, since all the member nations of the BIMSTEC club are within Asia.

To explain the comparative advantage this study applied the Balassa Index (Balassa 1965) and analyzed the intra-industry trade. The Grubel-Lloyd Index (Grubel, Lloyd 1975) has been used to investigate the fertilizer trade pattern among BIMSTEC countries. Different countries are represented as nodes, export relations between these countries are represented as edges, and the weights of each edge are calculated as the normalized value of exports. Further, this study used the Louvain Community Detection Algorithm to prepare the cluster of countries from the trade network and extracted the community structure of the said trade network (Blondel et al., 2008). The normalized export percentage of member countries to different source regions is treated as the weight of the network. The relative thickness of each edge in the export network signifies the dependencies of source countries to the destination regions.

Results and discussion/ implication: First, Myanmar and Bangladesh have the highest comparative advantages in all periods analyzed among the essential fertilizer exporters in the BIMSTEC, suggesting a high potential for competitiveness. Note that Thailand and India, despite being one of the biggest global fertilizer exporters, has generally decreasing and low comparative advantages. The Grubel-Lloyd indices indicate that Bangladesh captured the highest position in an intra-industry trade among BIMSTEC countries. The value of the clustering coefficient belongs to [0,1], and the higher the indication, the closer the connection between nodes in the network. The global clustering coefficient is 0.4454974 for export and 0.3586957 for import, implying that the



relations between countries are relatively less tight in the country-level network. In this study, the clustering coefficients are 0.6610699 (export) and 0.3586957 (import), respectively, for the fertilizer trade network of BIMSTEC countries at the continental level, which suggests the relations between countries are relatively tight in the network.

Conclusion: The result shows that Thailand and India have the most diversified Trade market for fertilizer, whereas member countries like Nepal and Bhutan have high centrality to a few source regions. Further, this study has applied the Balassa and Grubel-Llyod indices to explore the pattern of trade of fertilizer products among the member countries. The study concluded that there is significant scope to diversify the export market to avoid region-specific disturbances in international business.

Keywords: BIMSTEC, Clustering, Balassa index, Grubel-Llyod index

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Influences of Theater Practices in Higher Educational Institute: A Comparative Study with Maturity-Immaturity Model of Chris Argyris on Theatre Activist and Non-theatre Activist Students

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Introduction: It is the motive of educational institutions to make students confident enough to handle not only academic pressures but also the social pressures which exist and can appear in future. There appears a coalescence of past and present which leads to the future with a stronger base. A stronger base can be assessed with the level of maturity among the people. To assess the maturity level among people, Chris Argyris has developed a useful theory 'Maturity and Immaturity Model' that can specifically define all the related dimensions to being mature people that contribute to the development of a mature nation. This study has been conducted using the theoretical lens of Chris Argyris's model to compare personality differences of the students of the university level in terms of maturity and immaturity which has not been scholarly investigated earlier. The main purpose of this study is to identify maturity levels by analyzing the differences in behavior, mentality reaction, thoughts, feelings, and daily working practices between the theatre activist students and the general students at the universities.



Materials and methods: This study has been conducted using a qualitative approach that includes. In qualitative study, the observation method has been applied. The total number of students at Rajshahi University is more than 30000 and among the students, more than 100 students work for many renowned voluntary theatre organizations which are located at Rajshahi University Central Students' Union Bhaban (RUCSU Bhaban). To study theatre activist students through qualitative methods, one voluntary theatre organization has been selected named 'Anushilan' which is one of the famous and oldest theatre organizations founded in 1979 and still actively running its operations, as a field site. For qualitative inquiry, data has been collected from 44 students among them 14 were theatre activists of 'Anushilan' and 30 were general students who were in Masters' level. The convenience sampling method has been applied to select the participants in the qualitative part. In the case of qualitative study, observation data has been analyzed thematically and the data has been coded manually using Microsoft Word 2016.

Results and discussion/ implication: In qualitative inquiry, four major results have been found. This study finds that mind and body-stimulating activities are practiced inside the theatre organization such as physical exercise, perception upgrading sessions, impromptu/extempore activities, rotating job responsibilities, performance appraisal sessions (360-degree approach), and organized and thematic theatre activities. Subsequently, the study showed that theatre activities are a variety of sources of knowledge such as physical fitness, energy and its maintenance, voice and its appropriate utilization, the art of accent or pronunciation, developing distinct strategies for task accomplishment by confidence amplifying, concentration strategy, empathy growing, strong superior and unwavering control of self, diverse knowledge like self-exploring and utilization along with continuous improvement. Again, the study finds that theatre practices and knowledge bring a rapid change in personality such as making students more hardworking and active, love to be independent in every situation rather than being a burden to others, arise deep interest in mind to discover something new, increase self-awareness and control, develop diverse behavior, respectful to time and used to be long-term thinking, form super-ordinate personality. Finally, the study finds that the students who are engaged in theatre activities are more active, have diversified behavior, thoughtful in decision-making, have personalities with just-in-time practices, independent attitudes, deep interest in knowing, long-term thinking, being super-ordinate personalities and self-awareness and control than the general students at the university under study.

This study will contribute to the policymakers, managers, employers, and society to identify, use, and recruit mature person in their respective workplaces to promote the concept of employing the right person in the right place. Moreover, this study will contribute to the knowledge domain of existing literature.

Conclusion: This study provides evidence that theatre practices have a positive impact on maturity and personal and professional development. Future research could explore whether these benefits are sustained over time or if they diminish after graduation. Another limitation is that it does not explore the specific career paths that theatre activist students pursue after graduation. Future research could explore whether engagement with theatre practices has a greater impact on certain career paths or industries. This study focuses on theatre practices in general, but it does not differentiate between different types of theatre practices or programs. Future research could explore whether different types of theatre practices (e.g., acting, directing, technical theatre, improvisation session, exercise, review session, gossiping with guests, different event management, and volunteer) have different impacts on personal and professional development. Moreover, the result of this study may not provide generalization because of the lack of quantitative analysis of the large sample. In future, the quantitative method can be applied to have a general picture of the study and validation of the findings of the qualitative study.

This study provides valuable insights into the influences of theatre practices on the development of maturity in higher educational institutes and underscores the importance of incorporating such practices into educational curricula to promote well-rounded personal and professional development among students.



Factors Affecting Organizational Climate at Tertiary-Level Educational Institutions: An Empirical Study on Private University Teachers in Bangladesh

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Introduction: Tertiary-level educational institutions play an important role in building the citizens and society of a country. To build a smart Bangladesh, besides other components, the university's contribution is vital. The organizational climate ensures the goals of smart Bangladesh. Organizational climate is how employees feel about their work environment and how it affects them as people. In this study, the researcher investigates the factors of organizational climate which affect the private universities' teaching environment.

Materials and methods: There are 15,393 teachers in 102 private universities in Bangladesh, where the number of permanent teachers is 12,082. 261 responses were collected using a convenient sampling technique from the faculty members of different private universities situated in Chattogram. A structured questionnaire, both in hard copy and Google Forms, is used to collect the responses from the targeted respondents. A five-point Likert scale has been formulated to gather primary data. To construct the new factors, a sophisticated statistical tool called "Factor Analysis" is used, including Principal Component Analysis, PCA and Confirmatory Factor Analysis.

Results and discussion/ implication: The results of the study showed four new factors of organizational climate, such as: 1) Employee involvement 2) Innovation and creativity 3) Flow of Information and 4) Support of top management and peer group. This result indicates that total variables explain 69.652 % of the organizational climate of the private university in Bangladesh.

Conclusion: The implications of the study include the necessity of employee involvement, an innovative and creative environment, proper flow of information, and the support of top management and peer groups to ensure a smart organizational climate at the tertiary level of education. The present study has some limitations too. The sample size and area are narrow in this study. A wide range of areas would be included to get a more generalized conclusion on organizational climate at the tertiary level of education.

Keywords: Organizational climate; tertiary level educational institution; smart Bangladesh.

Creating Ethical Tech Savvy Business for Smart Bangladesh

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Introduction: Building a nation that is digitally enabled, more intelligent, technology-based, and more sustainable is the goal of the Smart Bangladesh vision and policy, which is developed by the government of Bangladesh. It seeks to harness the power of technology to improve the standard of living of all residents, generate new economic possibilities, and propel forward the process of sustainable development. The goal of constructing a "Smart Bangladesh" by the year 2041 will be attained through the development of "Smart Citizens," "Smart Economies," "Smart Societies," and "Smart Governments". It is essential to rethink business strategies in order to achieve the goals of both a smart economy and a smart society. The tech-savvy business strategy entails having the most recent and cutting-edge technology available to all in order to assist companies in operating in a manner that is more effective. This can involve employing the most recent software, having a website that is straightforward to visit, or making use of storage solutions that are hosted in the cloud. It is vital to have knowledge of tech-savvy business models in order to make investments in the appropriate technology for the primary activity of the business and to supply new products and services at a high rate of frequency. In this area, it is essential to conduct oneself ethically, in addition to developing a teach-savvy model for the business world. The role of ethics has grown increasingly important in the minds of both the consumers who engage with technology



and the executives who create and implement it as a result of the broad adoption of technology to facilitate the provision of products and services. As a foundational component of their digital transformation, the most astute businesses need to acquire the ability to comprehend and accept the complexities that lie at the confluence of human values and technological advancements. The research concentrates on a business model well-suited to a technologically advanced Bangladesh. This research shows how vital ethical issues are when working with this kind of framework. The study also highlights some real-life examples of Bangladeshi companies which are practising unethical business. This study uses qualitative methods to collect data, which is then presented in descriptive form.

Materials and methods: Descriptive analysis is one that assists in explaining, illustrating, or helpfully summarizing data points in order to facilitate the development of patterns that meet all of the requirements imposed by the data. Using both recent and previous data, this method seeks to establish relationships and patterns in order to draw conclusions. On the other hand, It is possible to define the qualitative research method of collecting data as the study of the nature of phenomena, and it is particularly suited to answering questions regarding the reasons why something is (or is not) observed, evaluating interventions that involve multiple complex components and concentrating on the enhancement of interventions. This descriptive research analysis and qualitative research method were perfectly matched for this study. All the data for this study was collected from secondary sources such as a wide variety of sources, including the websites of several government ministries, the internet, journals, newspapers, and earlier articles that were pertinent to the topic.

Results and discussion/ implication:

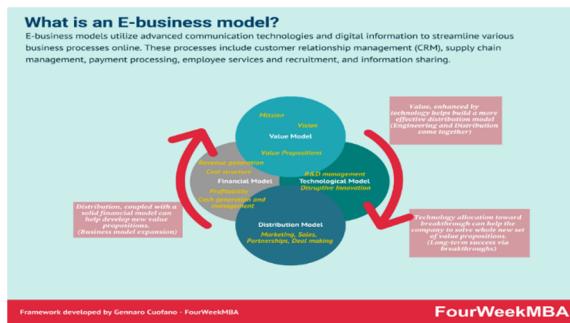


Figure 1: Internet or technology-based business model

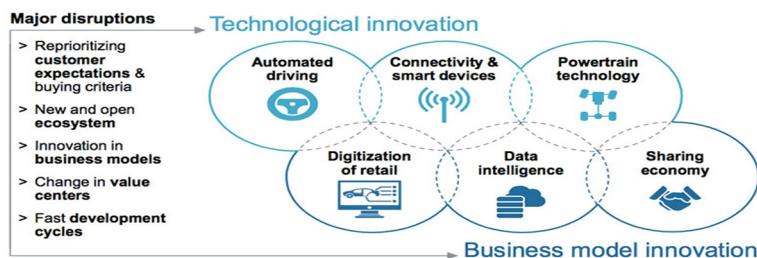


Figure 2: Technologically innovative business model

Both Figs 1 and 2 show that technology-based or tech-savvy business models change the work process of a business. Using smart devices, data intelligence, using technology in every sector of business-like value creation, distribution, management, etc. is essential here. The outcome of this research is that a tech-savvy business model should be described for the purpose of realizing Vision 2041 and utilizing ethics for a tech-savvy business strategy. Examples of unethical business practices can also help companies to reform in the future.

Conclusion: The practice of ethics in business helps to shield organizations from legal liability and ensures that they show proper courtesy to both their clients and their employees. The use of disruptive technologies can present an enormous opportunity for businesses to improve their levels of intelligence, agility, flexibility, and responsiveness. But technologies are quickly becoming an essential part of the operations of organizations before many individuals have taken the time to thoroughly evaluate the implications of their use. When employees utilize



certain applications, gadgets, and systems, it might present them with ethical conundrums, which is something that some executives are beginning to realize.

Keywords: Smart Bangladesh, Tech-savvy business models, Digital transformation, Ethical considerations

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The Role of Digital Advertisement and Influencer Marketing on Brand Equity

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Introduction: In recent years, influencer marketing and digital mass media marketing have become increasingly popular in Bangladesh, particularly among young people. Both forms of marketing have had a significant impact on brand equity among this demographic. Influencer marketing involves partnering with social media influencers who have large followings and a significant amount of influence over their audience (Liu, 2021). Brands collaborate with these influencers to promote their products or services to their followers, who may be more likely to trust and purchase from a brand if their favourite influencer recommends it. This has been particularly effective



in Bangladesh, where social media usage is on the rise and young people are more likely to trust the opinions of their peers and influencers over traditional advertising (Verma, 2018). Digital mass media marketing involves using online channels such as social media, search engines, and display advertising to promote a brand's products or services. This has become increasingly popular in Bangladesh due to the country's rapidly expanding internet access and smartphone usage (Chopra, 2020).

Both influencer marketing and digital mass media marketing have had a positive impact on brand equity among young people in Bangladesh. These marketing techniques have helped to increase brand awareness and brand recall, making it more likely that young people will choose a particular brand over its competitors. Additionally, these techniques have helped to create a sense of trust and loyalty between brands and their users. (Miltjen, 2019). As discussed above, with the advent of social media, the role of influencers and digital mass media marketing has become increasingly important in shaping consumer behavior. This study aims to investigate the impact of influencer marketing and digital mass media marketing on brand equity among young people in Bangladesh. The objective of this study is to determine the extent to which these marketing strategies influence brand awareness, brand image, and purchase intentions.

Materials and methods: This study is a quantitative research design that employs a survey questionnaire to collect data. The survey consists of questions related to exposure to influencer marketing and digital mass media marketing in relation to the brand equity of commonly purchased online products. The survey was administered online to a sample of 250 young people aged 18-30 years old living in Bangladesh. The data collected is analyzed using the statistical software SPSS and AMOS graphics. To specify the relevant items associated with each variable, factor analysis is used. In contrast, structural equation modeling (SEM) with the use of AMOS software is employed to test the driven hypothesis.

Results and discussion/ implication: The results of this study suggest that both influencer marketing and digital mass media marketing have a significant impact on brand equity. The study also found that the effectiveness of these marketing strategies varied depending on the type of product being marketed. For products that are more personal in nature, such as fashion and beauty products, influencer marketing was found to be more effective. For products that are more utilitarian in nature, such as electronic gadgets and appliances, digital mass media marketing was found to be more effective.

The findings of this study have important implications for marketers in Bangladesh. Marketers should consider using both influencer marketing and digital mass media marketing to create a strong brand image and increase brand equity. However, they should also consider the type of product being marketed and choose the most appropriate marketing strategy accordingly.

This study has several limitations. Firstly, the study is limited to a sample of 250 young people living in Bangladesh, which may not be representative of the broader population. Secondly, the study is limited to only two marketing strategies, influencer marketing and digital mass media marketing, and does not consider other marketing strategies. Thirdly, the study relies on self-reported data, which may be subject to bias and inaccuracies.

Conclusion: This study provides valuable insights into the impact of influencer marketing and digital mass media marketing on brand equity among young people in Bangladesh. The findings suggest that marketers should use a combination of both strategies to create a strong brand image and increase brand equity. However, they should also consider the type of product being marketed and choose the most appropriate marketing strategy accordingly.

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Nexus between Swift Guanxi and Purchase Decision in Livestreaming

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Introduction: Livestreaming has emerged as a popular and rapidly growing e-commerce channel, especially in developing countries, and with the increasing availability of affordable internet access, the demand for Livestreaming services has also increased in Bangladesh. Livestreaming is getting growing popularity among retailers as a new model of social commerce (Kim et al., 2021). As reported in Grand View Research (2021), the worldwide live-streaming market size is increasing rapidly; it was approximately USD 50.1 billion in 2020, compound annual growth rate (CAGR) is likely to increase at of 21.0% from 2021 to 2028. The study also emphasizes how livestreaming significantly affects consumer behavior when swift guanxi, a Chinese notion is embodied with growth, adding that the increasing demands for convincing contend along with increased usage of social media tools, is likely to boost the market growth for the projected time period. In a survey conducted by BigCommerce (2018), it was discovered that 82% of consumers prefer live video from a business to social posts and that 80% of consumers would rather watch a live video from a company than read a blog. In addition, 56% of customers reported that after watching a video of a product being used or shown, they were more likely to purchase it.

Along with Livestreaming's popularity, Swift Guanxi has emerged as an important factor in the success of these efforts. Swift Guanxi is the term describing the quick development of social ties between individuals or organizations, frequently made possible by social media platforms. It entails establishing rapport and fostering a sense of familiarity with individuals in a brief period of time and is founded on the principles of reciprocity, trust, and social exchange. Livestreaming allows vendors to quickly build Swift Guanxi with viewers using a variety of strategies, such as delivering personalized greetings, answering questions and comments, and employing humorous and interesting content. In addition, tie strength and customer engagement may operate as intermediaries between Swift Guanxi and actual purchase choices. Tie strength measures the degree of proximity between the livestream host and their audience, whereas customer engagement measures the degree of interaction and participation of viewers in the livestream.

Although there is limited research available specifically on the impact of livestreaming on buying behavior in Bangladesh, it is safe to assume that the global trends highlighted above are likely to hold true in the country as well. As such, businesses in Bangladesh can benefit from incorporating livestreaming into their marketing strategies to engage with their target audience and influence their purchasing decisions. Therefore, the purpose of the current study is to investigate the significance of Swift Guanxi in the context of livestreaming and how it affects customer purchase behavior. This study specifically addresses three research questions: (1) How is Swift Guanxi important in Livestreaming? (2) Does the Swift Guanxi convert into a real purchase decision? (3) Whether and how tie strength and customer engagement serve as a mediator between Swift Guanxi and actual purchase? Extending the above-mentioned research objectives or research questions, we propose a conceptual research model (see Figure 1).

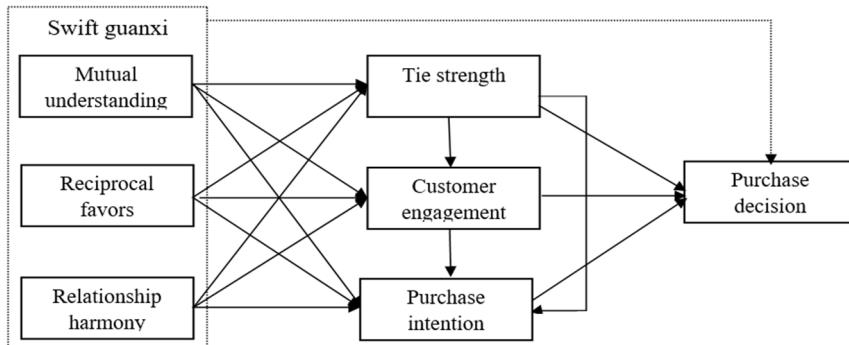
Materials and methods: The study uses a mixed-methods approach to address these research topics. First, a thorough literature analysis will be done to comprehend the idea of Swift Guanxi and how it affects purchasing decision. Second, to better understand how Swift Guanxi might influence purchasing decisions, primary data will also be gathered from customers in Bangladesh using a standardized questionnaire. In order to find potential relationships, the data will be analyzed using structural equation methods. The conceptual model was developed



from review of recent literature following the gap that no scarce efforts were found in materializing the swift guanxi's role in converting social ties, customer engagement into real purchase decision.

Results and discussion/ implication: Our study will potentially contribute to the several following

Figure 1: Conceptual research model



folds. First, the study can provide insights into the understanding and perception of Swift Guanxi in Bangladesh, which is a rapidly growing economy in South Asia. It can explore how the concept of Swift Guanxi differs from traditional Guanxi in Bangladesh and how it is perceived and practiced by businesses and consumers. Second, the study can identify the social and economic factors that influence the development of Swift Guanxi relationships in Bangladesh. These factors could include social networks and cultural practices, family ties, and economic factors such as income levels and social

mobility. Third, the study can examine how Swift Guanxi influences consumer purchase decisions in Bangladesh, including factors such as brand loyalty, trust in sellers, and willingness to pay a premium for products or services. Fourth, the study can examine the role of technology in facilitating the development and maintenance of Swift Guanxi relationships in Bangladesh. Finally, this knowledge will bring precious contributions for marketers and livestream hosts seeking to maximize the impact of their livestreaming efforts and leverage Swift Guanxi to increase customer engagement and drive sales.

Conclusion: Swift Guanxi plays a crucial role in livestreaming as it helps to establish and maintain relationships between live streamers and their audiences. This social connection is essential for building trust and credibility, which can ultimately influence purchase decisions. However, it is not enough for Swift Guanxi to exist solely within the livestreaming context; it must also translate into real purchase decisions. Tie strength and customer engagement can serve as mediators between Swift Guanxi and actual purchase, as they contribute to the development of a stronger and more loyal customer base. Therefore, it is important for businesses to foster Swift Guanxi, tie strength, and customer engagement in their livestreaming strategies to enhance their potential for converting social connections into tangible sales.

Keywords: Livestreaming, Consumer behavior, Engagement, Tie strength, Purchase decision

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**Extended Abstracts
on
Law**



Road to Safety: Legal Ways to Address the Key Behavioural Risk Factors Behind Road Crashes in Bangladesh

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Introduction: Improving the legal regime relating to road safety in Bangladesh is vital to national health, well-being, and economic growth. Road traffic deaths and injuries have emerged as a silent epidemic in Bangladesh. Some of the many reasons behind the failure to prevent the fatality in road traffic crashes in Bangladesh includes: weak road safety law and policy, limited execution and enforcement of existing laws, neglecting safety approach in legislations etc. Bangladesh presently suffers from a holistic law incorporating Safe System Approach and focusing on road safety issues comprehensively. The country will not get success in ensuring road safety without addressing the safety issues in legislative framework.

The purposes of this research are to review the present legislative frameworks relating to road safety to identify the gaps in the present laws and policies to regulate the key behavioural risk factors, suggest specific reform proposals to address those loopholes and find out opportunities to strengthen road safety legislations in Bangladesh.

According to the Centre for Injury Prevention and Research, Bangladesh (CIPRB) and the health ministry statistics 23,166 people die in road crashes annually in Bangladesh although the number of people injured or crippled through road accidents in the country is difficult to quantify because of underreporting. Road crashes cost 3% of its Gross Domestic Product (GDP) every year (Tajmim, 2023).

Significant contributing factor for road crashes in Bangladesh is behavioural risk factors. Using sub-standard helmet by the bikers and pillion, failure to wear seat belts by all passengers while driving, uncontrolled speeding, influence of drug and alcohol during driving, not using child restraint for adolescent are key behavioural risk factors while the present legal frameworks of Bangladesh lack to address these behavioural risk factors properly. A new helmet standard coupled with symbolisation of standard helmet and prohibition of import and sell of sub-standard helmet is necessary for the country. Similarly, fixation of seat belt standard and enforcement of seat belt law for all passengers could reduce the fatality rate. On the other hand, there is chaotic situation in speed management in Bangladesh now. Thus, a proper speed management is urgent to reduce road crashes at this moment. Likewise, the issue of driving under the influence of drug or alcohol is not well furnished in the current laws. Last but not least, the child restraint system is highly neglected in this country and most of the people not even aware about this system. As a result, a legislative reform is essential to address the above-mentioned key behavioural risk factors.

This study is crucial to identify the lacks in the existing legislative frameworks to ensure safety on roads and to suggest a way forward to overcome the detreating situation. There is no such study earlier which analyse the legislative gaps to address the key behavioural risk factors to reduce road crashes in Bangladesh. Reducing fatalities and decreasing mortality on roads will not be possible without having strong legal instrument and proper implementation of law. Thus, this study will be advocating for enactment of a new standalone law emphasizing on safety on road transport by inclusion of safe system approach. This research will also help the policy makers to change the thinking relating to road safety in Bangladesh.

Materials and Methods: The present study on the legislative gap analysis of road safety legislations in Bangladesh require participation from various stakeholders and policy makers. To achieve the objective of the study, the approach adopted includes reviewing and identifying gaps in the existing Act, Rules, and proposed policy and also consultations with different stakeholders in the form of one-to-one interviews and expert group meetings.

The available relevant literatures such as various legislation, research studies, various data on road crashes case studies and best practices relating to the study will be collected and analysed. Some of the relevant news appeared in media will also be collected and referred. The principal primary literatures surveyed include the following:

The Motor Vehicle Ordinance, 1983;

The Road Transport Act, 2018;



The Highways Act, 2021;
The Road Transport Rules, 2022.

Results and Discussion: In the Road Transport Act, 2018 and the Road Transport Rules, 2022 have inadequate provisions relating to key behavioural risk factors like they have provisions for helmet use for both the driver and pillion but it does not provide any standard for helmet. They simply shifted the burden to Bangladesh Standards and Testing Institution (BSTI) while the standard of helmet fixed by the BSTI is quite old and not compliant with the UN standard. Also, the BSTI has no testing lab at this moment whereas the laws also do not suggest any punishment for noncompliance of standard. As a result, the law enforcers (i.e police/BRTA) are also not aware about enforcement of standard helmet to save lives. Likewise, the above laws ban driving under influence of alcohol and other classified drugs but there is no guideline for the police to identify the influence of drug. Moreover, there is shortage of devices to detect the influence of alcohol/drug. Mandatory seat belt use for all motor vehicle have been provided in the laws albeit seat belt standard and ways to wear seat belt are not enumerated there. Furthermore, seat belt for rear seat passengers is overlooked by the law enforcers and there is no guideline for seat belt use for public transport (like bus) on highways. In addition, there is no detail mention about mandatory child restraint system for the adolescent. On the contrary, the speed management system is highly chaotic at this moment in the country as there is no maximum speed limit fixed by the concerned authority depending on various road types, conditions and vehicle types.

Moreover, the key legislations namely the RTA, 2018 and the RT Rules, 2022 do not include the safe system approach to ensure safety and have no provision to address the safety for the most vulnerable road users like pedestrians, bicycle riders and passengers of rickshaw.

Conclusion: Hence, enactment of a new law focusing safe system approach and five pillars of road safety is the sustainable alternative in the long run to minimise the risks of road crash and to build a safer road condition for Bangladesh. Otherwise, a chapter on road safety in the existing RTA could be incorporated for the time being to tackle the situation whereas some temporary measures can be taken through government orders, notification, official gazette, policy, guideline to handle the situation urgently like following the existing legal mandate a national and local speed limit guideline may be prepared and adopted to combat speeding. It is also critical to educate road users about safety issues through multimodal approach with cooperation of stakeholder including civil societies.

Acknowledgement: The author gratefully acknowledges the contribution of Mr. Md. Mostafizur Rahman for articulating some of the ideas of this research and Global Road Safety Project (GRSP) and Global Health Advocacy Incubator (GHAI) for funding this project.

Keywords: Road safety, Road crash, Law, RTA, Bangladesh

Are Child Actors Workers in Bangladesh? A Critical Legal Analysis

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Introduction: Child actors are children who perform in movies, TV shows and advertisements. They often start their career early under parental supervision and are deprived of a typical childhood due to their fame. In the entertainment industry, employers, parents and legal guardians sometimes exploit their age, ignorance and vulnerability. The Minimum Age Convention, 1973 (C. 138), and the Worst Forms of Child Labour Convention, 1999 (C. 182) prohibit the employment of children below 14 years and eliminate the worst forms of child labour (i.e. slavery, forced labour and trafficking). However, the age limitation for employing children is flexible when they are engaged in artistic performance (C. 138, Articles 2 and 8). Unfortunately, international laws fail to



explicitly define children performing artistically and render specialised safeguard measures for their employment. The number of children employed in the entertainment industry is rapidly increasing with the rise of numerous entertainment platforms, and Bangladesh is no exception. Bangladesh ratified both C. 182 and C. 138 and has a strict legal obligation to eradicate child labour. The Bangladesh Labour Act 2006 (BLA) already contains provisions restricting the employment of a child below the age of 14 (Section 2(63) read with Sec 34) but is silent on the employment of child actors. The research investigates whether the child actors in the entertainment industry are workers under the BLA. It is imperative to determine the definition and legal status of the child actors to secure their working conditions and protect them from the worst forms of child labour.

Materials and Methods: The legal research investigates whether the child actors are workers under BLA. It also examines the legal protection rendered to child actors in the laws of Bangladesh. The study is limited to children involved in print media platforms (movies, TV series and advertisements). This qualitative research is based on primary and secondary data and follows the legal research methodology. The primary data is collected from national and international legislations and judicial decisions, and the secondary data is collected from peer review journal articles, books, reports, blogs, newspapers, websites etc. The paper first analyses the international legislation defining child actors and guaranteeing their decent work conditions. Then it examines the compliance of Bangladesh with international standards by examining the national legislation. Finally, it explores the legal status of child actors in the BLA and other domestic legislation. The secondary sources are also contextually analysed in line with the objective of the paper.

Results and Discussion: C. 138 prohibits employing children below the age of 14 years but does not explicitly mention child actors. Nonetheless, the age limitation is flexible for artistic performances (C. 138, Articles 2 and 8), but the convention does not define the term. Hence, it is challenging to determine which types of performance qualify as artistic performance in the entertainment industry. Moreover, C.138 does not provide any specialised guidelines for employing child actors below 14 years and their decent working conditions like working days and hours, medical care, contract restrictions, wage, and guardianship laws.

Bangladesh lacks specialised safeguard measures for child actors in the entertainment industry. Even though the country ratified C.138, the BLA is yet to be amended. The BLA prohibits the employment of children below 14 (section 34) and contains no exception for artistic performances in compliance with C.138. Without the saving clause, employing children who are below 14 as actors results in a violation of BLA, sec 34. The BLA provides specific guidelines for employing children above the age of 14 years and secures their decent work conditions. Child actors above 14 are entitled to these rights. Sadly, the Film Development Corporation Act, 1957 (FDC Act) has no specific provision for child actors in the entertainment industry, includes no age flexibility for employing children for artistic performance, and contains no specialised protection measures to safeguard them. Therefore, employers in the entertainment industry in Bangladesh are violating sec 34 of the BLA by employing child actors under 14.

Even though the Constitution of Bangladesh (Article 28(4)) and the National Children Policy 2011 promote the formulation of specialised legislation for children based on the principle of best interest, it is yet to be formulated for the child actors. The existing laws are inadequate to safeguard their decent work conditions in the entertainment industry in compliance with C. 138 and C. 182. The child actors in Bangladesh are invisible in legislation and still remain beyond adequate legal protection.

Conclusion: Despite many child actors being actively involved in the entertainment industry, the BLA is completely silent on their explicit definition, recognition and rights. The FDC Act also fails to make any specialised provisions for their employment, working conditions and safeguard measures. Moreover, there is no special legal provision regarding employing children under 14 years for artistic performance, and consequently, the employers are violating the BLA while employing child actors below 14 years. Determining the legal status of child actors is imperative to safeguard their decent work conditions in the entertainment industry. The BLA and FDC Act should be adequately amended to render them better protection in compliance with international standards.

Keywords: Child actors, Bangladesh Labour Act (BLA), Artistic performance, Decent work



Knowledge, Practice and Response of Right to Information (RTI) Act: A Study at Jatiya Kabi Kazi Nazrul Islam University, Bangladesh

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Introduction: This study attempts to investigate the knowledge level and scenarios of practicing of Right to Information (RTI) Act among different stakeholders. It also tries to explore the response of authorities supplying the information to the stakeholders within and outside of Jatiya Kabi Kazi Nazrul Islam University, Bangladesh. The RTI Act is widely used all over the country, Bangladesh since its enactment in 2009. Dreaming to smart Bangladesh, after 14 years of RTI Act, it's a matter of question whether Right to Information is ensured or not in every institution in Bangladesh. As the study area, it's also significant to pay attention to the overall scenarios of using RTI Act at Jatiya Kabi Kazi Nazrul Islam University, Bangladesh. This study is an original empirical study which is significant because without ensuring right to information in an institution, it's not possible to dream to the smart Bangladesh. This study will help to the authority understanding the overall scenarios and finding major challenges and strategies spreading of practicing RTI Act at this university.

Materials and Methods: This is a mixed method study which include both qualitative and quantitative study. In the qualitative study, a Face-to-Face Survey is conducted to capture the scenarios of using RTI Act at university campus. On the contrary, in the qualitative method, Key Informant Interviews (KII) and Case Studies are conducted to collect the hidden stories related to practice and response of RTI Act in the university campus. The students, teachers and officers are the respondents of survey interview. Besides, the Deans, Registrar, Head of the Departments, Provosts, Directors of different institutions, and journalists are the respondents of KII and Case Studies. The total sample size of the study is 240 (Survey= 220, KII= 15 and Case Study= 5). The convenient sampling technic is used to conduct the entire study. The male-female ratio is considered and ethical issues are followed by the researchers during both data collection and data analysis periods.

Results and Discussion: This study has not been completed and it needs more time to finish all the tasks. However, the expected results of this study reveals that the knowledge level of RTI Act among different stakeholders is not satisfactory. The scenarios of practicing this Act is also not significantly positive. It found some trainings, seminars and workshops on using RTI Act among the officers but it's not satisfactory. It is a matter of hope that, the current university authority assigned the Information Officer and Appeal Officer in among the officers of the university. This Act is going to be popular among all gradually, but needs more attention.

Conclusion: Right to Information (RTI) Act widely used in Bangladesh. Every people has the right to seek information from every institutions if necessary and the particular institution is bound to supply the information to the applicant. It's a human right. In this study, it's expected, RTI act is not popularly used at Jatiya Kabi Kazi Nazrul Islam University, Bangladesh. There are lots of limitations of using RTI act among the officers, teachers and other stakeholders. But its exception that, the authority is trying to make awareness among different stakeholders arranging seminars, workshops and trainings. This study used good governance theory to relate with this study. If the authority use the RTI Act, the accountability, transparency, and reducing corruptions would be ensured. However, RTI Act is significant to all the stakeholders to ensure their human rights.

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Keywords: Right to Information (RTI) Act, Human Right, University, Bangladesh



Assessing the Awareness about the Constitution of Bangladesh: An Empirical Study on the Secondary and Tertiary Level Students in Mymensingh District.

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Introduction: Constitutionalism is a crowning achievement of modern human civilization. In the contemporary world, almost all countries have a constitution that is fundamental and supreme law of the state. It is supreme because it is framed by the direct or indirect approval of the people. It is the source of all other laws and any laws which are inconsistent with the requirement of the highest law shall be void. Bangladesh has framed her own Constitution in 1972 immediate after the independence in 1971 Pakistani unjust and treacherous rulers. The Constitution of Bangladesh is not merely a lengthy or frozen document rather it is the embodiment of feelings, emotions, aspirations of millions of martyrs that lead to shed their bloods for their own country. But skipping to modern day the students, professionals except law backgrounds are constantly behind the knowledge of the Constitution, less desire to the Constitutional issues. Nonetheless, it should be a fundamental course from secondary to tertiary level student because it guides the three branches of government in day-to-day operation, demonstrating that what the Constitution means to the people of Bangladesh. Apart from that, the Constitution is not kept in the library of the educational institutions like other reference materials. It is true that no research project has been undertaken on this topic, but the situation is same in all the districts of Bangladesh. Regardless of scope and limitations, if the study project finds out the actual awareness rate of the Constitution in Mymensingh District, it is hoped that it will provide recommendations to the appropriate authority for making the Constitution available in the library and for taking initiatives to create awareness among the students regarding the Constitution and Constitutional issues.

Materials and Methods: This is an empirical type of research that adopts both qualitative and quantitative approach in analyzing the issue. Additionally, it uses information from both primary and secondary sources. Primary data is collected from the students and concerned educational institutions applying the interview method, questionnaire method, focus group interviews, and first-hand observations at educational institutions in Mymensingh District. Seven Upazillas among thirteen Upazillas in Mymensingh are selected in a simple random sampling method in this regard. Provided that information collected from participants and informants using snowball sampling method. The researcher was fully aware to maintain a check and balance between urban and local area. Secondary data is collected from peer-reviewed journal articles, books, international, government, and non-government organization reports, and grey literature, including some articles published in electronic and print media. Therefore, data gathered using quantitative methods, structured research instruments, and forms of number and statistics are arranged in tables, charts, figures, or other non-textual forms with care. Then the collected data is analyzed systematically to draw findings and recommendations. Before drawing recommendations expert opinions from legal scholars like professionals, jurists, practitioners etc. are considered with care.

Results and Discussion: I have already gone through the 60 educational institutions including Schools, Colleges, Madrashas and Universities in 4 upazillas to find out how far students, from secondary level to tertiary level, are acquainted with the Constitution of the People's Republic of Bangladesh. It has been discovered that 98 percent of secondary level students did not see the Constitution, and 85 percent of students here do not know what the Constitution is. It seemed to me interesting that 40 percent students among 98 percent aforementioned told that they had seen the Constitution but when I have asked that what is the colour of the cover page of the constitution, then they were silent. But the number is somewhat increased in intermediate level students. In that case 30 percent students are familiar with the Constitution but here 90 percent students did not see the constitution. In the graduation level 80 percent students know what the Constitution is but 83 percent students did not see the constitution. When I have asked, "Have you seen the constitution in your educational institutions library?" almost 95 students answered negative. But they are interested to know the Constitution and Constitutional issues. The most important aspect of this research is that among 60 educational institutions only 6 institutions have Constitution in their library which is only 10% in total number. As this project is running, the percentage may be changed if another three upazillas are explored.



The research project desires to draw the attention of the concerned authorities to require initiatives enriching the syllabus with Constitution and Constitutional issues and the library is equipped with Constitution and Constitutional references. Apart from this, the law teachers, lawyers, and law graduates are interested to arrange seminars, workshops, and training sessions on the Constitution and Constitutional issues to enrich the students with the basic idea of the Constitution.

Conclusion: The Constitution of Bangladesh is the solemn expression of the will of the people and of course supreme law of Bangladesh. Every country has aspirations which are particular and personal to its people, a distinctive tradition and culture as well as its own problems. As the expected results is below than satisfactory, we should create awareness among the students' arranging seminar, workshops or lecture series on basic ideas of Constitution and Constitutional issues. The students thus come to know the actual spirit of drafting the Constitution. Besides the students will be introduced with the basic tenets of the Constitution are upheld by the three organs of Government each one acting independently of the other for the common good.

Keywords: Constitution, Constitutionalism, Awareness.

Law and Economics of Positive Discrimination under Constitution: Bangladesh Context

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Introduction: Though positive discrimination under The Constitution of Bangladesh is a legal practice, it demands to be discussed in the lens of Economics. Positive discrimination is a term that refers to a collection of schemes and activities that have been implemented by the Government and the community as a whole in order to include specific groups of people based on factors such as their caste, creed, gender, etc.(Pant, 2021). The field of economics, in general, offers a behavioral framework to explain how individuals react to legal rules(Cooter & Ulen, 2011). Article 27 of the Constitution sets forth the general principle of equality, which prohibits any form of classification that is arbitrary or irrational (Islam, 2012). On the flip side, Article 28(4), 29(3), and 65(3), respectively, contain provisions relating to positive discrimination, allowing preferential action for some portions of citizens. A rational human being always intends to maximize his own benefit. Hence, while certain people get preferential treatment, others deserve an economic explanation for such positive discrimination. The objectives of this study are to explore two questions: first, what are the impacts of these legal rules on the relevant actors, and second, whether or not these impacts are desirable from a societal standpoint.

Methods and Materials: The study was conducted using a qualitative phenomenological approach.

Instrument Development: Legislations regarding positive discrimination were taken from The Constitution of Bangladesh. We adopted pertinent economic principles, theories, and doctrines for economic analysis.

Study setting: A comprehensive study of existing literature was conducted.

Results and Discussion:

1: Normative or Positive Economics?

Normative or welfare economics makes value-based normative recommendations for what ought to be. Positive economics makes objective, demonstrable statements about what is instead of how things should be(Schotter, 1994). In modern English, normative economics is interpreted as "applied social ethics." Over the past two centuries, utilitarianism has influenced social ethics(Kolm, 1994). Utilitarianism is the belief that activities are right if they are desirable or advantageous to the majority. Positive discrimination is upheld by utilitarianism, and Rawls' theory of justice serves as its economic foundation. Therefore, it is prudent to discuss "positive discrimination" under normative economics rather than positive economics.

2: In Compliance with Rawls' Theory or Not?



Generally, when evaluating the utility implications of distributional inequalities, academics invoke Rawls' Theory of Justice, 1971(Parisi, 2004). The best illustration of the applicability of Rawls' theory is positive discrimination, which emphasised that attention should be paid to those who are placed in less favorable conditions rather than market demand if the administration wants to treat all people equally and create a congenial atmosphere in society by giving equal opportunity to all(Surovtsev & Syrov, 2015). Rawls says, "those with similar skills and talents should have similar life chances." In order to achieve fairness, the state must prevent "excessive accumulations of property and wealth" and sustain "equal opportunities"(Taylor, 2009). But in Bangladesh still now equal opportunities among different sections of people have not been ensured, excessive accumulation of property and wealth is still visible. So, the provision of positive discrimination under the aforementioned constitutional provisions comply with Rawls' theory.

3: Efficiency of Positive Discrimination under Pareto Criterion

An economic status is Pareto efficient when it is impossible to redistribute the resources to make someone better off without making someone else worse off(Popa, 2007). Pareto improvement occurs when a resource reallocation makes one person better off while leaving others in the *status quo*. Pareto efficient points are those where no Pareto improvement is possible. Article 27 of the Constitution announced that all people are equal before law. Hence, any preference for any portion of citizens makes the others worse off. The touchstone of efficiency of positive discrimination is whether such preference happens by keeping the rest portion in *status quo* position or not. The provisions of Article 28(4) and 29(3) make some portion of society better off and make other others worse off. For instance, quota system, special legislation for women and children. According to Pareto efficiency, Articles 28(4) and 29(3) are inefficient since they do not improve the condition of particular peoples by maintaining the others in *status quo* position. Article 65(3) is economically a Pareto improvement condition as it makes a portion better off by keeping the others in *status quo* position.

4: Cost-Benefit Analysis

According to Galanter, The positive discrimination program's design prevents assessment of monetary cost-benefit(Galanter, 1991). However, he makes his significant judgments after a basic positive discrimination evaluation. Based on his decisions, some findings in Bangladesh perspective are as follows:

- a. The great majority of backward people are not directly impacted by affirmative action, however, reserved sectors raise the number of families emancipated from knee-crooking positions.
- b. The scheme has had substantial redistributive effects, as access to education and employment is now more widely distributed across the spectrum of disadvantaged sections than before, although redistribution is not distributed evenly among many beneficiary groups.
- c. Positive discrimination has made beneficiary groups and their issues evident to the educated society, but it has yet to raise concern for their inclusion beyond government policy.

Therefore, Galanter concludes that positive discrimination has been partly successful(Deshpande, 2006). The affirmative action program and the gaps and inequalities that it was intended to solve need to be examined in more detail, taking into account both the direct and indirect benefits and costs(Joseph & Coleman, 1997).

Conclusion: When the provisions regarding positive discrimination are brought into any Constitution may raise questions about their effects on beneficiaries and if they are justified. Here we analyzed these two issues from the perspective of Bangladesh. This study synthesizes positive discrimination within the scope of positive and normative economics. It also assesses whether the legal provisions comply with the Rawls' Theory of Justice under Welfare Economics. This study has shown whether these rules are efficient pursuant to Pareto Efficiency. Finally, the schemes, taken based on positive discrimination, which are not economically efficient, their economic justification has been given by means of cost-benefit analysis. Economic analysis has not been conducted on the view of Reverse Discrimination.

Keywords: Positive Discrimination, Equality, Welfare Economics, Efficiency, Cost-Benefit Analysis

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Meme Culture in Bangladesh: “My Right Ends Where Yours Begin”, From Freedom of Expression to Undesirable Consequences in Digital Age

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Introduction: We are what we are because of genes; we are who we are because of meme. (*Memes 101: How Cultural Evolution Works*, n.d.) In today's digital age, memes have become a ubiquitous form of communication and expression that transcends borders and cultural boundaries, and Bangladesh is no exception. Meme culture has exploded in Bangladesh in recent years, with social media platforms like Facebook and Instagram being the primary channels for meme dissemination. With Bangladeshi netizens using them to express their opinions on various issues ranging from politics to pop culture, memes have become a powerful tool for social commentary and political satire. But sometimes these can cross a line, leading to real-world consequences. In Bangladesh, the right to freedom of expression is guaranteed by the constitution, but these right ends where it infringes on the rights of others. This delicate balance between freedom of expression and respecting others' rights is often challenged in the context of meme culture.

In this paper, we will explore the phenomenon of memes in our society, their potential for both harm and good, the responsibility that comes with their use, as well as the legal and ethical implications. We will examine notable cases where memes have led to crime, defamation, and harm, adding examples of memes being used as a means of protest and social commentary. Ultimately, we will argue that the power of memes lies not only in their ability to entertain but also in the fact that the right to free expression must be balanced with the need to protect the rights of others.

Materials and Methods: The study's methodology blended a descriptive and analytical approach and relied on an array of sources. Parliamentary statutes, court rulings, books, journals, online sources, and media articles served as the analogies for this dissertation. The following were combined to shape a thorough study of Bangladesh's Meme Culture:

Qualitative Analysis: Conducted qualitative analysis of online content such as memes and social media conversations to identify themes, patterns and cultural nuances surrounding meme culture in Bangladesh. Legal and Ethical Framework Analysis: This study examined Bangladesh's legal and ethical frameworks for freedom of speech, defamation, and other related topics and evaluated how they pertain to meme culture.

Case Studies: Examined noteworthy instances where memes led to unfavorable outcomes, such as defamation, hate speech, or illegal activity, and evaluated the ethical and legal ramifications.

Literature Review: A thorough review of existing research and literature on meme culture in Bangladesh, including relevant case studies, legal and ethical frameworks, and social and political contexts was conducted.



Comparative Analysis: Based on parallels and variations in cultural, legal, and societal contexts, a comparative analysis of meme culture in Bangladesh with that of some other nations was conducted. Furthermore, by analyzing the results, I gathered a lot about Meme Culture in Bangladesh including its various dimensions which enabled me to draw the outline of my study.

Results and Discussion: The right to freedom of expression is guaranteed by Article 39 of the Constitution of the People's Republic of Bangladesh, "subject to reasonable restrictions imposed by law." Additionally, Articles 19 and 20 of the International Covenant on Civil and Political Rights contain the right to freedom of expression (ICCPR). Plus, the freedom of opinion and expression is guaranteed by Articles 4 and 5 of the Convention on the Elimination of All Forms of Racial Discrimination (CERD), Articles 12 and 13 of the Convention on the Rights of the Child (CRC), and Article 21 of the Convention on the Rights of Persons with Disabilities (CRPD). However, this right comes with multiple limitations.

The essential tenet "My Right Ends Where Yours Begin" recognizes that while we each have some unique rights, we also must respect the rights of others. This idea becomes more crucial in the context of meme culture in the digital age. Memes are frequently used in ways that blur the line between free speech and hurting other people. For instance, a meme may contain inaccurate or deceptive statements about someone's personal or professional life, or it might exploit that person's name or image in a way that is meant to mock or embarrass them. This can damage the person's reputation and result in social exclusion, a loss of employment potential, or other unfavorable outcomes.

Memes empower people in Bangladesh to share their opinions easily and cheaply on a variety of topics without worrying about censorship or retaliation. Nevertheless, despite potential perks, several adverse factors must be taken into consideration. The potential for negative preconceptions and false information to be perpetuated via memes is one of the main problems. Additionally, in the absence of regulations, memes occasionally transgress moral borders and insult particular facets of society. On top of that, there are worries that memes are being used by extremist groups in Bangladesh to spread hate speech and their ideas. The absence of accountability in Bangladeshi meme culture is another problem. Since memes are frequently made and shared anonymously, it can be challenging to hold creators accountable for the content they create.

On legal sides, the sharing or publication of any data in digital media that is offensive, menacing, or simply fraudulent is addressed in Section 25 of the Digital Security Act, 2018. Additionally, Section 29 states that distributing or publishing any information in electronic form with the intent to slander a person is a punishable offense. The Penal Code of 1860's Section 499, however, governs what would be considered "defamation." Furthermore, under the Pornography Control Act of 2012, the act of defamation could be punished if it resulted from the usage of pornographic materials.

Although using memes as a form of expression is a fundamental human right, a lack of digital literacy can lead to incitement to violence, hate speech, defamation, obscenity, and threats to national security.

Conclusions: It is vital to strike a balance between free expression and responsible use of memes, through education and awareness-raising about their potential impacts. Memers should be aware of specific obligations and restrictions as with any form of expression or communication in order to avoid disobeying the law or hurting other people. Memers should be subject to several limitations, including: 1. Respect for the laws that are relevant to them, such as those that prohibit hate speech, defamation, and inciting violence. 2. Be mindful of other's privacy rights and refrain from revealing their personal information or photographs without permission. 3. Respect for other people's intellectual property rights, such as the ones on copyrighted text or photos. 4. Avoiding harassment or cyberbully, including the use of memes to target specific people or organizations. 5. To check that the information provided via memes is accurate and not deceptive, especially when it comes to well-known people or significant public topics. 6. Evaluate cultural sensitivity while sharing memes, especially if they contain offensive or inappropriate content.

Overall, the limitations placed on memers should be founded on the virtues of decency, respect for others, and lawfulness. Memers must make sure that they are exercising their right to free expression in a way that is beneficial, moral, and legal by adhering to these directions. Furthermore, there is a need to develop guidelines and regulations to ensure the responsible use of memes in public discourse. Additionally, encouraging digital literacy and critical thinking abilities can help people understand the nuances of meme culture and assess the



appropriateness and authenticity of the memes they come across. Together, authorities and civil society groups must create a comprehensive strategy for controlling meme culture without compromising freedom of expression.

In conclusion, it is up to all of us to make sure that meme culture remains a force for good and not a cause of turmoil and harm as it continues to develop and flourish.

Keywords: Meme Culture, Effects, Freedom of Expression, Limits in Bangladesh

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The Unsupervised Business Practices Through Online Market Platforms Causing Barriers to Sustainable Economic Growth: Need for Legal Reforms

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Introduction: The main ethos behind SDG goals is to recognize that any action in one area can impact results in others. The goals are focused on attaining a balanced and all-inclusive development which will ensure a harmonious relation between social, economic, and environmental feasibility. To maintain a sustained economic growth through online market and to safeguard such business practices which have gained immense popularity during the COVID- 19 pandemic a set of legal rules is required. But unfortunately, the required standard of legal development has been failed to emulate the rate of rapid digitalization and AI revolution in Bangladesh. The vacuum is getting greater with the passing of time and because of this numerous fraud cases are being occurred. The age-old legislations regarding sale of goods and contractual liabilities are required to be updated in attending and defining virtual business conducts.

Materials and Methods: This paper through data analysis and qualitative method of research will focus on the urgency of legal reforms and protection mechanism for conducting online business.

Results and discussion/ Implication: The lack of monitoring and infrastructural developments is encouraging more illegal practices such as misrepresentation in online advertising, business frauds and tax evasion. The E-commerce Association of Bangladesh (E-CAB), a welfare organization for the marketeers practicing e-commerce though helping the companies to unite and exchange views has no authority to supervise the transactions. Moreover, the increased practices of online business transaction through social media platforms such as Facebook, Instagram etc. have made it a concern in recent times. The people in cities being locked down in their houses at the outset of the pandemic have saved their lives mostly buying goods from online shops. On the other hand, people at home took endeavor to run small business through online social platforms more freely than ever. It has allowed many people economic solvency and saved them from the harsh impact of global economic distraught because of Corona virus outbreak. But the worry pertains to the absence of supervision of such transactions. Who will oversee if there is any illegal transaction or frauds being committed? The platforms do not require any verified information from the marketeers to start an online shop. Besides, most of the shops do not have any e-BIN number which let the sellers to evade taxes. So, a separate business world has been created online which is left unattended by the laws of the land.

Conclusion: For controlling above mentioned illegal business activities which are creating obstacles to achieve the sustained growth of economy and productive employment in a developing country like Bangladesh.

Keywords: Legal reforms, sustainable economic growth, Illegal business practices, online market, social media.



Pharmaceutical Patents under the TRIPS Agreement and Its Potential to Protect Public Health during Pandemic in Bangladesh

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Introduction: This study examines the provisions of the World Trade Organization Agreement on Trade-Related Aspects on Intellectual Property Rights (TRIPS) and the legal regime of Bangladesh as to pharmaceutical patents. It interprets them from their relationship and suitability to the protection of public health in Bangladesh particularly during pandemic. This study argues that the minimum standards setting by the TRIPS Agreement as to pharmaceuticals has been in ill-designed with the purpose of serving the Global North. Because this Agreement does not consider different developmental and conceptual understanding of states divided substantially on political, social, economic, and other grounds. Again, the old-aged legislation of Bangladesh in this regard has created a double bar in flourishing a research based pharmaceutical sector. Due to this the country still bears the colonial concept of intellectual property rights. Thus, the concern regarding protection of public health in Bangladesh originates simultaneously both from national as well as international level. Consequently, the country may face difficulties to protect public health.

It is to be noted that indications, Agreement is set to offer uniform and extensive protection of intellectual property rights (IPRs) to trademarks, patents, copyrights, industrial design, trade secrets, geographical indications and integrated circuit industrial designs.

Part II of the TRIPS Agreement offers protection to any inventions, whether products or processes, including pharmaceuticals. This Agreement also poses restriction on compulsory licensing of patented products as well as circumscribes flexibility clauses. Thus, it undervalues the needs of developing and least developed countries (LDCs) by offering same standard setting for all member countries on the one hand and providing restrictive measures on compulsory licensing on the other. In this backdrop, protection of public health in a low-income country like Bangladesh becomes an issue of debate with the imposition of IPRs protection standards, especially during pandemic. This situation demands a wised reformation in the current concept of pharmaceutical patents under the TRIPS Agreement based on participatory and equity-promoting principle. This study recommends that Bangladesh needs to frame appropriate legislation, take initiatives for flourishing a research based pharmaceutical sector, effective surveillance on the activities of manufacturers of drugs and development of infrastructure for promoting generic drugs.

Material and Methods: This study is generally based on the qualitative research methodology consisting of primary and secondary sources. The primary sources include international conventions, domestic laws and regulations and other foreign statutes. As a secondary source, this study uses textbooks, treaties, commentaries on statutes, dictionaries, research articles, national and international journals.

Results and Discussion: For this paper, I have studied scholarly writings. These writings acknowledges that the TRIPS provisions as to pharmaceuticals are not on equal footing. It promotes the interests of developed countries more particularly of their multilateral corporations. In doing so it disregards the interests of the Global South. Hence the issue of public health and access to essential medicines in these countries are not covered successfully under this Agreement. Again, Bangladesh has an enriched pharmaceutical sector by using TRIPS flexibility clauses which manufactures patented drugs. However, it has short of manufacturing generic drugs. The country also possesses colonial concept of pharmaceutical patents. The cumulative effect of these problem may be that Bangladesh may face obstacles to protect public health in near future if appropriate and immediate actions are not taken. This writing critically evaluates the present situation in this regard and make recommendations to get rid of these problems.

Conclusion: Bangladesh needs to have a vigorous outlook in order to extract the maximum benefits from the TRIPS flexibility clauses in pharmaceutical sector. Again, appropriate legislative and other measures should be framed for a research-based pharmaceutical sector to protect public health.



Combating Cybercrime in the Financial Sector: A Study on Problems, Preventions and Cyber Laws of Bangladesh

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Introduction: Crime, which has historically been rooted in the physical world, has been moving more and more into the informational realm during the past decades. Since the days when commodities were delivered by stagecoach, robbery has altered to keep up, even to our contemporary equivalent—credit and debit cards. This is because crime exists always but it changes its patterns. Theft of credit card numbers, web-based attacks, data breaches, denial of service, etc. is now a widely known risk. Cyberbullying, fraud, abusive e-mail, cyber stalking, and hacking of email id are the most prevalent types of internet crime nowadays. According to UNCTAD, out of 195 nations, 156 have enacted cybercrime legislation to secure, to protect the data. However, only a few Asian nations, such as China, Vietnam, India, and Singapore, have specific laws to govern cyber delinquencies, while the other countries have only general laws focusing on the protection of citizens' personal information, the information of governmental institutions, and the information of businesses engaged in electronic commerce. Though Bangladesh is a party to the International Covenant on Civil and Political Rights (ICCPR), 1966, and Article 17, of this article, provides that no one shall be subject to arbitrary or unlawful interference with privacy, also Article 43(B) of the Constitution of Bangladesh, 1972, have safeguards the citizens' privacy in correspondence and communication but still, we have no formal laws relating to the commercial sector and the protection of the data of customers. family, home, or correspondence. The existing legal structure is not sufficient to cope with the newly manifested economic threats to Bangladesh.

Materials and Methods: The research has been conducted by deductive research methodology where existing laws related to the protection of cybercrime have been gathered and the problems during implementation have been analyzed through case studies and some secondary research.

Results and Discussion/ Implication: The paper will show the current situation of the economic organizations of Bangladesh. There are 61 scheduled banks in Bangladesh established under the Bangladesh Bank Order, of 1972 and the Bank Company Act, of 1991. Amongst them are 43 private commercial banks, 10 Islamic Shariah-based Private Commercial Banks, and so on. There are also 5 non-scheduled banks. To protect internet security this bank has to follow the Guidelines on ICT Security

For Banks and Non-Bank Financial Institutions published in May 2015 by Bangladesh Bank. The aim of this paper is to find out the problems in the implementation of the law and find out the gap between law and practice.

Conclusion: In this article after attempting to define cyber-crime, we examine the problems that have played a major role in increasing financial cyber-crime in Bangladesh. We will also examine the loopholes in cyber laws related to financial organizations existing in Bangladesh to combat economical cybercrimes. We also look at the challenges of identifying and quantifying the ratio of economic cybercrime, the approaches taken to try and punish or prevent it, and the efficacy of these measures. The main aim of this paper will be to propose some guidelines for the financial sectors to protect their data and other valuables in reference to the law practices in other developed countries.

Keywords: financial organizations, hacking, internet banking

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Laws Relating to Women Trafficking in Bangladesh: A Comparative Study with Saarc Countries

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Introduction: The concept of women trafficking is defined legally by the requisite traits it exhibits, such as recruiting, transporting, harboring victims through force, fraud, and other coercion to exploit them. It is a growing problem in both Bangladesh and the rest of the world, which has made it imperative to tackle the threatening issue. Bangladesh has a particularly high rate of exploitation of women, with some women sold for as little as 65 dollars. The efforts to combat such an appalling fate are examined considering the desperation of those who face it. Poor public health, disruptions of communities, and a diminished level of social development are some of the costs to society. As a result of victimization by human traffickers, women are suffering from adverse physical and psychological health conditions, as well as social disadvantages. This research will focus on the laws of SAARC countries and will seek to analyze the present status of Anti-Women trafficking laws in SAARC countries and how effective those laws are in Bangladesh compared to other SAARC countries? The objective of this present research will be focused on examining the effectiveness of Anti-Women trafficking laws in Bangladesh by a comparative study with the laws of other SAARC countries.

Materials and methods: The research is a doctrinal study that relies on desk work. A comparative study has been conducted among the Anti-Women trafficking laws of SAARC countries to assess the effectiveness of the anti-trafficking legislation in present society. Secondary sources were used to collect most of the data which included research reports and publications of various organizations working on women trafficking, as well as journals, reports, booklets, and newspaper clippings. To provide readers with a deeper understanding of the problems of women trafficking, existing laws were studied in a tabular form.

Results and discussion:

1. Anti-Women Trafficking Laws in SAARC countries.
2. Punishments for trafficking under different laws of SAARC countries

Findings: 1. Due to the absence of liability on the part of the investigating authority to complete the investigation within the stipulated timeframe, it takes longer to solve one case when there is a large case log.

2. The existing laws do not have a sufficient penalty policy because they don't create a fear among the traffickers that will prevent them from engaging in such heinous behavior.

Another reason for delayed relief is a lack of an effective and efficient investigation team which gives the traffickers a means of escape.

Recommendations: Imposed liability on investigating authority: Existing laws should impose liability upon the investigating authorities so that they are obligated to complete their investigation within time frame and are obligated for their actions.

Adequate punishment: Current punishment under the existing provisions in case of trafficking are not adequate required to the amount of mental and physical injury to the victims. So, the provisions on punishment should be amended.

Efficient investigating team: It takes a lot more creativity and effectiveness in capturing a trafficking racket compared to a murderer so the team investigating a trafficking case should be trained differently and uniquely to work in such cases with expertise.

Conclusion: As a global phenomenon, the Government of Bangladesh along with NGOs, INGOs, and Civil Society Organizations should take steps to eliminate this curse from our society. Most trafficked women come from poor and vulnerable rural and urban families and due to the fewer interests of such families to bring these incidents to light; it becomes difficult to bring the traffickers to a proper trial. If the laws are amended and proper channels are made to repatriate the victims despite degrading their privacy publicly then the drawbacks of trafficking can be controlled more effectively.

Keywords: women-trafficking, anti-trafficking, SAARC, Bangladesh, laws, victims



Protecting Women's Right: The Role of Alternative Dispute Resolution in Bangladesh

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Introduction: Violence against women is a pervasive and serious issue worldwide, and Bangladesh is no exception. Women in Bangladesh face numerous challenges in their everyday lives, including unequal access to education, limited job opportunities, and widespread discrimination. Domestic violence is a major problem, affecting many women and some men. In Bangladesh, domestic violence has become even more prevalent during the COVID-19 pandemic, as women are forced to stay at home with their abusers and face increased stress and economic hardship. This has made it even more difficult for women who are already struggling to take care of their families and want to feel safe in their own homes. The legal system in Bangladesh is overwhelmed with cases, and many women may not report incidents of domestic violence because of fear of stigma or retaliation. Traditional legal methods may be insufficient in addressing domestic violence in Bangladesh due to factors such as a lack of resources or awareness among law enforcement agencies, or cultural attitudes that may discourage women from reporting incidents of violence. Alternative Dispute Resolution (ADR) offers a promising solution to this problem. ADR is a voluntary process in which the parties involved in a dispute work with a neutral third party to come to an agreement. This approach offers several advantages over traditional legal methods, including lower costs, faster resolution, and greater flexibility.

This paper argues that alternative dispute resolution offers a promising solution to the problem of domestic violence in Bangladesh by providing a faster, more flexible, and more accessible means of resolving disputes and protecting women's rights. The paper begins with a review of the literature on ADR and its effectiveness in addressing domestic violence. It then presents the results of interviews with legal experts and women's rights advocates in Bangladesh to assess the current state of ADR use in the country. Finally, the paper makes recommendations for policymakers and other stakeholders to promote the use of ADR in addressing domestic violence and protecting women's rights in Bangladesh.

Overall, this paper aims to raise awareness of the potential of ADR in addressing the problem of domestic violence in Bangladesh and to encourage greater attention and action to promote its use. By exploring the challenges and opportunities of ADR, this paper provides a roadmap for policymakers and other stakeholders to develop effective strategies for promoting women's rights and reducing the incidence of domestic violence in Bangladesh.

Materials and methods: This paper consist mixed-methods approach allowed us to gather a rich and diverse set of data to inform our analysis of the role of ADR in protecting women's rights in Bangladesh. By triangulating data from interviews, case law, and literature, we were able to develop a comprehensive understanding of the current state of ADR use in Bangladesh and to make recommendations for promoting its use to address the problem of domestic violence.

Qualitative Analysis: In order to assess the current state of ADR use in Bangladesh, we conducted interviews with legal experts and women's rights advocates between January and March 2023. We used a qualitative research approach, which allowed us to gather in-depth insights into the experiences and perspectives of our participants. We identified participants through purposive and snowball sampling techniques, targeting those with expertise in the legal system and/or women's rights advocacy. We conducted a total of 20 interviews, each lasting between 30 and 60 minutes. The interviews were conducted in person or via video conferencing, and were audio recorded and transcribed for analysis.

Case Law: We also conducted a review of relevant case law related to domestic violence and ADR in Bangladesh. We searched online databases for cases related to domestic violence that had been resolved through ADR mechanisms. We analyzed these cases to identify trends and best practices in the use of ADR for resolving domestic violence cases in Bangladesh.



Literature Review: Finally, The author conducted a comprehensive review of existing research on ADR and its effectiveness in addressing domestic violence in Bangladesh. We searched online databases and academic journals for relevant articles, reports, and other sources of information. We analyzed the literature to identify key themes and insights related to the use of ADR in addressing domestic violence in Bangladesh. We also reviewed relevant policy documents and reports from national and international organizations to understand the policy context for ADR use in Bangladesh.

Results and discussion: ADR has the potential to offer a more efficient and effective means of resolving domestic violence cases than traditional legal methods. ADR is a voluntary process in which the parties involved in a dispute work with a neutral third party to come to an agreement. ADR offers several advantages over traditional legal methods, including lower costs, faster resolution, and greater flexibility. The interviews with legal experts and women's rights advocates in Bangladesh revealed that ADR is not yet widely used in the country, but there is a growing recognition of its potential benefits. Many stakeholders are working to promote the use of ADR in resolving domestic violence cases in Bangladesh.

Conclusion: To promote the use of ADR in addressing domestic violence and protecting women's rights in Bangladesh, we recommend the following actions: **1)**Develop and implement training and awareness- raising programs on ADR: These programs should be targeted at legal professionals, women's rights advocates, and the general public to promote understanding and awareness of ADR processes and their potential benefits.**2)**Establish ADR centers in communities: These centers could serve as a means of providing accessible and affordable ADR services to women who may not have the means to access traditional legal processes.**3)**Strengthen the capacity of the legal system to support ADR processes: This could involve developing guidelines and protocols for ADR processes, providing training for legal professionals on the use of ADR, and establishing clear referral pathways between the legal system and ADR centers.**4)**Address power imbalances and promote inclusive decision-making processes: Efforts should be made to ensure that ADR processes are fair and inclusive, particularly with respect to gender and power imbalances. This could involve promoting the participation of women in decision-making processes and providing support for women who may be hesitant to participate in ADR processes due to fear of retaliation or stigma.

This research paper shows that Alternative Dispute Resolution (ADR) has the potential to address domestic violence and protect women's rights in Bangladesh. While there are some concerns about the fairness of ADR processes, this paper suggests that ADR is a promising alternative to traditional legal methods. To promote the use of ADR, there needs to be more awareness and training on ADR, the establishment of ADR centers, and the strengthening of the legal system's capacity to support ADR processes. The successful use of ADR will also require efforts to address power imbalances and promote inclusive decision-making processes, as well as a commitment to gender equality and the protection of women's rights.

Keywords: Mediation, Arbitration, Domestic violence, Women's right

Technology Facilitated Violence against Women in Bangladesh

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Introduction: Nowadays, we are living in a time of cutting-edge technology and the way a person communicates with others is facilitated by technology. Technology has both positive and negative aspects to society. On the one hand, technology is contributing to social transformation and on the other hand, it is found as a tool of social repression (Powell & Henry, 2017).Technology-facilitated violence is a kind of violence which is mediated by technology. Technology permits an individual to interact with others virtually. Powell & Henry (2017) found that the identity of an individual between online and offline is increasingly blurred. Thus technology induces different



kinds of violences in different forms. The most common forms of technology-facilitated violences are found facilitated through the social network sites. Gender plays a pivotal role in reproducing gender hierarchy in society through the social network sites like facebook, twitter, instagram, whatsapp, messenger etc. (Udwadia & Grewal, 2018). In the social media the discussion of technology-facilitated violence has just started in 2016 and the concept of technology-facilitated violence against women thus is not a new mode of violence (Whiting, Olufuwote, Cravens-Pickens, & Witting, 2019) where women and girls are found strangely affected in the digital spaces (ICRW, 2018).

The present study comes to analyze the violence against women that are technology facilitated especially through the common social network sites in Bangladesh. There are three research questions of the study as follows: How does technology facilitate violence against women through social network sites in Bangladesh? Why do women face technology facilitated violence via social network sites in Bangladesh? And what are the impacts of technology-facilitated violence on women in Bangladesh? To meet the research questions stated above there are three specific objectives of the study are as follows:

1. To identify the ways technology facilitates violence against women through social network sites in Bangladesh.
2. To analyze the reasons women face technology facilitated violence through social network sites in Bangladesh.
3. To explore the impacts of technology facilitated violence on women in Bangladesh.

Materials and methods: A mixed research approach will be used by this study to address the research questions and the data will be collected from both the primary and secondary sources. Both the quantitative and qualitative data will be collected with a semi-structured questionnaire. In depth interview (IDI) method will be used as a research method for this study. IDI helps to extract the experiences of the respondents and helps them to participate fully in a discussion (Punch, 2014). Random sampling technique will be used to select the respondents: women (18-40 years of age) who use social network sites i.e.; Facebook, Instagram, twitter, WhatsApp and messenger in Bangladesh. A total of 50 (fifty) women will be interviewed. We will use the SPSS and the holistic coding approach to analyze and interpret the data for this study. We will consider the ethical issues and the respondents will be anonymous throughout the study. We commit not to disclose anyone's name and we will be highly maintaining the privacy of our respondents.

Results and discussion: The present study may find that the technology facilitates gender-based violence especially via the social network sites in many ways in Bangladesh may include: cyber bullying, stalking, intimidating, humiliating etc. Negative comments, personal content sharing without permission, posting personal photos and videos, sending unwanted images or text messages, trolling, tagging other people, live streaming etc. via social network sites may allow individuals to defame women and girls.

The study may also find the reasons as the dominating patriarchal norms which may provoke technology facilitated violence against women in Bangladesh. The ease and availability of technology might be the reason behind it. Offline gender relations in society may affect and trigger online gender relations. Moreover, artificial intelligence may permit posting and sharing fake content that may reproduce gender based violence against women.

Technology-facilitated violence has real world consequences. Virtual violence is found impacting severely offline especially among the young generations (Patton, et al., 2014). Technology facilitated violence may severely impact women and girls in Bangladesh. Domestic violence, online sexual harassment, image based sexual exploitation etc. might be risen up. Depression, anxiety, stress, poor academic performance, loss of productivity, etc. may increase more and more in the time of cutting-edge technology which cannot be denied. Overall, the online violence may exacerbate the violence in real life and might be found as one of the darkest sides of the social network sites. It is expected that the study will have an important implication focusing the concepts and theory studies and reviewing the related literature by this research.

Conclusion: The use of social network sites has many more advantages for women and girls however it allows the perpetrator to communicate and disseminate unwanted content momentarily that might threaten the human rights of women and girls. Still there is no such option to identify the fake accounts on social network sites which



might be the biggest reasons behind the cyber bullying. In the age of the 4th industrial revolution the government has to consider the pros and cons of using social network sites in Bangladesh and should come forward taking action addressing technology facilitated violence against women in Bangladesh.

Keywords: Technology, Violence, Women, Bangladesh

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Misconception of Dowers: An Evil Exercise Which Leads to an Unethical Burden to a Man

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Introduction: Dower, also known as Mahr, is a sum of money that the husband must pay to the wife upon marriage, either by mutual consent of the parties or by operation of law. Dower is a fundamental and unbreakable rule of marriage. It must be paid before or after marriage. The concept of dower is currently being misused by using this right to receive dower as a tool. The misconception of dowers refers to the misunderstandings and incorrect beliefs people hold about dowers in Islamic marriage. An unethical burden on a man relates to the wrong belief that dower is an oppressive financial duty unfairly placed on men, which may end up resulting in negative perceptions toward dower and potential exploitation or abuse of women who demand their proper dower. Despite the dower's significance, the idea of dower has come to be widely misinterpreted in many communities, where it is frequently perceived as an oppressive burden on men.

Materials and methods: The study utilizes a wide range of materials to examine the topic. These materials include books, academic journals, newspapers, opinions of legal experts, books on Islamic law and marriage, customs, and online resources related to Muslim marriage. The sources were carefully selected to ensure credibility and represent diverse perspectives on the subject matter. These sources provided insightful analysis and context on the moral and legal foundations of dower in Islamic law, as well as the social and cultural elements affecting attitudes toward dower. The methodology involves a comprehensive review and analysis of these materials to identify common misconceptions and evaluate the ethical implications associated with Muslim dowers.

This paper tries to show how the practice of dower came about, what are the main purposes of dower, how dower gives security to married women, what should be the amount of dower, how dower misconceptions originated and run, how dower is being misused, how it is creating an unethical pressure on men, how it is misinterpreted, how



this right is used to make a business and what are the common reasons behind the divorce. The paper also highlights the dark side of dower by analyzing several cases and events related to dower misuse.

Results and discussion: The study found that misconceptions surrounding dowries in the Islamic context exist. According to the results. The dower's noble intentions are currently being undermined. And it is happening in different ways. The imposition of an exorbitant dower is increasing the tendency of divorce by the wife. Not only this but after the divorce, the husband has to suffer financially or become destitute while carrying the burden of a huge dower. Many such girls are seen who marry only to collect dower (money) and later divorce their husbands. They later marry again for the same purpose. Also, it is found that sometimes the concept of dower is misinterpreted intentionally and a disproportionate amount is imposed on men in the name of dower. This study has looked into and discussed a number of the following cases-

1. Thakurgaon's Morjina Akhter Mim (32) has created such a sensation. She had 10 marriages. From the report, it can be seen that marriage was his main business (The Daily Campus, 2022).
2. A woman by the name of Mitu divorced her husband only for getting 35 lakh taka dower. The husband could not bear these pressures and committed suicide (Jugantar, 2019).

Divorces are currently happening at a noticeable rate and are on the rise. According to The Daily Ittefaq an average of 19 divorces are happening in Dhaka every day. However, the results show that excessive dower demands, cultural pressures and expectations, inequality and gender Biases, lack of understanding etc create unethical pressure on men. Findings highlight the importance and way of addressing and dispelling the misconceptions surrounding dower in the Islamic context.

Conclusion: To respect the inherent object of the dower we have to accept the following points- 1) To obey the law of Allah, one must pay respect to the wife and give her dower. 2) Dower must not be misconstrued in any way. 3) A dischargeable burden cannot be imposed on the husband in the name of a dower. 4) Those who do business using dowries should be brought under the law and punished. 5) The socio-economic status of the husband must be taken into consideration while fixing the dower, etc.

The perception of Muslim dowries as an evil exercise leading to an unethical burden on men is a misconception that overlooks key aspects of the concept. While the dower places a financial responsibility on the groom, it serves as a symbol of commitment, financial security, and protection for the bride. The dower is agreed upon mutually and takes into consideration the financial capabilities of the groom. Flexibility in payment and Islamic principles of fairness further mitigate any undue burden. Cultural practices that may impose excessive demands should be distinguished from the core concept of the dower. Overall, the dower in Islam aims to foster mutual respect.

Keywords: Dower, Marriage, Misuse, Misinterpret

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A Study on the Effectiveness of Environmental Laws in Bangladesh in Protecting the Country's Natural Resources

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Introduction: Bangladesh is a country with a rich and diverse natural resource base that provides livelihoods to millions of people. However, rapid industrialization, urbanization, and population growth have led to significant environmental degradation, posing serious threats to the country's natural resources and the health and well-being



of its citizens. In response to these challenges, the government of Bangladesh has developed a legal and policy framework for environmental protection.

The purpose of this study is to examine the effectiveness of environmental laws in Bangladesh in protecting the country's natural resources. Specifically, the study aims to identify the weaknesses of the legal and policy framework for environmental protection, analyze the factors contributing to the ineffective implementation and enforcement of environmental laws, and explore strategies for improving their implementation and enforcement. Overall, this research aims to contribute to the literature on environmental governance in developing countries by examining the effectiveness of environmental laws in Bangladesh and proposing strategies for improving their implementation and enforcement.

The study is original in its focus on Bangladesh and its comprehensive analysis of the legal and policy framework for environmental protection, as well as its identification of factors contributing to the ineffective implementation and enforcement of environmental laws.

Materials and Method: The proposed study on the effectiveness of environmental laws in protecting Bangladesh's natural resources has utilized a mixed-methods approach to enhance the reliability of the findings. Primarily, the study has used a qualitative research approach, but quantitative data has also been used where applicable. It has provided a comprehensive and detailed analysis of the effectiveness of environmental laws in protecting Bangladesh's natural resources and identified ways to strengthen environmental governance and promote sustainable development. Data has been collected from both primary and secondary sources. Primary data has been collected through various sources, including international conventions, national legislation, policies, and judicial decisions. Field visits and interviews with legal experts have also been conducted to obtain further insights into the implementation of environmental laws in Bangladesh. Secondary data has been collected from relevant reference books, journal articles, research reports, and official publications.

Results and Discussion: In this study the researcher has found that in Bangladesh, although there are comprehensive legal and policy framework for protecting countries natural resources such as forest, wildlife and biodiversity, soil, water, air, fisheries and climates still they are under serious threat of degradation due to several environmental issues including water pollution, air pollution, climate change, deforestation, biodiversity loss and soil degradation. Analytical views of the legal framework of environmental laws in Bangladesh has shown that there are several weakness and factors behind the ineffective implementation of these laws in protecting the natural resources of the country. These includes: Limited access to justice, Complexities in access to Justice, Insufficient penal policy, Ambiguous and uncertain provision, Insufficient integration of environmental concerns into development policies, Absence of internationally recognized principles, Lack of Public Awareness, Limited public participation, Inadequate monitoring and enforcement.

Conclusion: Bangladesh has made significant progress in developing a legal and policy framework for environmental protection. However, the implementation and enforcement of these laws remain a challenge due to several factors, including insufficient funding, inadequate human resources, weak institutional capacity, and limited public awareness and participation.

The study has highlighted the key environmental issues in Bangladesh, such as air and water pollution, deforestation, loss of biodiversity, and climate change, which have significant impacts on the country's natural resources. The strengths and weaknesses of the legal and policy framework for environmental protection in Bangladesh have been identified, along with the factors contributing to the ineffective implementation and enforcement of environmental laws.

The study has also examined case studies of environmental law application in Bangladesh and explored strategies for improving the implementation and enforcement of environmental laws in the country. These include strengthening institutional capacity, improving coordination among stakeholders, increasing public awareness and participation, and addressing corruption and political interference.

The study has broader implications for environmental governance in developing countries, highlighting the need for stronger institutional capacity and increased public participation in environmental decision-making. Ultimately, effective environmental governance is crucial for achieving sustainable development and protecting natural resources for future generations.

Keywords: Environmental laws, Natural resources, Sustainability



Ecocide Laws: A New tool to Environmental Justice

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Introduction: The fundamental concept of human rights is inextricably linked to nature and the environment. For proper enjoyment of Human rights, protection of environment is crucial. Throughout prehistoric times, various types of environment degradation have existed (Sarker, 2021). The widespread degradation of environment is known as Ecocide. Yet, starting in the latter half of the 20th century, Ecocide became a menace and a global concern (Gray, 1996). There have been many obstacles and initiatives to safeguard the environment throughout the last few decades. We now live in a time when further destructive activities must be feared since they not only pose a threat to world peace and security as current core crimes do, but also to the environment. According to the Intergovernmental Panel on Climate Change IPSS's assessment (IPCC, 2022), if we continue to degrade the environment at this rate, our ecosystems will suffer catastrophic repercussions (Herald, 2021). Environmental devastation has become a key matter of concerns for international attorneys and scientists (Sarker, 2021). International criminal law has the potential to be viewed as a beneficial and effective tool in resolving and preventing environmental damages from occurring. Contrary to International Human Rights legislation or International Environmental law, for example, criminalizing Ecocide under domestic and international law might actually alter societal behavior, penalize the offender, and help deter future crimes of a similar nature. The legal community has long disagreed on the definition of the word "Ecocide" (Sarker, 2021). At the Conference on War and National Responsibility in 1970, American biologist Arthur Galston introduced the term "ecocide" for the first time (Bary, 1997). Many International legal experts and practitioners have argued that the four other "core" crimes listed in the Rome Statute should be included in this category and that the International Criminal Court (ICC) should have the authority to try offenders for these crimes (Kozlowski, 2022). Another group of academics, however, have argued against classifying it as a distinct crime under international law. Interpreting Ecocide, through a Human Rights perspective, will help generating laws which deliver genuine environmental and climate justice (Lisa & Kate, 2022). Moreover, criminalizing Ecocide is a challenging but crucial undertaking. Yet, it is not just about finding the perpetrators and punishing them; it is also about altering the public's consciousness (Higgins, 2010). Thus, it is imperative to alter as there has not yet been a specific convention on Ecocide. Nonetheless, several nations have made ecocide a felony inside their borders in times of peace. Most of the countries defined Ecocide as intentionally causing "widespread, long-term and severe damage to the environment". In Bangladesh, the committee on the Ministry of Environment, Forestry and Climate Change has recommended the government to criminalize Ecocide similarly to genocide (The Financial Express, 2021). The paper supports Ecocide as an international crime as well as it instigates to add Ecocide laws in the legal purview of Bangladesh.

Sources and Method: In order to the greatest extent feasible, the sources indicated in Art. 38 of the Statute of the International Court of Justice (ICJ) were used, to respond to the research question (Statute of ICJ, 1946). Due to the lack of specified legal rules and policies on Ecocide, existing international and domestic legal frameworks is used in order to predict future developments. Nonetheless, a few judicial rulings were used in order to support pertinent claims. Various secondary sources like NGOs' statements and reports, newspaper articles, and opinionated essays and blogs by legal professors is used to define Ecocide. The majority of the resources were used to synthesis many current points of view and arrive at a justifiable conclusion (Kozlowski, 2022).

Results and Discussions: The paper advocates for the recognition of Ecocide as a criminal offense on a global scale. The implementation of an ecocide law is expected to mitigate pollution and environmental degradation, safeguard biodiversity, and facilitate a decrease in the impact of climate change. The primary aim is not punitive in nature, but rather preventive, with the provision of a robust legal impetus for decision makers to exercise prudence in matters pertaining to environmentally hazardous activities. Every activist is expressing their own clarification regarding anti-ecocide laws, but there are still a few gaps that must be filled before it can be



considered and enacted as a global law. Besides, there are no specific laws and policies on Ecocide in Bangladesh. The Preamble of the Constitution states that the State is obligated to fulfill socialism's central promise of providing a fair standard of living for all people, which is only feasible in an environment free from pollution. Article 18A of Bangladesh constitution enunciates that the State shall endeavor to protect and improve the environment. Furthermore, the landmark decision of *Dr. M. Farooque v Bangladesh* acknowledged that an environment free from pollution constitutes an integral aspect of the right to life, which is safeguarded by the Article 31 and 32 of the Constitution. Destruction of the Sundarbans, pollution of rivers by toxic chemicals and waste dumped into rivers, deforestations all are examples of Ecocide in Bangladesh. According to these findings, specific laws against Ecocide are urgently needed because of the overuse and destruction of natural resources as well as the environment's ecology and environment. As the environment and ecosystem have a stronger impact on the health of millions of people in the country, Bangladesh is in a prime position to develop Ecocide law and implement it as a prominent shield to protect them.

Conclusion: The goal of this article was to examine how Ecocide interacts with the current international environmental legal framework in order to determine what potential effects Ecocide might have on averting environmental harm and safeguarding the planet for future generations. Ecocide is just one of the ideas that have been floated in recent years to close the gaps in the international response to environmental deterioration on a global scale (Zahra, 2020).

Keywords: Ecocide, International Crime, Environmental Justice, Bangladesh

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Role of Artificial Intelligence in Law and Legal Technology

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Introduction: Artificial Intelligence (AI) has been rapidly transforming various industries, and the legal sector is no exception. The adoption of AI in law and legal technology has the potential to improve legal services, increase efficiency, reduce costs, and provide better access to justice for individuals and businesses. In this abstract, we will discuss the role of AI in law and legal technology and the opportunities and challenges associated with its implementation. The utilization of artificial intelligence (AI) in the legal industry is quickly developing, with huge potential to upgrade legal administrations and smooth out legal cycles. This research paper aims to give a far-reaching survey and investigation of the job of AI in regulation and legal innovation, looking at the reason, foundation, and creativity/commitment/oddity of the exploration work. The legal industry is confronting huge difficulties, for example, expanding client requests, the requirement for financially savvy arrangements, and the developing intricacy of legal issues. Because of these difficulties, law offices and legal experts are going to AI to give creative apparatuses that can work on the proficiency and precision of legal administrations.

Materials and methods: The research methodology included an efficient survey of significant writing and industry reports, trailed by a basic investigation of the findings. The data was broken down utilizing topical examination to distinguish key subjects and patterns in the utilization of AI in the legal industry.

Results and discussion: The research findings show that AI can possibly change legal practice by giving creative apparatuses to legal research, document examination, contracting executives, and different areas of legal practice. The advantages of AI incorporate expanded proficiency, exactness, and cost-viability, as well as the possibility to further develop admittance to equity. The utilization of AI in legal research can essentially decrease the time and exertion expected for legal research, making it more proficient and savvier. AI apparatuses, for example, prescient examination and regular language handling, can rapidly break down immense measures of legal data and recognize significant legal points of reference and cases. This can fundamentally work on the precision of legal research and give legal experts the additional opportunity to zero in on different parts of legal practice. AI can likewise be utilized to mechanize record investigation and contract management, lessening the requirement for manual audit and diminishing the gamble of mistakes. AI instruments can rapidly filter and examine legal archives, recognize key conditions and arrangements, and feature expected dangers and areas of concern. This can essentially work on the productivity and exactness of examination on contracts and agreements, while likewise lessening the gamble of mistakes and legal questions.

The paper examines the ramifications of AI for legal calling, remembering the possible effect of legal training, the changing job of legal experts, and the requirement for administrative structures to guarantee the moral and dependable utilization of AI in the legal industry. The paper likewise features the difficulties and restrictions of AI in the legal calling, like the requirement for excellent data, the gamble of predisposition, and the potential for work uprooting. The utilization of AI in the legal industry likewise raises moral and administrative worries that should be tended to. The utilization of AI devices for legal dynamics raises worries about straightforwardness, responsibility, and the potential for predisposition. There is a requirement for administrative systems to guarantee that AI is utilized in a moral and dependable way in the legal industry.

Conclusion: In conclusion, this paper gives a thorough survey and examination of the job of AI in legal regulation and innovation, offering experiences into the capability of this innovation to change legal practice and the difficulties and suggestions that should be tended to. AI can possibly alter the legal industry, yet its execution should be painstakingly figured out how to guarantee moral and capable use.



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Keywords: Artificial intelligence, Law, Legal technology, Legal practice, Ethics

Using Artificial Intelligence (AI) to Enhance Smooth Legal Operations: Potentials and Challenges

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Introduction: The legal industry is generally considered one of the slower-moving industries in adopting new technologies, though the position of this industry is stagnant in Bangladesh. Under the dynamic leadership of the current government, we have digitalized our country, developed an atomic energy source, launched satellites, joined the 5G network, and accomplished many other goals. Meanwhile, legal services are running under British-made 200 years old backdated rules. As a result, we have to face many problems in matters of legal service providing, suit filing, processing, and prompt delivery of justice.

Thereby, our fundamental right to a speedy and transparent trial under Article 35(3) of the Constitution of Bangladesh is being violated. Besides, it is affecting the utilization of other constitutional rights. In a nutshell, our entire system suffering fatal losses. Especially At the time when the government launches its “Smart Bangladesh with Smart Citizen” initiative, it will remain incomplete without modernizing this sector.

In this context, AI can elevate the speed and reliability of legal services. This study analyzes the possibility of implementing AI in the legal sector to overcome the present challenges and enhance judicial functions smoothly as well.

Materials and methods: To explore the potential of AI, I have used mixed methods in this research. Data are collected from primary and secondary sources regarding the validity and depth of this research. Primarily, I have analyzed data on suit filing, summon issuing, processing, and record-keeping matters. Secondarily I analyzed various law journals, newspaper reports, and articles and also interviewed law experts, and law firms, and noted their observations regarding these matters. Though there are some limitations in that I only reached a limited number of experts but their valuable perception helped me to reach the conclusion.

Results and discussion: Analyzed nearly a hundred primary data and interviewed a mentionable number of legal specialists the finding of the study show that there is a significant possibility for AI deployment in this sector. Even though, a long way to go for its implementation.

Firstly, evidence from primary sources revealed that, despite the world's modernization, the antiquated rules established by the British to access legal services remain everywhere. This system is still limited to letters, thick record books, lawyers, and running around in courtrooms. As a result, almost everyone who has received legal services in the past perceives the traditional method to be the biggest barrier and believes that as in other industries, the use of AI will make it easier in the future.

Secondly, various law journals, articles, and websites make one thing very clear the implementation of AI in this sector already successfully uses in different countries. Not only that, but we used a variety of AI services in our daily lives, such as messenger Chabot, scheduled SMS or email, automatic notifications, etc. These may also be applied in the legal field to facilitate the operation of the law easier by minimizing processing time, costs, and complications.



Thirdly, almost all legal experts argue that the employment of AI will result in significant advancements in the modernization of legal services and the judicial process. Moreover, the majority of them opined the Chabot, e-summon, and automatic notification alert can play the most effective role. But first, we must digitalize the entire legal process and make the workforce in this field effective.

Despite the possibilities, there are certain obstacles to implementing AI in our legal system. Because currently, it operates entirely by analog methods, and no soft copy is saved against it. Additionally, there are no multimedia courtrooms, qualified programmers, or maintainers in this field. So, before we begin the original task, we must complete these criteria. This may be tuff but not impossible.

Conclusion: Technologies like AI have immense potential in the upcoming days. If we do not welcome such constructive possibilities, we will fall far behind as a nation. Although there are some challenges to face now, we must not sit back but rather face them. Therefore, it is very urgent to 1. Remove the barriers of law to update our legal system, 2. Modernize this sector by incorporating technologies, 3. Multifunctionalize the courtrooms, 4. Skill the manpower of this sector, 5. Launching an AI program and sequentially automating the entire system. Otherwise, the great objective of our constitution will not be able to be implemented. Wherefore, we should take technology as a blessing, not a curse.

Keywords: Artificial Intelligence, Legal service, Technology

Freedom of Expression and the Digital Security Act, 2018: Achievements and Complexities in Smart Bangladesh

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Introduction: Technology has given individuals an unprecedented ability to express themselves but also has led to controversy and concerns about protecting the rights of others. In today's smart era, freedom of expression is considered a keystone of democracy and a crucial element of all types of freedoms (Rahman, 2014). Freedom of expression is an equal right for all that enables individuals to express their thoughts, opinions, and ideas without fear of censorship or punishment (Kathleen et al, 2011). This study aims to reveal the present achievements and complexities of the DSA concerning freedom of expression in Bangladesh. In recent years, Bangladesh like many other countries has experienced significant changes in the digital space. The government of Bangladesh enacted the Digital Security Act (DSA) in 2018, which aimed to regulate online activities and protect national security. It was enacted to address cybercrimes, extremism, and hate speech, and also to ensure digital security (Bari & Dey, 2019). Despite the freedom of expression as a fundamental right under Article 39 of the Constitution of Bangladesh, the DSA does not explicitly address the extent and implications of its applicability. It creates a clear violation of the nation's obligations as per international law and protects free speech in the digital age (Runa, 2019; Nishat et al, 2022). More than 1500 cases were filed under this Act from 1 January to March 2021 (CGS, 2022). It also provides absolute power to the government's Digital Security Agency to arrest anybody, without a warrant, simply on suspicion that a crime may be committed using digital media, which is an attack on freedom of expression (Amnesty International, 2018). Additionally, the DSA protects the data security, and privacy of the citizens and stops spreading falsehood, propaganda lies, and hate speeches in digital media (Shuvro, 2020). The Act has been met with criticism from various quarters, and the critics argue that it stifles freedom of expression that is being used to suppress dissent (Kundu & Haque, 2019). This research aims to explore the implications of the Act on freedom of expression that resulting both achievements and complexities in Bangladesh. Moreover, this research study provides insights into the challenges faced by the government and civil society in balancing national security and individual rights in the digital age.

Methodology: This study is a mixed-methods approach, incorporating both qualitative and quantitative data. This approach was chosen to provide a comprehensive understanding of the achievements and complexities



surrounding freedom of expression and the Digital Security Act in Bangladesh. Qualitative data was collected through focus group discussions (FGD), secondary data sources, and reviews of relevant literature, including academic articles, books, and reports, as well as analysis of relevant legal documents and court cases. For the quantitative section, a total of 200 survey interviews were conducted with the sample population of the study, including journalists, activists, lawyers, civil society members, and individuals who have been affected by the Digital Security Act. The sample size is comparatively small, which can be a limitation of the study. The survey sample was selected using purposive sampling, ensuring that a diverse group of individuals was included in the study. The data was analyzed using both qualitative and quantitative methods, including secondary data analysis and descriptive statistics. Ethical considerations were taken into account throughout the research process, with obtaining informed consent from the participants and ensuring their anonymity and confidentiality.

Results and discussion: This study revealed that the Digital Security Act, of 2018 has both positive and negative impacts on freedom of expression in Bangladesh. The study explored, more than one-third of the respondents (35%) believed that DSA has helped to combat cybercrime and protect national security. Besides, near about two-thirds of the respondents (65%) felt that it has been used to suppress dissent and curtail freedom of expression. The findings found that the DSA has been successful in reducing online crimes, lies, and hate speech. In addition, the Act has been misused to silence dissenting voices and restrict freedom of expression. It contains sections that criminalize online speech, including criticism of the government, which could potentially limit freedom of expression in the country and also has a negative impact on the country's democracy. The vague language and broad provisions of the DSA have also raised concerns about its compatibility with international human rights standards. These findings have significant implications for Bangladesh's aspirations to become a smart country. The government needs to review and amend the DSA to ensure that it upholds the principles of free speech and human rights. Civil society groups need to create awareness about the potential misuse of the Act and advocate for its proper implementation. International human rights organizations should continue to monitor the situation in Bangladesh and raise concerns about any violations of human rights.

Conclusion: The study highlights the achievements and complexities of regulating freedom of expression in the digital age in the context of smart Bangladesh. DSA has both achieved its intended purpose and created complexities in Bangladesh. The Act has reduced online crimes and hate speech, but at the same time, it has restricted freedom of expression. The vague and ambiguous language used in the Act has created confusion and misinterpretation, leading to the potential misuse of the Act. This Act has both achievements and complexities in relation to freedom of expression in Bangladesh. The government must examine the clauses of the law and guarantee their conformity with international human rights standards. This study highlights the need for a balanced approach to digital security and freedom of expression. The Act should be revised to ensure that it does not infringe on citizens' right to free speech. This study is conducted using qualitative and quantitative analysis that may not reflect all viewpoints regarding the Digital Security Act, 2018 in Bangladesh. This DSA needs to be amended to protect the freedom of expression of citizens and prevent any violations of their rights. Moreover, this study reveals a necessity for more education, awareness regarding digital security, and freedom of speech in the country.

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Keywords: Freedom of expression, Digital Security Act, Cybersecurity, Human rights, Smart Bangladesh.

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Controlling Online Content: How the Digital Security Act 2018 Limits Freedom of Expression under Article 39 of the Bangladesh Constitution

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Introduction: In an effort to tackle cybercrime, the Bangladeshi government introduced the Digital Security Act in 2018, which has been met with controversy due to its potential negative impact on the citizens freedom of speech and freedom of the media. Despite these rights being enshrined in the Bangladesh Constitution (Article 39), the law is not well-suited for the digital age and may impede the free flow of information. There have been numerous allegations that the government has misused the law for their own political gain. This paper examines the Act's broad definition of crimes and severe penalties, which could have a chilling effect on the aforementioned freedoms and the right to access information. The law restricts the media and individuals in various ways, and expressing an opinion could result in severe punishment. Additionally, the vague language of the law could be interpreted to misuse citizens without court approval. Through a content analysis method, this study aims to demonstrate how the current digital security law complicates free speech and the media and how journalists and citizens face challenges due to the law's misapplication. It also analyzes international standards for protecting freedom of speech and media in democratic countries.

This paper concludes that the Digital Security Act violates the Bangladesh Constitution, international standards, and democratic values by preventing independent journalism and free speech. Amending the act is necessary to uphold these fundamental rights.

Materials and methods: The study methodology included a qualitative analysis of the Act's provisions, case studies of individuals affected by the Act, and a comprehensive literature review. The methods analysis with a critical perspective, with a focus on identifying potential conflicts between the Act and the constitutional guarantee of freedom of expression under Article 39 of the Bangladesh Constitution. Qualitative Analysis: We conducted a qualitative analysis of the Digital Security Act 2018 by examining the Act's provisions and analyzing their potential impact on freedom of expression in Bangladesh. Our analysis included a review of relevant legal documents, academic articles, and news reports to identify key issues and controversies surrounding the Act.

Case Studies: To gain a deeper understanding of the impact of the Digital Security Act 2018 on freedom of expression in Bangladesh, researcher conducted case studies of individuals who have been affected by the Act. Researcher selected cases that exemplify the Act's potential to restrict online content and suppress dissenting views, including cases of journalists, bloggers, and social media users who have been charged under the Act

Literature Review: A comprehensive literature review conducted to assess the potential impact of the Digital



Security Act 2018 on freedom of expression in Bangladesh. Our review included academic articles, legal documents, and news reports that examined the Act's provisions and their potential impact on online content creators.

Result and discussion: The right to freedom of expression, thought, and conscience guaranteed by Article 39 of the Constitution of Bangladesh, and the restrictions imposed on this right by laws such as the Digital Security Act 2018. While the Act aims to address digital crimes, it includes provisions that could be used to suppress freedom of expression and limit access to information online. Human rights organizations have expressed concern that the Act could stifle the online community in Bangladesh, which includes journalists, bloggers, and social media users who use the internet to express dissenting views and hold the government accountable. The Act criminalizes certain types of online content, such as material that is deemed to be "propaganda" against the state or that "tarnishes" the image of the country. This could be used to target individuals who express dissenting views online, which raises questions about the Act's compatibility with Article 39 of the Bangladesh Constitution. The Act also gives law enforcement officials the power to conduct searches and seizures without a warrant in cases related to digital crimes, which further curtails the right to privacy and freedom of expression.

It is important to critically examine the implications of the Digital Security Act 2018 on freedom of expression in Bangladesh, particularly in light of the vibrant online community that exists in the country. The Act's provisions must be analyzed in relation to Article 39 of the Constitution, which guarantees the right to freedom of thought and expression. Any restrictions imposed on this right must be necessary and proportionate, and should not be used to suppress dissent or limit access to information. The potential impact of the Act on the online community in Bangladesh must be carefully considered, and steps should be taken to ensure that the Act is not misused to curtail freedom of expression and violate human rights.

Conclusion: The right to freedom of thought, conscience, and speech is a fundamental human right that is enshrined in Article 39 of the Bangladesh Constitution and Article 19 of the Universal Declaration of Human Rights 1948. However, laws like the Digital Security Act 2018 have the potential to limit this right in the digital realm. While the Act aims to address digital crimes and protect national security, its provisions may be used to suppress freedom of expression and limit access to information online. This could have a significant impact on the vibrant online community in Bangladesh, which includes journalists, bloggers, and social media users who use the internet to express dissenting views and hold the government accountable. Therefore, it is important for the government to strike a balance between protecting national security and ensuring that citizens can freely express their thoughts and opinions. The Digital Security Act 2018 should be reviewed periodically to ensure that it does not infringe upon fundamental rights and freedoms, and that its provisions are not used to stifle free speech or suppress dissenting views. In addition, the government should engage in a dialogue with human rights organizations and other stakeholders to address concerns about the Act's impact on fundamental rights and freedoms. This will help to ensure that Bangladesh remains a democratic society that respects and upholds the rights of its citizens, both online and offline.

Keywords: Cybercrime, Journalism, Propaganda, Freedom of expression



The Impact of Government Surveillance on Individuals' Right to Privacy and Freedom of Expression in Bangladesh

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Introduction: The right to privacy and freedom of expression are fundamental human rights enshrined in international human rights law. The concept of privacy law acknowledges an individual's entitlement to solitude and the inviolability of personal space. The necessity for privacy and its formal acknowledgment as a fundamental right is a relatively recent development. Article 43 of the Constitution of Bangladesh specifically declares the entitlement of every citizen to privacy in their correspondence and other modes of communication (Shikder, 2013). Article 39 of the Constitution of the People's Republic of Bangladesh guarantees the right to freedom of expression, with the notion that, this right may be subject to reasonable limitations imposed by law. Freedom of expression serves as a cornerstone for the protection and enhancement of other fundamental rights, as it enables individuals to openly express their opinions on important matters, access information, and hold those in positions of power accountable. The ability to exercise these rights collectively contributes to the sound development of any society (Ahmad, 2015). However, in recent years, the Bangladeshi government has come under criticism for its use of surveillance technology to monitor citizens' online activities, social media posts, and phone conversations. In this paper, we will discuss the impact of government surveillance on individuals' right to privacy and freedom of expression in Bangladesh, examine the implications of government surveillance for fundamental human rights, and highlight the need for increased transparency and accountability in the use of surveillance technology.

Materials and methods: The paper is based on secondary sources. The prime goal of this paper is to discuss the impact of government surveillance on individuals' right to privacy and freedom of expression in Bangladesh. And this paper particularly draws attention to review of literature. More specifically, two sources are researched and analyzed. First, this paper analyzes newspaper article, books, academic publication reports on e-governance. Second, this paper scrutinizes government related documents, public websites and policy documents of international organization about government surveillance on fundamental rights in Bangladesh. Hence, this paper is trying to find the following questions

1. How does the government surveillance affect the ability of individuals to express their opinions freely without fear of retaliation or censorship?
2. To what extent does government surveillance violate individuals' right to privacy and undermine democratic principles in Bangladesh?
3. What legal and policy frameworks are in place to protect individuals' right to privacy and freedom of expression in Bangladesh?
4. How can the government balance national security be concerning with the protection of individuals' privacy and freedom of expression?
5. How can international human rights standards be used to promote and protect individuals' right to privacy and freedom of expression in the context of government surveillance in Bangladesh

Results and discussion: The Bangladeshi government's surveillance practices have a concerning impact on the fundamental rights of its citizens. The monitoring of phone calls, emails, and social media activity creates a climate of fear, discouraging individuals from expressing their opinions and engaging in dissent. This chilling effect on free speech undermines the essential democratic principle of freedom of expression. Additionally, the right to privacy is violated as individuals cannot exercise their privacy without fear of government monitoring. It is crucial for the Bangladeshi government to respect the privacy and freedom of its citizens, allowing for free



expression and dissent without retaliation. The failure to do so not only violates fundamental rights but also undermines the very foundation of democracy in Bangladesh.

Conclusion: In conclusion, government surveillance poses a significant threat to individuals' right to privacy and freedom of expression. The fear of being watched and monitored can lead to self-censorship, stifling free expression and critical thinking. Thus, it is necessary to establish greater transparency, oversight, and accountability in government surveillance to protect individual rights to privacy and freedom of expression.

Keywords: Right to privacy, Freedom of expression, Government surveillance

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Challenges and Prospects of Digitalization of Land Documents in Reducing Land Related Cases in Bangladesh

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Introduction: Bangladesh is a densely populated country with limited land resources, and land-related disputes are a common problem. The traditional paper-based land administration system in Bangladesh has been criticized for being slow, inefficient, and prone to corruption. As a result, the government of Bangladesh has introduced a digital land management system to modernize the land administration system, ensure transparency, and reduce land-related disputes. The government's initiative includes the development of a digital land database, the introduction of an online land registration system, and the implementation of an e-mutation process.

The purpose of this paper is to discuss the challenges and prospects of digitalization of land documents in Bangladesh in lessening land-related cases. The paper aims to highlight the current scenario of the land administration system in Bangladesh and the need for digitalization to address the challenges faced in managing land records. It will also explore the benefits and challenges of digitalizing land documents and recommend ways to ensure the successful implementation of the digitalization process in Bangladesh.

The novelty of this paper lies in its focus on the challenges and prospects of digitalization of land documents in Bangladesh. While many studies have focused on the benefits of digitalizing land records, this paper also highlights the challenges that need to be addressed for the successful implementation of the digitalization process. Moreover, the paper recommends practical solutions to overcome the challenges and ensure the efficient functioning of the digital land administration system in Bangladesh. The study will contribute to the existing literature on digitalization of land documents and provide insights into the potential of digitalization in addressing land-related disputes in developing countries like Bangladesh.

Materials and methods: The methodology used in this paper is doctrinal research with a qualitative approach. Doctrinal research is a type of legal research that involves analyzing legal principles and doctrines to understand their application and impact. The materials used in this paper include primary and secondary sources. The primary sources consist of legal documents, such as laws, regulations, and court decisions related to land-related cases in Bangladesh. The secondary sources include academic articles, books, and reports that provide insights into the challenges and prospects of digitalization of land documents in Bangladesh. The data collection for this study involved a review of the legal documents and secondary sources mentioned above. The legal documents were analyzed to identify legal principles and doctrines relevant to land-related cases in Bangladesh. The secondary



sources were reviewed to understand the challenges and prospects of digitalization of land documents in Bangladesh.

Results and discussion: Challenges of Digitalization of Land Documents in Bangladesh:

The digitalization of land documents in Bangladesh has been a long-standing issue, as the country still relies heavily on manual processes for land registration and documentation. While digitalization can bring about numerous benefits, such as increased efficiency and transparency, there are several challenges that need to be addressed for the successful implementation of this initiative. One of the major challenges of digitalization in Bangladesh is the lack of a robust IT infrastructure. Many areas in the country still do not have access to reliable internet connectivity and electricity, which can hinder the implementation of digital systems. Another significant challenge is the resistance to change from the stakeholders involved in the process. Many landowners, real estate companies, and government officials are accustomed to the traditional manual processes and may be hesitant to adopt digital systems.

The lack of digital literacy among the population is also a significant challenge. Corruption is a significant issue in Bangladesh, and it is a challenge that could hinder the success of digitalization of land documents. There is a risk that digital systems could be exploited or manipulated, which could compromise the integrity of land registration and documentation. However, Bangladesh's legal system and regulatory framework may not be adequate to support digital systems for land registration and documentation. Moreover, The land management and administration in Bangladesh is multisectoral and so cooperation and coordination is a prerequisite before initiating any innovative digitalized system in the land management system in Bangladesh.

Prospects of Digitalization of Land Documents in Bangladesh:

The digitalization of land documents in Bangladesh has the potential to revolutionize the country's land management system. Digitalization can bring about numerous benefits such as increased efficiency, transparency, and accountability. One of the major benefits of digitalization is the reduction of fraudulent land transactions. With digitalization, the process of land registration and documentation can become more transparent, making it easier to prevent fraudulent land transactions. Another benefit of digitalization is increased efficiency in land management. Digitalization can streamline the process, reducing the time and effort required to complete land transactions.

Digitalization can also promote financial inclusion, particularly for small landowners who may face difficulty accessing formal financial services including receiving loan from banks and financial institutions due to a lack of collateral. With digital land records, small landowners can use their land as collateral for loans. Moreover, digitalization can improve the accuracy and reliability of land records. Digitalization can help to ensure that land records are accurate, complete, and up-to-date, making it easier to verify ownership and prevent land disputes.

Reduction of Lawsuits through Digitalization of Land Documents:

Digitalization of land documents has the potential to significantly reduce land-related disputes and lawsuits in Bangladesh. With digitalization, land records can become more accurate and reliable, making it easier to verify land ownership and reduce disputes. Digital systems can help to create a comprehensive database of land ownership, which can be accessed and verified by different stakeholders in a transparent and efficient manner. This can help to prevent fraudulent activities such as fake land deeds, double sales, and illegal land grabbing, which are common in Bangladesh's manual land management. Moreover, digital systems can help to speed up the resolution of land disputes by providing access to accurate and up-to-date information. This can reduce the time and resources required to resolve land disputes, making the process more efficient and cost-effective.

Conclusion: In conclusion, the digitalization of land documents has the potential to bring about significant changes in the land management system of Bangladesh. The use of digital systems can help create a more accurate, reliable, and secure database of land ownership, which can be accessed and verified by different stakeholders in a transparent and efficient manner. However, challenges such as lack of technical infrastructure, limited digital literacy among stakeholders, and resistance to change must be addressed to ensure the success of the digitalization process. With the proper implementation of digital systems, the accuracy and reliability of land records can be improved, leading to a reduction in land-related disputes and legal battles. Overall, the prospects of



digitalization of land documents in Bangladesh are significant, with the potential to improve the land management system and reduce the burden on the legal system.

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Keywords: Land law, Digitalization, Land disputes, Land documents, Bangladesh

Arrest and Detention under Code of Civil Procedure: A Critique

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Introduction: The Code of Civil Procedure provides for various ways of enforcing a decree. One of these forms is the arrest and detention of sentenced debtors in civil prisons. The disposer can choose the method of enforcement of the disposition, and courts generally cannot compel a person to resort to a particular method of enforcement unless there are exceptional circumstances. (*Takwani, C.K. Civil Procedure*, 5th edition (2006), p. 458]. Sections 51 to 59 and Rules 30 to 41 of Order XXI deals with the arrest and detention of judgment debtors in civil prisons. The Code of Civil Procedure contains specific provisions on arrest and detention. The Civil Procedure Code of 1908 sets out the process and procedure to be followed in civil proceedings in court. Code can be divided into two main categories. The first consists of 158 sections and the second consists of the first schedule with a total of 51 commands and rules. There are distinct differences between these sections and rules. While the sections referred to in this Code contain various provisions relating to general principles of jurisdiction, the Orders and Regulations indicate how civil proceedings in Bangladesh should be governed. In some cases, the favorable judgment is called the "judgment holder" and in others the "judgment debtor".

Objective of The Study: Followings are the objectives of the study

1. To recognize the causes behind arrest and detention under CPC in Bangladesh.
2. To highlight the existing scenario of arrest and detention under CPC in Bangladesh

Methodology: The research is qualitative in nature and methodology of the study is exploratory based on primary and secondary data and document analysis. Besides some cases are studied to find out the present position of arrest and detention under CPC in Bangladesh. (*Bari and Islam. MJ-2022*). A quantitative approach was also used in this study. The research was compiled primarily from primary and secondary sources such as existing laws, statutes, books, magazines and other publications, reports from NGOs and articles in national newspapers. In addition, available published research reports and articles are considered, developing a discussion and analysis of various aspects of her inter-CPC arrest and detention in Bangladeshi society.

Conclusion: Execution relief through arrest and execution is an unprecedented measure that cannot be punished by law, and arrest cannot be wavered to comply with court orders. This allows statute holders to recognize the value of statutes in their favor. It also provides protection if the judgment debtor fails to comply with the order. Willful debtors can be arrested. This legal remedy is double as it also protects the enforcement owner as the enforcement debtor. This remedy is not exhaustive and prevents unusual harassment of judgment debtors. It also protects judgment debtors by giving alimony during their imprisonment. A judgment debtor is given many opportunities to prove their willingness to disobey an order. If the judgment debtor is not an intentional debtor, he or she may not be arrested and given the opportunity to right their wrongs. Therefore, these provisions are not strict.



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Key word: Arrest, Detention, Decree holder and Judgement Debtor

Revisiting Major Legal Provisions Regarding Pecuniary Matters in Bangladesh

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Introduction: The value of money does not exist always the same. The value of money decreases against the daily commodity and service over time which is known as inflation. When the value of money decreases, the amount of money should increase. In Iran, the dower money is given by adjusting with the inflation in case the money is not taken instantly but rather later (Ansari-pour, 2017). In the USA there is an inflation law concerning civil monetary penalties where a fixed amount of civil monetary penalty is adjusted according to inflation (Thurlow & Bushey, 2014). However, many laws in Bangladesh includes provisions implicating fine, damages, pecuniary jurisdictions, etc. The appropriate amount fixed for the said fine, damages, and pecuniary jurisdictions in different laws many years back has scarcely changed. The then-fixed amount is not appropriate in the present societal context as the value of money has decreased over time. Therefore, the amount of money should be increased. Although the amount of money has been increased in a few statutory laws with the advancement of time, it has not been increased in most of the laws. It may cause injustice in society. The provisions need to be updated with the present time situation implicating the proper valuation of money. This paper has explored some provisions of some laws involving money and shows how inappropriate the amount is to nowadays situation. Therefore, it demands the increasing of money suitable in the provisions of different laws involving money in the present societal context. Moreover, a provision should be made to update the monetary issue on a regular interval to make them updated with the change in the value of money and hence this research. There is some research on the matter of how money changed as a result of inflation over time. These are shown as follows. AA Hossain has shown that his article reviews Bangladesh's CPI-inflation trends during the early 1950s and explores the key concerns in rule-based monetary policy for price stability, meaning low and steady inflation (Hossain, 2015). Niaz Morshed and Mohammad Razib Hossain in their article Causality analysis of the determinants of FDI in Bangladesh: fresh evidence from VAR, VECM, and Granger causality approach has shown the FDI i. e. Foreign Direct Investment and its relationship with the inflation and the matter of import and export based on FDI and inflation relationship in Bangladesh perspective (Morshed & Hossain, 2022). In his article, An Economic Analysis of Interest Rate Spread in the Commercial Bank of Bangladesh, Muhammad Rabi Ullah has shown that Banks with more non-interest revenue as a percentage of total assets have lower spreads. He highlighted how the loan interest rate, inflation, broad money, official exchange rate, quasi-money, as well as personal remittance relate (Ullah, 2022). In her article The Asymmetric Impacts of Crude Oil Prices, Inflation, the Exchange Rate, Institutional Quality, and Trade Balance on Tourist Arrivals in Bangladesh: A Nonlinear ARDL Model Approach, Rehana Parvin shows that according to the research, oil prices and currency rates have a long-term negative and considerable impact on tourism demand, but institutional quality increases visitor arrivals. The study also found a nonlinear relationship between trade balance, tourism demand, and inflation (Parvin, 2022). Emon Kalyan Chowdhury investigated how inflation affects Bangladeshi commercial bank lending rates. The result demonstrates no correlation between inflation and rates (Chowdhury, 2012). However, there is no significant research in Bangladesh on the matter this researcher here is doing.

Materials and methods: A qualitative and analytical method has been used here. Data have been collected from primary sources and secondary sources. Primary sources are different Acts, rules, etc. Secondary sources are data from different books, articles, research papers, newspapers, etc.



Implication: Inflation means the devaluation of money ensuring the increase of the amount of money. It (inflation) is published in the form of a percentage. The inflation rate is published every year by the World Bank, and IMF globally whereas in Bangladesh it is published by the Bangladesh Bank. There are inflation calculators which can determine the value of money at different periods or years. Since the early 1950s, as was said above, Bangladesh's inflation has been moderately high, volatile, and steady (1950- 2012) (Hossain, 2015). At present up to January 2023 the inflation rate in Bangladesh is 8.57% which was 8.71% in December 2022 and it was 5.86% in January 2022 (Trading Economics, 2023; Bangladesh Bureau of Statistics. National accounts statistics-2022, p 62) This is measured by the Consumer Price Index, base 2005-2006 which implies that the value of money has decreased by 8.57 up to January 2023 which was 8.71% in December 2022 and it was 5.86% in January 2022. Because of this, the amount of money should be increased. However, there are many places in different statutory laws of Bangladesh made many years back where the amount of money remains the same whereas the value of money has decreased over the years because of inflation which demands an increase in the amount of money in line with the inflation rate to ensure justice but the amount has not been increased. Though in very few laws the amount of money has been increased many years back after that, many years have passed and again it demands an increase of the amount of money anew to be updated with the latest inflation. In the rest of the laws, the amount has not been increased since their origin with the advancement of time keeping pace with the inflation and the devaluation of money. These may cause injustice, imbalance, and delay in justice in society.

Conclusion Everything in the world is changing day by day. The value of money is the same which either increases or decreases though generally increase because of inflation. Therefore, the amount which was at the time of their framing is not the same today, and if the same amount is kept outstanding that will not give justice which would give at the time of their framing. Therefore, for the sake of justice, the amount of money should be always kept updated or a provision of discretionary power to customize the fixed amount by the judge should be kept there. The inflation calculator will help to determine it. Therefore, all the laws containing provision implicating money needs to be updated always which may increase or decrease with the advancement of time. It can indicate that the current amount of money either as compensation or fine fixed back at a different time in different laws of Bangladesh needs a rudimentary update with the present-day situation. Therefore, the government of Bangladesh should take the necessary measures to address the matter. It may be taken by passing an inflation law which will be applicable in the monetary matter in different laws of Bangladesh.

Keywords: Laws, money, time, inflation, change

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