ACCRA TECHNICAL UNIVERSITY
DIRECTORATE OF RESEARCH, INNOVATION, PUBLICATION AND TECHNOLOGY TRANFSER (DRIPTT)

1. ANNUAL RESEARCH

a) PUBLICATIONS BY ACADEMIC STAFF IN TOP-TIER JOURNALS, 2020/2021 ACADEMIC YEAR

DEPARTMENT OF MECHANICAL ENGINEERING

ADAMS, MORO (PhD)

A. Wang, C., **Adams, M.**, Jin, T., sun, Y., Röll, A., Luo, F., & Gavaises, M. (**2021**). An analytical model of diesel injector's needle valve eccentric motion. *International Journal of Engine Research*, DOI: 10.1177/1468087420987367.

Web of Science Core Collection: Science Citation Index Expanded; **Scopus Index**

Past experimental studies have shown that the needle valve of high-pressure diesel injectors undergoes lateral movement and deformation, while the continuous increase in injection pressure enlarges the gap of the needle valve assembly. Two different analytical models, considering or omitting this change are presented here, linking the geometries of the needle valve assembly with the magnitude of needle valve tip lateral movement. It is found that the physical dimensions of the needle valve assembly and the injection pressure have a significant impact on the radial displacement of the needle. For example, for nominal clearances between the needle guidance and the needle valve of about 1–3 μm, the magnitude of the radial movement of the needle tip could reach tens of microns. The model that takes into account the variation of the gap between the needle guide and needle valve is found to give predictions closer to the experimental results.

B. Wang, C., **Adams, M.**, Luo, T., Jin, T., Luo, F., & Gavaises, M. (**2020**). Hole-to-hole variations in coupled flow and spray simulation of a double-layer multi-holes diesel nozzle. *International Journal of Engine Research*, DOI: 10.1177/1468087420963986.

Web of Science Core Collection: Science Citation Index Expanded; **Scopus Index**

In diesel engines, double-layer multi-holes nozzles contribute significantly in making spray injection uniform in both the circumferential and axial directions; they further ensure that minimal or no interactions are encountered among the spray jets emerging from the nozzle holes and positively affect fuel atomisation and enhance mixing during engine operation. In this study, the variation in internal flow characteristics and spray patterns from the upper and the lower layer nozzle holes were investigated experimentally and computationally. A double-layer 8-hole heavy-duty diesel engine injector nozzle was utilised for the characterisation of hole-to-hole variation on spray formation. The actual nozzle geometry was derived from X-ray scans obtained at the third generation X-ray imaging and biomedical beamline station in SSRF, revealing all geometrical differences between the individual injection holes. The momentum fluxes from each holes were obtained together with spray tip penetration under non-evaporating conditions. These data were used to validate the computational fluid dynamics (CFD) model suitable to describe the relevant flow processes. Initially, an Eulerian-Eulerian two-phase flow model was utilised to predict the internal nozzle flow under cavitating conditions. This model was weakly coupled with a Lagrangian spray model predicted the subsequent atomisation and

penetration of all individual spray plumes. The results show that cavitation development within the upper layer holes is more intense than those formed within the lower layer nozzle holes; this is leading to higher injection rates from the lower layer nozzle holes that they also exhibit less cycle-to-cycle variations in the observed spray patterns.

ASEMPAH, ISAAC (PhD)

A. Li, X., Cheng, B., **Asempah, I.,** Shi, Q., Long, A. Q., Zhu, Y. L., ... & Jin, L. (**2020**). Effect of Different Ni Contents on Thermal Stability of Cu (Ni) Alloy Film. *Journal of Electronic Materials*, *49*(10), 5674-5680.

Web of Science Core Collection: Science Citation Index Expanded; **Scopus Index**

The effect of doping different contents of Ni on the thermal stability of Cu(Ni) alloy films has been investigated. Cu(Ni) films with different Ni contents were deposited on SiO2/Si substrates by magnetron sputtering, then annealed in vacuum at 350°C to 650°C for 0.5 h. X-ray diffraction analysis and resistance measurements revealed that high-resistance copper silicide was formed after annealing at 450°C for the Cu(Ni, 1.66 at.%) and Cu(Ni, 9.16 at.%) samples. However, no copper silicide was observed for Cu(Ni, 3.59 at.%) even after annealing at 650°C. Transmission electron microscopy provided evidence for a ~25-nm self-formed barrier layer at the Cu/SiO2 interface with Cu(Ni, 3.59 at.%). The failure to form a diffusion barrier for the Cu(Ni, 1.66 at.%) sample resulted from its low Ni doping concentration, which was insufficient to produce such a self-formed layer during annealing. The barrier failure was caused by grain refinement due to the increased Ni content, providing diffusion channels for atom diffusion. The results clearly suggest that addition of an appropriate amount of Ni can improve the thermal stability of Cu(Ni)/SiO2/Si interconnect structure materials.

B. Yu, D., Yu, L., **Asempah, I.,** Ju, H., Xu, J., Koyama, S., & Gao, Y. (**2020**). Microstructure, mechanical and tribological properties of VCN-Ag composite films by reactive magnetron sputtering. *Surface and Coatings Technology*, *399*, 126167.

Web of Science Core Collection: Science Citation Index Expanded; **Scopus Index**

A series of VCN-Ag films with different Ag content were deposited by the magnetron sputtering system. The microstructure, mechanical and tribological properties of VCN-Ag films were characterized by X-ray diffractometer (XRD), Raman spectrometer, transmission electron microscopy (TEM), scanning electron microscopy (SEM), nano-indentation and ball-on disc tribo-meter. The results showed that the deposited VCN-Ag films consisted of face-centered cubic (fcc) Ag, fcc-VCN, tetragonal (t) V5CN and amorphous graphite and CNx phases, and nano-crystalline Ag was dispersed in the films. The addition of Ag below 0.72 at.% into the film increased the hardness, however, the hardness decreased rapidly when the Ag content was increased furtherly. The initial introduction of Ag into the film led to the lowering of the film's room-temperature wear rate, nonetheless, the wear resistance deteriorated when the Ag content was further increased. However, the friction coefficient of the films at room temperature increased monotonically as the content of the Ag increased. As for elevated temperature tribological properties of the film at 3.03 at.% Ag, there was an initial increase in frictional values but, when the temperature was above 300 °C the frictional values declined. More so, the wear rate increased monotonically when the temperature increased from 100 °C to 500 °C.

C. Yu, D., Yu, L., **Asempah, I.,** Ju, H., Xu, J., Koyama, S., & Gao, Y. (**2020**). Microstructure, mechanical and tribological properties of VCN-Ag composite films by reactive magnetron sputtering. *Surface and Coatings Technology*, *399*, 126167.

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D. Li, X., Cheng, B., **Asempah, I.,** Shi, Q., Long, A. Q., Zhu, Y. L., ... & Jin, L. (**2020**). Effect of Different Ni Contents on Thermal Stability of Cu (Ni) Alloy Film. *Journal of Electronic Materials*, *49*(10), 5674-5680.

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NYANOR, PETER (PhD)

A. **Nyanor, P.,** El-Kady, O., Yehia, H. M., Hamada, A. S., & Hassan, M. A. (**2020**). Effect of Bimodal-Sized Hybrid TiC–CNT Reinforcement on the Mechanical Properties and Coefficient of Thermal Expansion of Aluminium Matrix Composites. *Metals and Materials International*, 1-14.

Web of Science Core Collection: Science Citation Index Expanded; **Scopus Index**

Aluminium (Al) matrix reinforced with carbon nanotubes (CNT), micron-sized titanium carbide (TiC) particles, and bimodal (nano + micron) hybrid TiC–CNT is fabricated by

solution ball milling, followed by cold compaction and vacuum sintering to improve the mechanical properties and reduce thermal expansion. The hardness, wear resistance, compressive strength and CTE of pure Al, 0.6 wt% CNT/Al, 10 wt% TiC/Al, and hybrid 10–0.6 wt% TiC–CNT/Al composites have been investigated in this work. Analysis of strengthening mechanisms based on theoretical models, microstructure, and properties of constituent materials is performed. Microstructure analysis reveals an excellent distribution of the reinforcement phase and no new phase formation in sintered composites. The hardness value of bimodal TiC–CNT reinforced Al composite is significantly higher than monomodal TiC reinforced composite, reaching 2.3 times the hardness value of pure Al. Similarly, the wear resistance improved, and CTE reduced with CNT and TiC addition but is even significantly better in the hybrid reinforced composite. Experimental values of CTE show good agreement with the theoretical model. The strength and ductility of materials are mutually exclusive, but the compressive strength of pure Al has been doubled without significant loss in ductility through the use of bimodal-sized hybrid TiC–CNT reinforcement in this work.

B. **Nyanor, P.,** Bahador, A., El-Kady, O. A., Umeda, J., Kondoh, K., & Hassan, M. A. (**2020**). Improved ductility of spark plasma sintered aluminium-carbon nanotube composite through the addition of titanium carbide microparticles. *Materials Science and Engineering: A*, *795*, 139959.

Web of Science Core Collection: Science Citation Index Expanded; **Scopus Index**

The prevalence of low fracture strain in metal matrix composites (MMCs), in comparison to the unreinforced matrix material, has always been a challenge, especially in CNT reinforced composites. The study investigates the improvement in the ductility of carbon nanotubes (CNT) reinforced aluminium matrix composite, through the introduction of 2.5 μm titanium carbide (TiC) particles as a second reinforcement phase. The bimodal hybrid composite is fabricated by successive application of flake powder metallurgy of Al powder, solution coating of CNT on Al powder, spark plasma sintering, and hot extrusion of the resulting billet. Field-emission scanning electron microscopy (FE-SEM) analysis reveals that the solution coating process produced Al powder perfectly coated with individual CNTs. The pure Al so fabricated had a tensile strength of 125 MPa and elongation of 40%, while the tensile strength and elongation of the Al-0.5CNT composite of 232 MPa and 5.2%, respectively, is considered typical. However, introducing 2.5 wt% TiC microparticles to form Al-2.5TiC-0.5CNT hybrid composite, reduced the UTS to 186 MPa while the elongation increased to 33%. The role of dislocation generation and annihilation by the reinforcement phase is explored to explain the novel behaviour of the bimodal hybrid composite. The adverse effect of microparticles on the strength of the hybrid composite is contextualized in terms of strengthening mechanisms and a theoretical estimation.

KUTSANEDZIE, FELIX (PROF.)

A. Xu, Y., **Kutsanedzie, F. Y.,** Hassan, M., Zhu, J., Ahmad, W., Li, H., & Chen, Q. (**2020**). Mesoporous silica supported orderly-spaced gold nanoparticles SERS-based sensor for pesticides detection in food. *Food Chemistry*, *315*, 126300.

Web of Science Core Collection: Science Citation Index Expanded; **Scopus Index**

In this study, a novel sensor fabricated with compactly arranged gold nanoparticles (AuNPs) templated from mesoporous silica film (MSF) *via* air-water interface has been

confirmed as a promising surface-enhanced Raman scattering (SERS) substrate for detecting trace levels of 2,4-dichlorophenoxyacetic acid (2,4-D), pymetrozine and thiamethoxam. The densely arranged AuNPs@MSF had an average AuNPs size of 5.15 nm with small nanogaps (<2nm) between AuNPs, and exhibited a high SERS performance. SERS spectra of pesticides were collected after their adsorption on the AuNPs@MSF. The results showed that the concentration of 2,4-D, pymetrozine and thiamethoxam gave a good linear relationship with SERS intensity. Moreover, the designed SERS-based sensor (AuNPs@MSF) was stable for 3 months with ca. 3% relative standard deviation (RSD) and was applied successfully for the analysis of 2,4-D extraction from both environmental and food samples. The proposed SERS-based sensor was further validated by HPLC and showed satisfactory result ($p > 0.05$).

B. **Kutsanedzie, F. Y.,** Agyekum, A. A., Annavaram, V., & Chen, Q. (**2020**). Signal-enhanced SERS-sensors of CAR-PLS and GA-PLS coupled AgNPs for ochratoxin A and aflatoxin B1 detection. *Food Chemistry*, *315*, 126231.

Web of Science Core Collection: Science Citation Index Expanded; **Scopus Index**

Ochratoxin-A (OTA) and aflatoxin-B1 (AFT-B1) pose debilitating health threats to consumers and therefore require rapid monitoring with sensors. This work synthesized silver nanoparticles (AgNPs) within ($4 \leq pH \leq 11$) ± 0.2 to attain different enhancement-factors (EF). AgNP@pH-11 which gave the highest SERS-EF (1.45 × 108) was selected to fabricate SERS-sensor; and coupled to two chemometric algorithms for the prediction of OTA and AFT-B1 in prepared standard solutions (SS) and spiked-cocoa-beans samples (SCBS). The LOD for OTA (2.63 pg/mL) and AFT-B1 (4.15 pg/mL) in the SCBS were lower compared with 0.002 µg/mL. The built-models recorded residual-predictive-deviations above 3. Obtained recovery rates of 96–110%; and the low coefficients of variation (2.12–8.07%) realized for both toxins suggest the predicted results are reproducible. The SERS-sensor holds promise for the rapid quantification of OTA and AFT-B1 at pg/mL level in cocoa beans to enable safety assurance in the cocoa beans industry.

C. Xu, Y., **Kutsanedzie, F. Y.,** Hassan, M. M., Zhu, J., Li, H., & Chen, Q. (**2020**). Functionalized hollow Au@ Ag nanoflower SERS matrix for pesticide sensing in food. *Sensors and Actuators B: Chemical*, *324*, 128718.

Web of Science Core Collection: Science Citation Index Expanded; **Scopus Index**

Accumulation of pesticides in human body via food consumption poses health risks, hence the quantitative detection of pesticides in foodstuffs has become vital. In this study, a rapid and sensitive SERS-based sensor for detecting 2,4-dichlorophenoxyacetic acid (2,4-D) using antibody-functionalized magnetite nanoparticles (antibody-MNPs) as enrichment probe and antigen-MBA-functionalized hollow Au@Ag bimetallic nanoflowers (HAu@AgNFs@MBA-antigen) as SERS signal probe was developed. Under the optimized conditions, a wide linear range of 0.001−100 µg/mL for sensing 2,4-D was attained with a low detection limit (LOD) of 0.11 ng/mL. The developed sensor was successfully applied to detect 2,4-D in spiked tea and milk samples with recoveries of 89.73–100.27 % and the relative standard deviation (RSD) values of 2.56–4.97 % obtained. The SERS-based sensor fabricated when validated by the HPLC, no statistical significance differences were obtained based on their computed accuracy and precision values using the student's *t*- and *F*- tests at $\alpha = 5\%$.

D. Lin, H., Lin, J. J., Man, Z. X., Jin, H. J., **Kutsanedzie, F. Y.,** & Chen, Q. S. (**2020**). Development of Colorimetric Detection of 2, 4, 5-Trimethyloxazole in Volatile Organic Compounds Based on Porphyrin Complexes for Vinegar Storage Time Discrimination. *Food Analytical Methods*, *13*(12), 2192-2203.

Web of Science Core Collection: Science Citation Index Expanded; **Scopus Index**

2,4,5-Trimethyloxazole, an important volatile organic compound, is widely detected in food products such as wine and vinegar. The current study presents a colorimetric sensor array (CSA) made of porphyrins and pH indicator for analysing the 2,4,5-trimethyloxazole in complex volatile organic compounds (VOCs). Based on density functional theory (DFT), time-dependent density functional theory (TDDFT) and UV spectral analysis, porphyrin complexes were synthesized and optimized specifically for the discriminating of 2,4,5-trimethyloxazole. We explored the possibility of porphyrins binding with VOCs, and the binding energies, dipole moments or equilibrium constants of optimized porphyrins have an upward trend after combining with 2,4,5-trimethyloxazole. The colorimetric dye of 5,10,15,20-tetrakis(4-fluorophenyl)-21H,23H-porphine zinc (TPP-Zn-F) is found specifically sensitive to the compound of 2, 4, 5-trimethyloxazole. The optimized porphyrin can resist the interference of complex VOCs, and the accuracy of characterization of 2,4,5-trimethyloxazole was improved. Finally, CSA composed of TPP-Zn-F and two chemoselective dyes shows a great ability to identify the storage time of vinegar, and the rates of LDA and KNN algorithms to predict vinegar samples are 92.5% and 100%, respectively.

E. Zareef, M., Chen, Q., Hassan, M. M., Arslan, M., Hashim, M. M., Ahmad, W., ... **Kutsanedzie, F. Y.,** & Agyekum, A. A. (**2020**). An overview on the applications of typical non-linear algorithms coupled with NIR spectroscopy in food analysis. *Food Engineering Reviews*, 1-18.

Web of Science Core Collection: Science Citation Index Expanded; **Scopus Index**

Near-infrared (NIR) spectroscopy as a low-cost technique with its non-destructive fast nature, precision, control, accuracy, repeatability, and reproducibility has been extensively employed in most industries for food quality measurements. Its coupling to different modeling techniques has been identified as a way of improving the accuracy and robustness of non-destructive measurement of foodstuffs. This review provides an overview of the application of non-linear algorithms in food quality and safety specific to NIR spectroscopy. The review also provides in-depth knowledge about the principle of NIR spectroscopy along with different non-linear models such as artificial neural network (ANN), AdaBoost, local algorithm (LA), support vector machine (SVM), and extreme learning machine (ELM). Moreover, non-linear algorithms coupled with NIR spectroscopy for ensuring food quality and their future perspective has been discussed.

DEPARTMENT OF ELECTRICAL/ELECTRONIC ENGINEERING

ACAKPOVI, AMEVI (PROF.)

1. Asabere, N. Y., Xu, B., **Acakpovi, A.,** & Deonauth, N. (**2021**). SARVE-2: exploiting social venue recommendation in the context of smart conferences. *IEEE Transactions on Emerging Topics in Computing*. *9*(1), 14-31.

Web of Science Core Collection: Science Citation Index Expanded; **Scopus Index**

Globally, the superfluity of scholarly research conferences in varying disciplines has introduced the issue of scholarly big data and information overload related to both research papers and conference proceedings/sessions. This evident scholarly expansion in different disciplines has increased the collaborative importance of conferences. Consequently, the problem regarding attendees selecting the right conference session(s) to attend in academic conferences requires further and urgent attention. Using a smart conference scenario, this paper aims to address the problem above by proposing an improved venue recommender algorithm called Socially-Aware Recommendation of Venues and Environments-2 (SARVE-2). Using a closeness centrality approach, SARVE-2 initially employs Breadth First Search (BFS) and Depth First Search (DFS) strategies to search for relevant presenters for a target attendee. Then, the tie strength of the (searched) presenter and target attendee is computed to generate reliable social (conference session) recommendations for the target attendee. Through the utilization of a relevant (real-world) dataset, our benchmark experiments reveal that, in comparison with other contemporary methods, SARVE-2 exhibits better performance in terms of effective social recommendation search, as well as social recommendation quality, coverage and accuracy.

2. **Acakpovi, A.** Adjei, P., Asabere, N. Y., Sowah, R. A., Sackey, D. M. (**2021**), Techno-Economic Evaluation of Hydrogen, Fuel Cell Electricity Generation Based on Anloga (Ghana) Wind Regime, *International Journal of Energy Optimization and Engineering* (*IJEOE*), *10*(3), 47-69.

Web of Science Core Collection: Emerging Sources Citation Index; **Scopus Index**

This paper assesses the performance of electricity generation using wind/hydrogen/fuel-cell technology. The intermittency of renewables, especially wind, and the need for storage of excess energy make them unattractive for continuous generation of electricity. This paper focuses on the wind resource of Anloga (Ghana) and the potential of hydrogen production from water electrolysis. The assessment of this system covers three main areas including the potential energy generation, environmental impacts, and economic impacts. The paper adopted analytical models of energy generation of fuel cell and hydrogen technologies and further performs their assessment using HOMER software. It was revealed that the annual electricity production from the hydrogen fuel cell is 25,999kW/yr, with an annual capacity shortage of 392kW/yr representing a 10% capacity shortage. The levelized cost of electricity was 0.602$/kWh and the emissions have been completely minimized as compared to diesel generation plants.

3. **Acakpovi, A.,** Ternor, A. T., Asabere, N. Y., Adjei, P., & Iddrisu, A. S. (**2020**). Time series prediction of electricity demand using Adaptive Neuro-Fuzzy Inference Systems. *Mathematical Problems in Engineering*, Article ID 4181045, 1-14.
Web of Science Core Collection: Science Citation Index Expanded; **Scopus Index**

This paper is concerned with the reliable prediction of electricity demands using the Adaptive Neuro-Fuzzy Inference System (ANFIS). The need for electricity demand prediction is fundamental and vital for power resource planning and monitoring. A dataset of electricity demands covering the period of 2003 to 2018 was collected from the Electricity Distribution Company of Ghana, covering three urban areas namely Mallam, Achimota, and Ga East, all in Ghana. The dataset was divided into two parts: one part covering a period of 0 to 500 hours was used for training of the ANFIS algorithm while the second part was used for validation. Three scenarios were considered for the simulation exercise that was done with the MATLAB software. Scenario one considered four inputs sampled data, scenario two considered an additional input making it 5, and scenario 3 was similar to scenario 1 with the exception of the number of membership functions that increased from 2 to 3. The performance of the ANFIS algorithm was assessed by comparing its predictions with other three forecast models namely Support Vector Regression (SVR), Least Square Support Vector Machine (LS-SVM), and Auto-Regressive Integrated Moving Average (ARIMA). Findings revealed that the ANFIS algorithm can perform the prediction accurately, the ANFIS algorithm converges faster with an increase in the data used for training, and increasing the membership function resulted in overfitting of data which adversely affected the RMSE values. Comparison of the ANFIS results to other previously used methods of predicting electricity demands including SVR, LSSVM, and ARIMA revealed that there is merit to the potentials of the ANFIS algorithm for improved predictive accuracy while relying on a quality data for training and reliable setting of tuning parameters.

4. Asabere, N. Y., & **Acakpovi, A.** (**2020**). ROPPSA: TV Program Recommendation Based on Personality and Social Awareness. *Mathematical Problems in Engineering*, Article ID 1971286, 1-15.
Web of Science Core Collection: Emerging Sources Citation Index; **Scopus Index**

The rapid growth of mobile television (TV), smart TV, and Internet Protocol Television (IPTV) content due to the convergence of broadcasting and the Internet requires effective recommendation methods to select appropriate TV programs/channels. Many previous methods have been proposed to address this issue. However, imperative factors such as the utilization of personality traits and social properties to recommend programs for TV viewers remain a challenge. Consequently, in this paper, we propose a recommender algorithm called Recommendation of Programs via Personality and Social Awareness (*ROPPSA*) for TV viewers. *ROPPSA* utilizes normalization and folksonomy procedures to generate group recommendations for TV viewers who have common similarities in terms of personality traits and tie strength with a Target TV Viewer (TTV). Therefore, *ROPPSA* improves TV viewer cold-start and data sparsity situations by utilizing their personality traits and tie strengths. We conducted extensive experiments on a relevant dataset using standard evaluation metrics to substantiate our *ROPPSA* recommendation method. Results of our experimentation procedure depict the advantage, recommendation accuracy, and outperformance of *ROPPSA* in

comparison with other contemporary methods in terms of *precision*, *recall*, *f-measure* (*F1*), and arithmetic mean (*AM*).

5. **Acakpovi, A.,** Adjei, P., Nwulu, N., & Asabere, N. Y. (**2020**). Optimal Hybrid Renewable Energy System: A Comparative Study of Wind/Hydrogen/Fuel-Cell and Wind/Battery Storage. *Journal of Electrical and Computer Engineering*, 2020.
   Web of Science Core Collection: Emerging Sources Citation Index; **Scopus Index**

This paper performs a technoeconomic comparison of two hybrid renewable energy supplies (HRES) for a specific location in Ghana and suggests the optimal solution in terms of cost, energy generation capacity, and emissions. The two HRES considered in this paper were wind/hydrogen/fuel-cell and wind/battery storage, respectively. The necessity of this study was derived from the rise and expansion of hybrid renewable energy supply in a decentralised network. The readiness to embrace these new technologies is apparently high, but the best combination for a selected location that brings optimum benefits is not obvious and demands serious technical knowledge of their technical and economic models. In the methodology, an analytical model of energy generation by the various RE sources was first established, and data were collected about a rural-urban community in Doderkope, Ghana, to test the models. HOMER software was used to design the two hybrid systems based on the same load profiles, and results were compared. It turns out that the HRES 1 (wind/hydrogen/fuel-cell) had the lowest net present cost (NPC) and levelized cost of electricity (COE) over the project life span of 25 years. The energy reserve with the HRES 2 (wind/battery storage) was huge compared to that with the HRES 1, about 270% bigger. Furthermore, with respect to the emissions, the HRES 2 was environmentally friendlier than the HRES 1. Even though the battery storage seems to be more cost-effective than the hydrogen fuel-cell technology, the latter presents some merits regarding system capacity and emission that deserve greater attention as the world looks into more sustainable energy storage systems.

ASAMOAH, BARNES RICHARD

A. **Asamoah, R. B.,** Yaya, A., Nbelayim, P., Annan, E., & Onwona-Agyeman, B. (**2020**). Development and Characterization of Clay–Nanocomposites for Water Purification. *Materials*, *13*(17), 3793.
   Web of Science Core Collection: Science Citation Index Expanded; **Scopus Index**

In this work we propose a facile method of preparing cost-effective clay-metaloxide/metal (CuO/Ag and ZnO/Ag) composite pellets for an efficient water purification technique. Clay, with intrinsic antibacterial activity, served as a membrane support for different metaloxide/Ag nanoparticles (NPs) concentrations (2.5, 5 and 10 wt.%), as the active fillers. The effect of time (24 and 48 h) on the bactericidal activity of these pellets was also monitored. The clay–nanocomposite pellets were characterized using: X-ray diffraction, X-ray fluorescence, scanning electron microscopy, transmission electron microscopy, ultraviolet–visible (UV–Vis) spectrophotometry and nitrogen desorption analysis. The antibacterial activity performance was tested using E. coli and S. aureus strains of ATCC25922 and ATCC25923, respectively, in two aqueous media (nutrient broth and nutrient-free) by the colony-forming unit method. The results showed that the clay-CuO/Ag composite with a bandgap (1.24 eV) exhibited overall best performance under all conditions and time factors of ~100% efficiency in nutrient-free

medium for all concentrations and times and 20–40% efficiency in nutrient broth for 24 h. The clay-ZnO/Ag with a bandgap of 2.88 eV showed no bactericidal activity in both media, except for that with 10 wt.% ZnO/Ag which showed 100% efficiency in nutrient-free medium after 24 h. All the synthesized composites showed 100% bactericidal efficiency in nutrient free medium after 48 h. These results indicate that, the clay/metaloxide/Ag could serve as efficient water purification technique, with a potential for large-scale commercialization

B. Asamoah, R. B., Annan, E., Mensah, B., Nbelayim, P., Apalangya, V., Onwona-Agyeman, B., & Yaya, A. (**2020**). A Comparative Study of Antibacterial Activity of CuO/Ag and ZnO/Ag Nanocomposites. *Advances in Materials Science and Engineering*, *2020*.

Web of Science Core Collection: Science Citation Index Expanded, **Scopus Index**

The synergistic effects of transition metal based nanocomposites are known to possess enhanced antibacterial activities. However, in-depth analysis of the relative antibacterial performance of some of the prominent nanocomposites remains unavailable. This study compares the antibacterial activity of two separate nanocomposites, which are copper oxide with silver (CuO/Ag) and zinc oxide with silver (ZnO/Ag). The individual CuO/Ag and ZnO/Ag nanocomposites were synthesised by a mixed wet-chemical method. The resulting particles were analysed by XRD, XRF, TEM, UV-Vis spectrophotometer, BET, and FTIR. The antibacterial activity of the nanoparticles were tested on Gram-negative and Gram-positive bacteria, Escherichia coli (ATCC25922) and Staphylococcus aureus (ATCC25923), respectively, using the Kirby–Bauer disc diffusion and the microdilution methods. The Kirby–Bauer disc diffusion test results had the same minimum inhibition concentration (MIC) value for both CuO/Ag and ZnO/Ag against E. coli and S. aureus, which was 0.25 mg/ml. The applied nanocomposites using microdilution showed that CuO/Ag had approximately 98.8% and 98.7% efficiency on the respective Gram-positive and Gram-negative bacterial species, while ZnO/Ag achieved 91.7% and 89.3% efficiency, respectively, against the Gram-positive and Gram-negative bacterial species. This study presents a novel approach for relative analysis of the performance efficiency of transition metal based nanocomposites.

C. Asamoah, R. B., Yaya, A., Mensah, B., Nbalayim, P., Apalangya, V., Bensah, Y. D., ... & Annan, E. (**2020**). Synthesis and characterization of zinc and copper oxide nanoparticles and their antibacteria activity. *Results in Materials*, *7*, 100099.

Scopus Index, Publisher: Elsevier

Inorganic nano-metal oxides can be effective alternatives to drug resistant organic antibiotics due to their broad spectrum antimicrobial activity against pathogenic and mutagenic gram-negative and positive bacteria. In this study, zinc and copper oxides (ZnO and CuO) were synthesised using a wet chemical reduction method. The oxide nanoparticles were characterized using X-ray diffraction (XRD), UV–Vis spectrometer, Fourier Transformed Infra-red spectrometer and Transmission electron microscopy (TEM). The antibacterial activities of the nanoparticles were investigated against *e. coli* and *s. aureus* using disk diffusion and microdilution tests. The TEM micrographs showed that copper oxide nanoparticles assumed a nanorod shape of average length of 100 nm whiles zinc oxide nanoparticles were spherical of average diameter of 15 nm. The FTIR results showed that the nanoparticles were free of impurities and organic

surfactants, which was confirmed by XRD. For the antibacteria tests, the minimum inhibition concentration (MIC) of CuO against *e. coli* and *s. aureus* were 1 mg/ml and 0.25 mg/ml respectively whiles it was 0.1 mg/ml for ZnO against *s. aureus* with ZnO producing no inhibition against *e. coli*. With the microdilution test, both nanoparticles exhibited activity against both bacterias at all varying concentrations. The results concluded that CuO had higher antibacteria activity compared to ZnO.

DEPARTMENT OF CIVIL ENGINEERING

AGBOTUI, Y. PRODEO (PhD)

A. **Agbotui, P.,** Anornu, G., Agbotui, T., Gyabaah, F., Amankwah-Minkah, A., Brookman-Amissah, M., ... & Sallah, J. (**2021**). Risk-based contaminated land management policy mindset: a way out for Ghana's environmental challenges. *African Geographical Review*, 1-14.

Web of Science Core Collection: Emerging Sources Citation Index; **Scopus Index**

Ghana lacks an environmental policy on contaminated land. This commentary aims at suggesting a proactive risk-based contaminated land management policy by presenting precedents of land contamination and environmental disasters from developed jurisdictions and how lessons learned improved environmental regulation. In Ghana, however, when contamination and environmental disasters happen, they are hardly investigated, and even if investigated, recommendations are not implemented. Then, a summary of the United Kingdom's Contaminated Land Policy framework is presented and it is demonstrated that Ghana has the professionals to implement the policy. Recommendations are presented for future implementation of a contaminated land policy in Ghana.

B. **Agbotui, P. Y.,** West, L. J., & Bottrell, S. H. (**2020**). Characterisation of fractured carbonate aquifers using ambient borehole dilution tests. *Journal of Hydrology*, *589*, 125191.

Web of Science Core Collection: Science Citation Index Expanded; **Scopus Index**

Fractured carbonate aquifers derive their transmissivity essentially from a well-developed network of solutionally-enhanced fractures and conduits that can lead to high groundwater velocities and high vulnerability to contamination of water quality. Characterisation of the variation of hydraulic properties with depth is important for delineating source protection areas, characterising contaminant fate and transport, determination of the effectiveness of aquifer remediation, and parameter estimation for models. In this work, ambient open borehole uniform and point injection dilution tests were conducted on observation boreholes in the unconfined Cretaceous Chalk aquifer of East Yorkshire, UK, and interpreted in conjunction with other data via the implementation of a new work flow. This resulted in the characterisation of flow in these boreholes and the inference of properties such as groundwater flow patterns and velocities in the surrounding aquifer formation. Our workflow allowed sections of open boreholes showing horizontal versus vertical flow to be distinguished, and the magnitude of such flows and exchanges with the aquifer to be determined. Flow within boreholes were then used to characterise: i) presence and direction of vertical hydraulic gradients; ii) nature and depth distribution of flowing features; iii) depth interval porosity and permeability estimation of the flowing features from overall borehole transmissivity and geophysical image or caliper logs; iv) groundwater velocity estimation in the surrounding aquifer. Discrete flowing features were distributed across the range of depths sampled by the observation boreholes (typically up to 45–60 mbgl), but the majority were located in the zone of water table fluctuation marked by solutionally enlarged flow features. Quantitative interpretation of both uniform injection (tracer distributed throughout the open borehole section) and point injection (slug of tracer introduced at targeted depth) yielded vertical velocities within the borehole water column in broad agreement with those measured by flow logging.

Depth specific fracture kinematic porosities inferred from the ambient dilution data combined with long-interval pump test and geophysical log data ranged between 3.7 × 10−4–4.1 × 10−3 with an average of 2.1 × 10−3; these values were in excellent agreement with those from other methods applied to the same aquifer such as larger scale pumping tests. A new approach to estimation of groundwater velocities from the dilution test data using externally measured hydraulic gradients gave inferred horizontal groundwater velocities ranging between 60 and 850 m/day, in full agreement with those from previously conducted borehole-to-borehole tracer tests. These results confirm that the studied aquifer is karstic, with rapid preferential pathways which have implication for flow and transport modelling, and pollution vulnerability. Our study results indicate that ambient single-borehole dilution approaches can provide an inexpensive and reliable approach for the characterisation of fractured and karstic aquifers.

ODAI, SAMUEL NII (PROF.)

A. Badmos, B. K., Villamor, G. B., Agodzo, S. K., **Odai, S. N.,** & Badmos, O. S. (**2021**). Evaluating the impact of an agricultural land-use change adaptation strategy on household crop production in semi-arid Ghana. *Singapore Journal of Tropical Geography*, *42*(1), 65-84.

Web of Science Core Collection: Science Citation Index Expanded; **Scopus Index**

In this study, the Land Use Dynamic Simulator model was applied to investigate the impact of farm credit as an adaptation strategy to cope with effects of climate variability on agricultural land-use change and crop production in the Vea watershed in Ghana. The authors identified the determinants of crop choices within the landscape (e.g., farm household and biophysical characteristics of farm plot). The crop choice sub-model was then linked to the crop yield sub-model to determine the yields of selected crops. In adapting to the impacts of climate variability, the maize credit adoption sub-model under the maize cultivation credit scenario was integrated into decision-making. This was simulated for a 20-year period, and compared with the business-as-usual scenario. Under the simulated maize credit scenario, maize adopters increased from about 20 per cent to about 50 per cent and the area allocated for maize cultivation significantly increased by about 266 per cent. Consequently, the average annual aggregated household crop yield increased by 6.3 per cent higher than in the business-as-usual scenario. This simulation study shows that access to maize credit can significantly influence agricultural land-use change and food availability in the study area. However, although access to farm credit may translate into food availability, the sustainability of this strategy is questionable.

B. Darko, S., Adjei, K. A., Gyamfi, C., **Odai, S. N.,** & Osei-Wusuansa, H. (**2021**). Evaluation of RFE satellite precipitation and its use in streamflow simulation in poorly gauged basins. *Environmental Processes*, 1-22.

Scopus Index, Publisher: Springer

The performance of satellite Rainfall Estimates (RFE, version 2.0) at daily resolution was evaluated in comparison with ground-based meteorological datasets (GBD) by applying statistical and hydrological modeling approaches. In-situ daily rainfall observations from 5 stations in and around the periphery of the Nasia river basin in Ghana, covering a period of 15 years (2001–2015), were used in this research. Comparison of the observed rainfall data with satellite-based estimates revealed a strong positive correlation, which yielded the highest correlation coefficient (R2) of 0.74 at the monthly timescale as against the

weak positive linear relationship with the highest R2 of 0.41 at the daily timescale. Mean annual precipitation computed from both datasets also showed close correspondence yielding 978.83 mm/annum and 977.12 mm/annum for RFE and GBD, respectively. Calibration at the daily timescale showed that the ground-based data (GBD) performed better in simulating the observed streamflows compared to the satellite-based (RFE) simulations yielding a Nash Sutcliffe Efficiency (NSE) of 0.81 and 0.67 for the GBD and RFE, respectively. At the monthly timescale, the performance of both datasets improved, resulting in an NSE of 0.89 and 0.80 for the GBD and RFE, respectively. Although the RFE-based simulations could not perfectly reproduce the observed discharge, it can be used to supplement traditional in-situ gauge data to address the problem of non-availability of observed rainfall data for hydrological applications such as water resources planning and assessment. Future research into the usability of the RFE in other medium scale river basins could be carried out to compare with these results.

C. Logah, F. Y., Adjei, K. A., Obuobie, E., Gyamfi, C., & **Odai, S. N.** (**2021**). Evaluation and comparison of satellite rainfall products in the Black Volta basin. *Environmental Processes*, *8*(1), 119-137.

Scopus Index, Publisher: Springer

This study evaluated the performance of five satellite rainfall products (CHIRPS, PERSIANN, TRMM, RFE, and ARC) in the Black Volta Basin (BVB) using four performance evaluation methods: pairwise statistics, categorical statistics, rainfall intensity distribution, and extreme rainfall indices. In all, 21 rainfall stations distributed across the BVB with daily data spanning from 1981 to 2010 were used in the study. A high linear relationship was observed between observed and satellite rainfall data at decadal and monthly time scales as compared to weak relationship at the daily and annual time scales. The rainfall amount was least underestimated by CHIRPS at all the time scales. CHIRPS, PERSIANN and RFE performed well with the least deviation (BIAS ≤ 10%) from the observed rainfall amount at all time scales. Considering the high correlation coefficient and good NSE at decadal, monthly, and annual time scales, rainfall in the BVB is best represented by CHIRPS, followed by PERSIANN, RFE, ARC, and TRMM in that order. Though the probability of correctly detecting rainfall events is high (POD = 0.57–0.94), the satellite products were not able to adequately detect rainfall events in the basin at the daily time scale. The TRMM product was better in reproducing a very high rainfall amount (R ≥ 5 mm/day) in the basin as compared to CHIRPS, PERSIANN, RFE, and ARC. Extreme rainfall indices (R20, R99p, CWD and SDII) in the study basin were best represented by CHIRPS. Generally, precipitation in the BVB is best represented by CHIRPS, followed by PERSIANN, TRMM, RFE, and ARC in that order.

D. Abungba, J. A., Khare, D., Pingale, S. M., Adjei, K. A., Gyamfi, C., & **Odai, S. N.** (**2020**). Assessment of hydro-climatic trends and variability over the Black Volta basin in Ghana. *Earth Systems and Environment*, *4*(4), 739-755.

Web of Science Core Collection: Emerging Sources Citation Index; **Scopus Index**

The present study examines the trends of hydro-climatic parameters over the Black Volta Basin in Ghana. Trend analysis was carried at different time scales (i.e., monthly, seasonal, and annual) from 1961 to 2016. Modified Mann–Kendall (MMK) test, Sen's slope estimates, and Pettit–Mann–Whitney test were applied to compute the existence of a trend, the degree of change, and probable change point, respectively. The results

revealed that there are warming trends over the entire Black Volta Basin. Both temperature extremes, i.e., highest and lowest (annual, seasonal, and monthly scale), for upstream and downstream region revealed an increasing trend. The annual rainfall in the upstream region depicted a downward trend, while downstream showed an increasing trend in the Basin. The seasonal trend analysis for rainfall depicted a falling trend (@ Sen's slopes − 0.47 and − 0.69) with a percentage change over the 56 years − 19.66% and − 19.30%, respectively, for upstream and downstream regions during the dry periods. While, the rainy season showed a decreasing rainfall trend (@ Sen's slope − 0.71 and percentage change − 4.41%) for the upstream region and increasing (@ + 0.71 & 4.39%) for the downstream. However, annual rainfall for the sites in the Basin depicted a decreasing trend (@ − 0.88 and − 4.76%) for upstream and an increasing trend (@ + 0.16 with 0.81% change) for downstream region. Annual streamflow revealed an increasing trend (@ + 0.02 with a 1.53% change) over the 43 years for upstream and a decreasing trend (@—0.41 and − 15.04% change) for downstream region at Chache-Bole. Therefore, this study output will be helpful for different stakeholders and policymakers within the Black Volta Basin of the West African sub-region toward improving decisions on water resources management.

E. Ackom, E. K., Adjei, K. A., & **Odai, S. N.** (**2020**). Monitoring land-use and land-cover changes due to extensive urbanization in the Odaw River Basin of Accra, Ghana, 1991–2030. *Modeling Earth Systems and Environment*, *6*, 1131–1143.

Web of Science Core Collection: Emerging Sources Citation Index; **Scopus Index**

Excessive urban growth has led to degradation in ecosystems in most underdeveloped countries. Using Landsat data and combination of unsupervised and supervised classifcation methods, extent and trends of variations in the urban environment of Odaw River Basin (ORB) in Accra from 1991 to 2016 were assessed. Evaluation of land-use and land-cover (LULC) assessment of revealed that the ORB has been subjected to four diverse rates of land degradation during the periods of 1991, 2002, 2011, and 2016. This is as a result of upsurge in settlement of about 238.20%. The Markov chain and cellular automation integrated model simulated the 2016 LULC patterns successfully due to the results of the comparison with the classifed 2016 LULC. The expected LULC patterns for 2030 revealed that land degradation will be substantial in the northern, western, and the eastern portions of ORB where open forest, bare land, and closed forest are, respectively, transformed to settlement. These outcomes will provide a reference base for further research on hydrological response to the changing land use and land cover while helping the environmentalist fght against fooding in the study area.

F. Arthur, E., Anyemedu, F. O. K., Gyamfi, C., Asantewaa-Tannor, P., Adjei, K. A., Anornu, G. K., & **Odai, S. N.** (**2020**). Potential for small hydropower development in the Lower Pra River Basin, Ghana. *Journal of Hydrology: Regional Studies*, *32*, 100757.

Web of Science Core Collection: Science Citation Index Expanded; **Scopus Index**

This study examines the potential for Small Hydropower Development in a semi-arid environment albeit the lack of data. Geographic and site specific information acquired through geographic and remote sensing techniques are applied in a physically based semi-distributed hydrologic model to simulate discharges for ungauge areas for consideration of hydropower. Flow Duration Curves (FDC) and Power Duration Curves

(PDC) have been constructed for suitable sites from which design flow and firm energy is established. The final assessment resulted in the identification of ten sites (HP1 – HP10) along the LPR with potential for hydropower generation. The maximum and minimum mean annual flows were 172.9 m3/s and 5.3 m3/s at hydropower sites HP1 and HP2 respectively. HP1 demonstrated the highest hydropower potential with firm power and annual firm energy at 90 % dependability estimated as 12.22 MW and 77.10 GW h with a total annual energy production (AEP) of 183.77 GW h. Hydropower sites HP3 and HP7 also had relatively high hydropower potential with firm power and annual firm energy of 10.0 MW, 47.01 GW h and 9.0 MW, 40.77 GW h respectively with AEP expected to be in the order of 157.67 GW h and 141.91 GW h respectively. A cascade system is proposed for hydropower sites HP1, HP3 and HP7 with estimated combined AEP of 483.4 GW h.

G. Ackom, E. K., Adjei, K. A., & Odai, S. N. (2020). Spatio-temporal rainfall trend and homogeneity analysis in flood prone area: case study of Odaw river basin-Ghana. *SN Applied Sciences*, *2*(12), 1-26.

Web of Science Core Collection: Emerging Sources Citation Index; **Scopus Index**

Accurately forecasting rainfall trends is vital for the socio-economic development of a nation. Observed daily rainfall data from the Ghana Meteorological Agency (GMet) spanning 1980 – 2015 was deployed to study the spatio-temporal rainfall trend in the Odaw river basin (ORB) in Accra. Using Mann–Kendall (MK), Sen's slope and set of homogeneity tests, the monthly, annual and decadal rainfall variability based on the indices – rainfall total, daily maximum and rainy/wet day count were examined. Principal Component Analysis (PCA) and wavelet (WT) analysis were applied on the monthly time series in order to verify the spatio-temporal variability. It was observed that a mean value ranging from 760 to 1200 mm, 77.1–94.4 mm and 56–90 day count were recorded for Annual Rainfall Total (ART), Annual Daily Maximum (ADM) and Annual Rainy Days (ARD) respectively in the ORB. Mann–Kendal test recorded an overall non-significant positive trend in the Odaw basin for ART and ARD with an average positive slope of 3.7 mm/year and 0.23 wet days/year and a significant positive trend with slope value of 0.55 mm/year for ADM in the basin. On the monthly scale, a significant upward trend was observed for the dry seasonal months; December, January and February for the Monthly Rainfall Total (MRT) and Monthly Daily Maximum (MDM) rainfall series during the period at all stations. Homogeneity for both annual and monthly rainfall time series were observed over the stations in the basin by the Pettitt, Alexandersson's SNHT and Buishand's tests. PCA revealed that the spatial variability of rainfall in ORB is very diverse with 55.9% of the variability located in the middle to highland part while 44.0% of the variation is occurring mostly in the low-lying area at the southeastern part of the ORB. The wavelet analysis also revealed a strong annual periodicity at all the selected stations in the basin. The outcome of this study provides valuable information to formulate adaptation measures through appropriate strategies for managing flood in the study area.

H. Appiah, B., Poudyal, A., Anum, D. A., Appiah, G., Wesuta, A. C., Akodwaa-Boadi, K., ... & **Odai, S. N.** (2020). Challenges and facilitators of public engagement with water, sanitation, hygiene and other environmental health issues in Ghana and Uganda: perspectives of scientists, journalists and the public. *Journal of Water, Sanitation and Hygiene for Development*, *10*(1), 16-26.

Web of Science Core Collection: Science Citation Index Expanded; **Scopus Index**

Despite many water, sanitation, hygiene (WASH) and other environmental health challenges in sub-Saharan Africa, little is known about interactions involving scientists, journalists and the public to aid public understanding of the relationship between WASH and health. Using purposive sampling, we conducted key informant interviews and focus group discussions with scientists, journalists and members of the public in Ghana and Uganda to identify issues associated with the promotion of public engagement with WASH and other environmental health issues. An inductive thematic analysis was used to explore the evidence, challenges and opportunities of public engagement. The effectiveness of public engagement was constrained by poor interactions between scientists and journalists and limited understanding among the public on WASH and other environmental health issues. Challenges identified included inadequate scientists–journalists collaborations, scientists' lack of time, pressure from media organizations and concerns about journalists' inadequate capacity to communicate environmental issues due to lack of training. Possible solutions included increased interactions, science communication training and using public information officers as knowledge brokers between scientists and journalists to boost public engagement with WASH and other environmental health issues. Our study contributes to the literature on the need to actively engage the public with WASH and other environmental health concerns.

I. Ofosu, S. A., Adjei, K. A., & **Odai, S. N.** (2020). Ecological vulnerability of the Densu river Basin due to land use change and climate variability. *Cogent Engineering*, *7*(1), 1735714.

Web of Science Core Collection: Emerging Sources Citation Index; **Scopus Index**

Ecological hazards such as floods, drought and poor water quality remain notable disparaging natural catastrophes of climate variability in West Africa. Associated hazard manifestation is an amalgamation of various factors, which require enhanced knowledge of its spatio-temporal extent. This work aims at the identification and mapping of areas prone to ecological vulnerabilities in the Densu River Basin of Ghana. This research utilized a combination of Analytical Hierarchical Process (AHP) and multicriteria methods (MCM) using dataset such as land use land cover, type of soil, slope, drainage density, rainfall variability and the community distribution in the basin, using Geospatial Technology. Vulnerability mapping models were developed for flooding, drought and surface water quality. The resulting analysis revealed that about 15% of the basin was highly vulnerable to flooding, about 1% was prone to drought and 6% was prone to poor surface water quality. It was revealed that the southernmost part of the basin was susceptible to flooding whilst communities along the tributaries of the Densu river were predisposed to flooding and poor water quality. The study further displayed the extent of vulnerability of the communities within the Densu basin. Uniquely, a combination of AHP and MCM was successfully used to map the vulnerability of a river basin. Therefore, it is now possible to extend the procedures to other river basins for the development of effective mitigating strategies for future hazards.

J. Incoom, A. B. M., Adjei, K. A., & **Odai, S. N.** (**2020**). Rainfall variabilities and droughts in the Savannah zone of Ghana from 1960-2015. *Scientific African*, *10*, e00571.

Scopus Index, Publisher: Springer

In the Savannah region of Ghana, water scarcity appears to be a frequent occurrence, which is expected to worsen with the anticipated reductions in the quantity of rainfall received. A better estimation of future occurrences and the subsequent preparations are hinged on a solid understanding of past climatic patterns. Given that, trends in rainfall were analysed using the non-parametric Mann-Kendal test for nine (9) climate stations in as well as the entire Savannah zone of Ghana from 1960 to 2015. No significant trends were observed in annual rainfall for the entire study area as well as individual climate stations except Wenchi, where a negative trend (Sen's slope = -3.30, p-value = 0.01) was recorded at a 0.05 level of significance The Standardised Precipitation Index (SPI) was used to study rainfall anomalies. Droughts were observed to be a regular feature of the climate, occurring at alternating intervals with wet periods. Recovery of the wet periods from the droughts was observed to be declining post the year 2000. For most locations, 1983 recorded the most intense drought while a few others like Navrongo and Wa also saw 2015 being hardly hit by another. Aridity in the study area was found to be intensifying, with aridity index values increasing at a rate of 0.2/decade, although this was not found to be significant (p-value = 0.06) at a 0.05 level of significance. Similar to rainfall, aridity for most of the stations appeared to be increasing although these changes were not statistically significant except for Wenchi, which again recorded a significant increase (p-value of 0.02).

DEPARTMENT OF BUILDING TECHNOLOGY

ADJEI, EMMANUEL AKOI-GYEBI (PhD)

A. Adinyira, E., **Adjei, E. A. G.**, Agyekum, K. and Fugar, F.D.K. (**2021**). Application of machine learning in predicting construction project profit in Ghana using Support Vector Regression Algorithm (SVRA). *Engineering, Construction and Architectural Management*, doi.org/10.1108/ECAM-08-2020-0618.

Web of Science Core Collection: Emerging Sources Citation Index; **Scopus Index**

Purpose

Knowledge of the effect of various cash-flow factors on expected project profit is important to effectively manage productivity on construction projects. This study was conducted to develop and test the sensitivity of a Machine Learning Support Vector Regression Algorithm (SVRA) to predict construction project profit in Ghana.

Design/methodology/approach

The study relied on data from 150 institutional projects executed within the past five years (2014–2018) in developing the model. Eighty percent (80%) of the data from the 150 projects was used at hyperparameter selection and final training phases of the model development and the remaining 20% for model testing. Using MATLAB for Support Vector Regression, the parameters available for tuning were the epsilon values, the kernel scale, the box constraint and standardisations. The sensitivity index was computed to determine the degree to which the independent variables impact the dependent variable.

Findings

The developed model's predictions perfectly fitted the data and explained all the variability of the response data around its mean. Average predictive accuracy of 73.66% was achieved with all the variables on the different projects in validation. The developed SVR model was sensitive to labour and loan.

Originality/value

The developed SVRA combines variation, defective works and labour with other financial constraints, which have been the variables used in previous studies. It will aid contractors in predicting profit on completion at commencement and also provide information on the effect of changes to cash-flow factors on profit.

BROOKMAN-AMISSAH, MARK

A. Agbotui, P., Anornu, G., Agbotui, T., Gyabaah, F., Amankwah-Minkah, A., Brookman-Amissah, M., ... & Sallah, J. (**2021**). Risk-based contaminated land management policy mindset: a way out for Ghana's environmental challenges. *African Geographical Review*, 1-14.

Web of Science Core Collection: Emerging Sources Citation Index; **Scopus Index**

Ghana lacks an environmental policy on contaminated land. This commentary aims at suggesting a proactive risk-based contaminated land management policy by presenting precedents of land contamination and environmental disasters from developed jurisdictions and how lessons learned improved environmental regulation. In Ghana, however, when contamination and environmental disasters happen, they are hardly investigated, and even if investigated, recommendations are not implemented. Then, a summary of the United Kingdom's Contaminated Land Policy framework is presented and it is demonstrated that Ghana has the professionals to implement the policy.

Recommendations are presented for future implementation of a contaminated land policy in Ghana.

FACULTY OF APPLIED ARTS

DEPARTMENT OF HOTEL CATERING AND INSTITUTIONAL MANAGEMENT

GYEBI, EFUA AKYAA BARBARA

A. **Gyebi, B. E. A.,** Annan, R. A., Apprey, C., Asamoah-Boakye, O., & Asare, C. Y. (**2020**). Knowledge, attitude, and practices (KAP) of foodservice providers, and microbial quality on food served in Kumasi. *Journal of Foodservice Business Research*, 1-18.

Scopus Index, Publisher: Taylor and Francis

Background

Poor Knowledge, Attitude, and Practices (KAP) of food safety and hygiene by foodservice providers lead to food contamination and pose health threats to consumers. This study assessed the KAP on food safety and hygiene, and microbial quality of food sold by formal and informal foodservice providers in Kumasi, Ghana.

Methods

Eighty-one (81) foodservice providers were conveniently selected from ten different foodservice establishments. KAP on food safety and hygiene practices was assessed with a structured-questionnaire, while practices were observed with a prepared checklist. Food samples were collected and analyzed for microbiological counts (aerobic and coliform) and the detection of Staphylococcus species.

Results

About 58.7% of participants reported good knowledge versus 41.3% reporting little knowledge; 32.4% reported good attitude versus 67.6% bad attitude, and 54.6% reported good practices versus 43.4% poor practices. More informal foodservice providers (51.7%,34.5%,55.2%) had knowledge (p = .012), attitude (p = .798), and practices (p = .003) of food safety and practices below the 40th percentile than those of formal food service (23.1%,32.7%,19.2%) respectively. Food samples tested recorded high microbial counts for total aerobes and coliform counts and failed to meet ISO, GSA, and FDA safety standards. *S. aureus, E. coli, S. epidermidis*, and *E. faecalis* were identified in food samples. A weak, negative correlation (r = −0.231,p < .05) existed between attitude score and S. species present.

Conclusions

Poor KAP and microbial contamination were observed among food providers although the informal food provision was poorer. Bad attitude by foodservice providers was associated with poorer microbial quality of tested food. Education, monitoring, and stringent enforcement of HACCP are recommended.

FACULTY OF APPLIED SCIENCES

DEPARTMENTS OF SCIENCE LABORATORY TECHNOLOGY AND MEDICAL LABORATORY TECHNOLOGY

ADOTEY, GIDEON

A. **Adotey, G.,** Alolga, R. N., Quarcoo, A., Gedel, M. A., Anang, A. K., & Holliday, J. C. (**2021**). Ultra-Performance Liquid Chromatography-Quadrupole Time-of-Flight Mass Spectrometry (UPLC-Q-TOF-MS)-based metabolomic analysis of mycelial biomass of three Ganoderma isolates from the Lower Volta River Basin of Ghana. *Journal of Pharmaceutical and Biomedical Analysis*, *205,* 114355.

Web of Science Core Collection: Science Citation Index Expanded; **Scopus Index**

In this work, we sought to determine the differences and/or similarities in the metabolite composition of the mycelial biomass of three ganoderma isolates (Ganoderma LVRB-1, Ganoderma LVRB-9 and Ganoderma LVRB-17) from the Lower Volta River Basin of Ghana. The cultured mycelial mass of the three isolates were subjected to DNA sequencing. BLASTn searches of the internal transcribed spacer. (ITS) sequences of the isolates were conducted in the GenBank and the data obtained subjected to ITS phylogenetic analysis. Thereafter, extracts of the cultured mycelial biomass of the three isolates were subjected to untargeted ultra-performance liquid chromatography-quadrupole time-of-flight mass spectrometry (UPLC-Q-TOF-MS)-based metabolomic analysis. A cursory examination of the total ion chromatograms of the isolates gave evidence of the differential levels of the metabolites present. Further analysis of the metabolomic data using multivariate analysis better captured these marked differences in terms of the presence and/or levels of the metabolites. Finally, four lanostane triterpenoids, namely ganoderic acid C6, ganoderenic acid A, Ganoderenic acid D and ganoderic acid G, together with two annotated compounds (ganoderic acids K and AM1) were detected in the mycelia biomass of the three ganoderma isolates from the Lower Volta River Basin of Ghana. The results provide the first ever metabolomic data on the chemical constituents of the mycelial biomass of ganoderma isolates from the Lower Volta River Basin of Ghana.

B. Otu, P. N. Y., Azumah, B. K., Zhou, C., Yu, X., **Adotey, G.,** Hackman, H. K., & Richard, O. (**2021**). Reviews on mechanisms of in vitro antioxidant, antibacterial and anticancer activities of water-soluble plant polysaccharides. *International Journal of Biological Macromolecules*, *183*, 2262-2271.

Web of Science Core Collection: Science Citation Index Expanded; **Scopus Index**

Degenerative diseases such as cancer and cardiovascular diseases, and antimicrobial resistance are becoming prominent health problems needing utmost public health attention. Curative interventions such as the use of pharmaceutical drugs and alternative plant medicines are increasingly being explored. Plant polysaccharides have gained attention for their promising bioactivities such as antioxidant, antimicrobial and anticancer activities. Bioactive plant polysaccharides are also being preferred for their relatively few side effects compared to conventional pharmaceuticals. The elucidation of the bioactive potential of plant polysaccharides in disease treatment entails an understanding of the factors that determine their biofunctional properties using functional and mechanistic assays. This review summarizes the literature on the composition, structural, functional, and mechanistic determinations of the antioxidant, anticancer and antimicrobial activities

of plant polysaccharides. The outcome of this review highlights the leading trends in the elucidation of the antioxidant, anticancer and antimicrobial activities of plant polysaccharides and underscores the promising health benefits of plant polysaccharides.

AZUMAH, BRIGHT

A. Otu, P. N. Y., **Azumah, B. K.**, Zhou, C., Yu, X., Adotey, G., Hackman, H. K., & Richard, O. (**2021**). Reviews on mechanisms of in vitro antioxidant, antibacterial and anticancer activities of water-soluble plant polysaccharides. *International Journal of Biological Macromolecules*, *183*, 2262-2271.

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Degenerative diseases such as cancer and cardiovascular diseases, and antimicrobial resistance are becoming prominent health problems needing utmost public health attention. Curative interventions such as the use of pharmaceutical drugs and alternative plant medicines are increasingly being explored. Plant polysaccharides have gained attention for their promising bioactivities such as antioxidant, antimicrobial and anticancer activities. Bioactive plant polysaccharides are also being preferred for their relatively few side effects compared to conventional pharmaceuticals. The elucidation of the bioactive potential of plant polysaccharides in disease treatment entails an understanding of the factors that determine their biofunctional properties using functional and mechanistic assays. This review summarizes the literature on the composition, structural, functional, and mechanistic determinations of the antioxidant, anticancer and antimicrobial activities of plant polysaccharides. The outcome of this review highlights the leading trends in the elucidation of the antioxidant, anticancer and antimicrobial activities of plant polysaccharides and underscores the promising health benefits of plant polysaccharides.

B. Otu, P. N. Y., **Azumah, B. K.,** Gedel, A. M., Zhou, C., Yu, X., Richard, O., ... & Yang, H. (**2020**). Capacity of ethanol adjunct-treated interface of ionic liquid aqueous two phase system in simultaneous extraction and purification of sorghum leaf sheath polysaccharides. *Separation Science and Technology*, *56*(16), 2750-2765

Web of Science Core Collection: Science Citation Index Expanded; **Scopus Index**

Employing response surface methodology, partially purified polysaccharides from *Sorghum bicolor* L. leaf sheath were extracted using synergized ethanol adjunct-treated ionic liquid aqueous two phase system (1-octyl-3-methylimidazolium chloride, [C_8mim]Cl and K_2CO_3) and dual frequency ultrasound-assisted extraction. Under ultrasound conditions of 35 °C, 20&60 KHz, 25 mins an experimental yield of 16% PPS was achieved. Dual frequency ultrasound-assisted dialysis effectively reduced salt content of extracted PPS solution in a liquid membrane. The polysaccharides collected after dialysis maintained primary structures. The introduction of ethanol in the ionic liquid aqueous two phase system therefore ensured an excellent simultaneous extraction and partial purification.

GEDEL, AHMED MOHAMMED

A. Manson, E. N., Hasford, F., Inkoom, S., & **Gedel, A. M.** (**2020**). Integrating image fusion with nanoparticle contrast agents for diagnosis: a review. *Egyptian Journal of Radiology and Nuclear Medicine*, *51*(1), 1-11.

Web of Science Core Collection: Emerging Sources Citation Index; **Scopus Index**

As newer technologies in the field of medical imaging continue to expand, development of unique techniques for optimizing image quality and minimizing radiation dose becomes very necessary for improve diagnosis of pathologies and patient safety. Different types of medical imaging devices have been developed for specific diagnostic purposes. This article provides a brief overview on the need for co-registration of some medical images into a single image (image fusion), advantages of some nanoparticle contrast agents in medical imaging, and a discussion of present and future role of integrating image fusion with nanoparticle contrast agents in diagnosis. The use of nanoparticle contrast agents together with image fusion is a promising technique in future medical imaging as is likely to reveal pathologies of ≤ 1 nm sizes.

B. Otu, P. N. Y., Azumah, B. K., **Gedel, A. M.,** Zhou, C., Yu, X., Richard, O., ... & Yang, H. (**2020**). Capacity of ethanol adjunct-treated interface of ionic liquid aqueous two phase system in simultaneous extraction and purification of sorghum leaf sheath polysaccharides. *Separation Science and Technology*, *56*(16), 2750-2765.
Web of Science Core Collection: Science Citation Index Expanded; **Scopus Index**

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C. Adotey, G., Alolga, R. N., Quarcoo, A., **Gedel, M. A.,** Anang, A. K., & Holliday, J. C. (**2021**). Ultra-Performance Liquid Chromatography-Quadrupole Time-of-Flight Mass Spectrometry (UPLC-Q-TOF-MS)-based metabolomic analysis of mycelial biomass of three Ganoderma isolates from the Lower Volta River Basin of Ghana. *Journal of Pharmaceutical and Biomedical Analysis*, *205,* 114355.
Web of Science Core Collection: Science Citation Index Expanded; **Scopus Index**

In this work, we sought to determine the differences and/or similarities in the metabolite composition of the mycelial biomass of three ganoderma isolates (Ganoderma LVRB-1, Ganoderma LVRB-9 and Ganoderma LVRB-17) from the Lower Volta River Basin of Ghana. The cultured mycelial mass of the three isolates were subjected to DNA sequencing. BLASTn searches of the internal transcribed spacer. (ITS) sequences of the isolates were conducted in the GenBank and the data obtained subjected to ITS phylogenetic analysis. Thereafter, extracts of the cultured mycelial biomass of the three isolates were subjected to untargeted ultra-performance liquid chromatography-quadrupole time-of-flight mass spectrometry (UPLC-Q-TOF-MS)-based metabolomic analysis. A cursory examination of the total ion chromatograms of the isolates gave evidence of the differential levels of the metabolites present. Further analysis of the metabolomic data using multivariate analysis better captured these marked differences in terms of the presence and/or levels of the metabolites. Finally, four lanostane triterpenoids, namely ganoderic acid C6, ganoderenic acid A,

Ganoderenic acid D and ganoderic acid G, together with two annotated compounds (ganoderic acids K and AM1) were detected in the mycelia biomass of the three ganoderma isolates from the Lower Volta River Basin of Ghana. The results provide the first ever metabolomic data on the chemical constituents of the mycelial biomass of ganoderma isolates from the Lower Volta River Basin of Ghana.

HACKMAN, HENRY KWADWO (PhD)

C. Otu, P. N. Y., Azumah, B. K., Zhou, C., Yu, X., Adotey, G., **Hackman, H. K.,** & Richard, O. (**2021**). Reviews on mechanisms of in vitro antioxidant, antibacterial and anticancer activities of water-soluble plant polysaccharides. *International Journal of Biological Macromolecules*, *183*, 2262-2271.

Web of Science Core Collection: Science Citation Index Expanded; **Scopus Index**

Degenerative diseases such as cancer and cardiovascular diseases, and antimicrobial resistance are becoming prominent health problems needing utmost public health attention. Curative interventions such as the use of pharmaceutical drugs and alternative plant medicines are increasingly being explored. Plant polysaccharides have gained attention for their promising bioactivities such as antioxidant, antimicrobial and anticancer activities. Bioactive plant polysaccharides are also being preferred for their relatively few side effects compared to conventional pharmaceuticals. The elucidation of the bioactive potential of plant polysaccharides in disease treatment entails an understanding of the factors that determine their biofunctional properties using functional and mechanistic assays. This review summarizes the literature on the composition, structural, functional, and mechanistic determinations of the antioxidant, anticancer and antimicrobial activities of plant polysaccharides. The outcome of this review highlights the leading trends in the elucidation of the antioxidant, anticancer and antimicrobial activities of plant polysaccharides and underscores the promising health benefits of plant polysaccharides.

OSEI–ADJEI, GEORGE (PhD)

A. Osae, R., Alolga, R. N., Essilfie, G**., Osei-Adjei, G.,** Baduweh, C. A., Yarley, O. P. N., & Zhou, C. (**2020**). Variation in bioactive phytochemicals and sensory attributes of osmosonic convective dried ginger from four African countries. *Journal of the Science of Food and Agriculture*, *100*(7), 3164-3172.

Web of Science Core Collection: Science Citation Index Expanded; **Scopus Index**

The rhizome of ginger (*Zingiber officinale* Roscoe) is one of the most patronized spices worldwide and plays an important role in folklore medicine. In this study, we aimed to determine the quality of ginger samples from representative West African (Ghana, Nigeria) and East African (Uganda, Kenya) countries. By that, we also implicitly sought to determine the probable influence of location of cultivation (and the intrinsic growth conditions) on the quality of the samples. The ginger samples were pretreated by osmosonication prior to relative humidity convective drying and analyzed for differences in their metabolomes, total phenolic content (TPC) and total flavonoid content (TFC), antioxidant activities, sensory characteristics and volatile compounds composition (via electronic-nose determination). The outcome of our study showed marked source-dependent differences in the metabolomes of the samples as captured by a metabolomics approach. Based on the findings of the metabolomics study, 6-gingerol content was quantified and found to be higher in the samples of West African origin. Also, the samples from the two West African countries contained higher levels of bioactive phytochemicals

as evinced by the results of TPC, TFC, e-nose analysis, and antioxidant activities. They also gave better sensory attributes. In summary, for all parameters assessed, and on a country-by-country basis, the general quality trend observed was: Ghana > Nigeria > Uganda > Kenya. All results taken together, our findings at least in part, point to the influence of geographical regions of cultivation on the quality of the ginger rhizomes. © 2020 Society of Chemical Industry.

B. Zhang, Y., Gao, H., Osei-Adjei, G., Zhang, Y., Yang, W., Yang, H., ... & Zhou, D. (**2020**). Corrigendum: Transcriptional Regulation of the Type VI Secretion System 1 Genes by Quorum Sensing and ToxR in Vibrio parahaemolyticus. *Frontiers in Microbiology*, *11*, 2926.

Web of Science Core Collection: Science Citation Index Expanded; **Scopus Index**

Vibrio parahaemolyticus, the leading cause of seafood-associated gastroenteritis, harbors two separate T6SSs on chromosomes 1 and 2, i.e., T6SS1 (VP1386-1420) and T6SS2 (VPA1025-1046). T6SS1 contains at least 7 putative operons: VP1386-1387, VP1388-1390, VP1392-1391, VP1393-1406, VP1400-1406, VP1409-1407, andVP1410-1420. V. parahaemolyticus AphA and OpaR are the two master regulators of quorum sensing (QS) system that are highly expressed at low cell density and high cell density, respectively. ToxR is a membrane-bound virulence regulatory protein conserved across the Vibrio family. In the present work, we show that ToxR coordinates with AphA and OpaR to repress T6SS1 expression in V. parahaemolyticus. OpaR binds to the promoters of VP1388-1390, VP1400-1406, and VP1409-1407 to repress their transcription, but it appears to negatively regulate VP1393-1406 transcription in an indirect manner. By contrast, AphA negatively regulated the above four T6SS1 operons in an indirect manner. In addition, ToxR binds to the promoters of VP1400-1406 and VP1409-1407 to inhibit their transcription, but it presents an indirect interaction with VP1388-1390 and VP1393-1406 promoters. Notably, the expression of ToxR also manifested in a QS-dependent manner and the highest expression occurred at LCD. Meanwhile, the highest expression of T6SS1 occurred at an OD600 value of 0.6 to 0.8 due to the tight regulation of ToxR and QS, suggesting T6SS1 functions only during the mid-logarithmic growth phase. These observations provide significant insight into the molecular mechanism of T6SS1 gene regulation by QS and ToxR in V. parahaemolyticus.

OTU, PHYLLIS NAA YARLEY

A. **Otu, P. N. Y.,** Kojo, A. B., Zhou, C., Yu, X., Adotey, G., Hackman, H. K., & Richard, O. (**2021**). Reviews on mechanisms of in vitro antioxidant, antibacterial and anticancer activities of water-soluble plant polysaccharides. *International Journal of Biological Macromolecules*, *183*, 2262-2271.

Web of Science Core Collection: Science Citation Index Expanded; **Scopus Index**

Degenerative diseases such as cancer and cardiovascular diseases, and antimicrobial resistance are becoming prominent health problems needing utmost public health attention. Curative interventions such as the use of pharmaceutical drugs and alternative plant medicines are increasingly being explored. Plant polysaccharides have gained attention for their promising bioactivities such as antioxidant, antimicrobial and anticancer activities. Bioactive plant polysaccharides are also being preferred for their relatively few side effects compared to conventional pharmaceuticals. The elucidation of the bioactive potential of plant polysaccharides in disease treatment entails an understanding of the

factors that determine their biofunctional properties using functional and mechanistic assays. This review summarizes the literature on the composition, structural, functional, and mechanistic determinations of the antioxidant, anticancer and antimicrobial activities of plant polysaccharides. The outcome of this review highlights the leading trends in the elucidation of the antioxidant, anticancer and antimicrobial activities of plant polysaccharides and underscores the promising health benefits of plant polysaccharides.

B. **Otu, P. N. Y.,** Azumah, B. K., Gedel, A. M., Zhou, C., Yu, X., Richard, O., ... & Yang, H. (**2020**). Capacity of ethanol adjunct-treated interface of ionic liquid aqueous two phase system in simultaneous extraction and purification of sorghum leaf sheath polysaccharides. *Separation Science and Technology*, *56*(16), 2750-2765.
Web of Science Core Collection: Science Citation Index Expanded; **Scopus Index**
Employing response surface methodology, partially purified polysaccharides from *Sorghum bicolor* L. leaf sheath were extracted using synergized ethanol adjunct-treated ionic liquid aqueous two phase system (1-octyl-3-methylimidazolium chloride, [C_8mim]Cl and K_2CO_3) and dual frequency ultrasound-assisted extraction. Under ultrasound conditions of 35 °C, 20&60 KHz, 25 mins an experimental yield of 16% PPS was achieved. Dual frequency ultrasound-assisted dialysis effectively reduced salt content of extracted PPS solution in a liquid membrane. The polysaccharides collected after dialysis maintained primary structures. The introduction of ethanol in the ionic liquid aqueous two phase system therefore ensured an excellent simultaneous extraction and partial purification.

C. Mustapha, A. T., Zhou, C., Wahia, H., Amanor-Atiemoh, R., **Otu, P. N. Y.,** Qudus, A., ... & Ma, H. (**2020**). Sonozonation: Enhancing the antimicrobial efficiency of aqueous ozone washing techniques on cherry tomato. *Ultrasonics Sonochemistry*, *64*, 105059.
Web of Science Core Collection: Science Citation Index Expanded; **Scopus Index**
Ultrasound requires high power and longer treatment times to inactivate microorganisms when compared to ultrasound combined with other technologies. Also, the antimicrobial efficiency of aqueous ozone increases with an increase in its concentration and exposure time, but with a detrimental effect on the quality of the treated food. In this study, the effect of aqueous ozone at low concentration, multi-mode frequency irradiation and their combination on microbial safety and nutritional quality of cherry tomato was investigated. Individual washing with aqueous ozone and mono-mode frequency irradiation resulted in <1 log CFU/g reduction in the spoilage microorganisms, while dual-mode frequency irradiation (DMFI) resulted in higher microbial reduction (1.3–2.6 1 log CFU/g). The combined system (20/40 kHz + aqueous ozone) on the other hand, resulted in >3 log CFU/g microbial reduction. The application of DMFI enhanced the antimicrobial efficiency of aqueous ozone without any detrimental effect on the physicochemical properties (except the firmness), bioactive compounds, and antioxidants of the cherry tomato during 21 days refrigerated storage. The result obtained indicates the promising substitute to the single washing technique for microbial safety as well as preserving the nutritional quality and enhancing the shelf life of cherry tomato.

D. Chikari, F., Han, J., Wang, Y., Luo, P., He, X., Kwaw, E., & **Otu, P. N. Y.,** (**2020**). Dual-frequency ultrasound-assisted alcohol/salt aqueous two-phase extraction and purification of Astragalus polysaccharides. *Journal of Food Process Engineering*, *43*(4), e13366, 1-17.

Web of Science Core Collection: Science Citation Index Expanded; **Scopus Index**

The study investigated the effect of dual-frequency ultrasound-assisted alcohol/salt aqueous two-phase extraction and desalination on the yield, microstructure and antioxidant properties of Astragalus polysaccharides (APS). Extracts were desalinated for 10 (APS10), 20 (APS20), and 30 (APS30) minutes. A 28.40% experimental yield, well correlated to the response surface methodology predicted model was achieved. Thermodynamic parameters were non-spontaneous, irreversible and endothermic. Moreover, ultrasound enhanced the desalination rate and did not alter the chemical structure in the APS. Fourier Transform Infrared Spectroscopy showed a similar spectrum in all the APS samples. High-performance gel chromatography and scanning electron microscopy, respectively presented reduced molecular weights and altered microstructures in the samples. Monosaccharide analysis revealed the existence of xylose, mannose, galactose, glucose, arabinose, rhamnose, and ribose in the APS samples. Moreover, the APS20 showed strong hydroxyl and 2,2-diphenyl-1-picrylhydrazyl radical scavenging activities, thus showing its potency in reducing oxidative stress. Hence, this study demonstrates that coupled ultrasound and alcohol/salt ATPS is a sustainable technique, which generates high yields of simultaneously extracted products.

E. **Otu, P. N. Y.,** Osae, R., Abdullateef, M. T., Cunshan, Z., Xiaojie, Y., & Azumah, B. K. (**2020**). Characterization of Moringa oleifera leaf polysaccharides extracted by coupling ionic liquid separation system with ultrasound irradiation. *Journal of Food Process Engineering*, *43*(7), e13417, 1-13.

Web of Science Core Collection: Science Citation Index Expanded; **Scopus Index**

Replacement of organic solvents and short time for purification of polysaccharides has gained attention of researchers. Ionic liquid (IL) was optimally utilized to achieve the mentioned target. IL was coupled with ultrasound irradiation to obtain good yield of partially purified Moringa oleifera leaf polysaccharides. The yield of purified polysaccharides (75.11%) was close to the predicted (75.78%). Crude polysaccharides were found to be round group-like shape while purified polysaccharides displayed compact flat thick-slice shape under scanning electron microscopy. Using gas chromatography, galacturonic acid was detected as part of monosaccharide composition of crude polysaccharides. Functional groups associated with polysaccharides were confirmed using Fourier transform infrared spectroscopy. Using Congo red assay, polysaccharides were observed to be of nonhelical structure. The crude polysaccharide was more viscous in rheological property and had molecular weight of (304,700 g/mol). Using dynamic light scattering methodology, purified polysaccharides (24,370 g/mol) aggregated in water and possessed an excellent ABTS antiradical ability. Purification of polysaccharides using IL within a short time was feasible and presented useful characteristics needed in formulations by the food and pharmaceutical industries.

QUARCOO, ABRAHAM (REV.)

D. Adotey, G., Alolga, R. N., **Quarcoo, A.,** Gedel, M. A., Anang, A. K., & Holliday, J. C. (**2021**). Ultra-Performance Liquid Chromatography-Quadrupole Time-of-Flight Mass Spectrometry (UPLC-Q-TOF-MS)-based metabolomic analysis of mycelial biomass of three Ganoderma isolates from the Lower Volta River Basin of Ghana. *Journal of Pharmaceutical and Biomedical Analysis*, *205,* 114355.

Web of Science Core Collection: Science Citation Index Expanded; **Scopus Index**

In this work, we sought to determine the differences and/or similarities in the metabolite composition of the mycelial biomass of three ganoderma isolates (Ganoderma LVRB-1, Ganoderma LVRB-9 and Ganoderma LVRB-17) from the Lower Volta River Basin of Ghana. The cultured mycelial mass of the three isolates were subjected to DNA sequencing. BLASTn searches of the internal transcribed spacer. (ITS) sequences of the isolates were conducted in the GenBank and the data obtained subjected to ITS phylogenetic analysis. Thereafter, extracts of the cultured mycelial biomass of the three isolates were subjected to untargeted ultra-performance liquid chromatography-quadrupole time-of-flight mass spectrometry (UPLC-Q-TOF-MS)-based metabolomic analysis. A cursory examination of the total ion chromatograms of the isolates gave evidence of the differential levels of the metabolites present. Further analysis of the metabolomic data using multivariate analysis better captured these marked differences in terms of the presence and/or levels of the metabolites. Finally, four lanostane triterpenoids, namely ganoderic acid C6, ganoderenic acid A, Ganoderenic acid D and ganoderic acid G, together with two annotated compounds (ganoderic acids K and AM1) were detected in the mycelia biomass of the three ganoderma isolates from the Lower Volta River Basin of Ghana. The results provide the first ever metabolomic data on the chemical constituents of the mycelial biomass of ganoderma isolates from the Lower Volta River Basin of Ghana.

DEPATMENT OF APPLIED MATHEMATICS AND STATISTICS

MENDS-BREW, EDWIN

A. Asiamah, N., Opuni, F. F., **Mends-Brew, E.,** Mensah, S. W., Mensah, H. K., & Quansah, F. (**2021**). Short-Term changes in behaviors resulting from COVID-19-Related social isolation and their influences on mental health in Ghana. *Community Mental Health Journal*, *57*(1), 79-92. **Web of Science Core Collection**: Science Citation Index Expanded, **Scopus Index**

This study assessed the behavioral outcomes of Coronavirus 2019 (COVID-19) social distancing protocols and their influences on mental health. An online survey hosted by Survey Monkey was utilized to collect data from residents of three Ghanaian cities of Accra, Kumasi and Tamale. A total of 621 surveys were analyzed, with a sensitivity analysis utilized to select covariates for the regression model. The average age of participants was about 36 years. Findings indicate that reduced physical activity time and a change in sexual activity and smoking frequency are some short-term changes in behavior resulting from social isolation during the lockdown. An increase in sedentary behavior had a negative influence on mental health. For the most part, changes in behaviors in the short-term were associated with lower mental health scores. The study implied that COVID-19 social distancing measures should be implemented alongside public education for discouraging unhealthy changes in behaviors.

MENSAH, ALICE CONSTANCE (PhD)

A. Asare, I. O., & **Mensah, A. C.** (**2020**). Crash severity modelling using ordinal logistic regression approach. *International Journal of Injury Control and Safety Promotion*, *27*(4), 412-419.

Web of Science Core Collection: Emerging Sources Citation Index; **Scopus Index**

Road traffic accident is one of the major problems facing the world. The carnage on Ghana's roads has raised road accidents to the status of a 'public health' threat. The objective of the study is to identify factors that contribute to accident severity using an ordinal regression model to fit a suitable model using the dataset extracted from the database of Motor Traffic and Transport Department, from 1989 to 2019. The results of the ordinal logistic regression analyses show that the nature of cars, National roads, over speeding, and location (urban or rural) are significant indicators of crash severity. Strategies to reduce crash injuries should physical enforcement through greater Police presence on our roads as well as technology. There is also the need to train drivers to be more vigilant in their travels especially on the national roads and in the urban areas. The Recommendation is, a well thought out and contextualised written laws and sanctioned schemes to monitor and enforce strict compliance with road traffic rules should be put in place.

DEPARTMENT OF COMPUTER SCIENCE

ASABERE, NANA YAW (PhD)

A. **Asabere, N. Y.,** Acakpovi, A., Yeboah-Boateng, E. O., Torgby, W. K., & Amoako, E. (**2021**). Towards Career Development for High School Students: A Case Study of a Web-Based Expert System in Ghana. In *Developing Countries and Technology Inclusion in the 21st Century Information Society*, IGI Global, 56-86.

Scopus Index, **Google Scholar** - Publisher: IGI Global

Globally, choosing the right tertiary programme for university (higher) education is quite a difficult task for students. A wide range of programmes are offered by the individual universities which differ in terms of delivery modes and entry requirements. Technology inclusion in the 21st century has paved the way for the proliferation of electronic/computing systems such as electronic counseling (e-counseling) and electronic learning (e-learning). By employing a quantitative research instrument (questionnaire) to ascertain technology acceptance of Senior High School (SHS) in Ghana, this chapter proposes a web-based (e-counseling) expert system which will match students' backgrounds with the right tertiary programme towards career development. Evaluation of our proposed approach suggests that majority of the selected students (80%) out of 100 who used the system accepted and embraced it. Such a system will therefore solve and improve career guidance, counseling, and development problems of SHS students in Ghana.

B. **Asabere, N. Y.,** Xu, B., Acakpovi, A., & Deonauth, N. (**2021**). SARVE-2: exploiting social venue recommendation in the context of smart conferences. *IEEE Transactions on Emerging Topics in Computing, 9*(1), 14-31.

Web of Science Core Collection: Science Citation Index Expanded; **Scopus Index**

Globally, the superfluity of scholarly research conferences in varying disciplines has introduced the issue of scholarly big data and information overload related to both research papers and conference proceedings/sessions. This evident scholarly expansion in different disciplines has increased the collaborative importance of conferences. Consequently, the problem regarding attendees selecting the right conference session(s) to attend in academic conferences requires further and urgent attention. Using a smart conference scenario, this paper aims to address the problem above by proposing an improved venue recommender algorithm called Socially-Aware Recommendation of Venues and Environments-2 (SARVE-2). Using a closeness centrality approach, SARVE-2 initially employs Breadth First Search (BFS) and Depth First Search (DFS) strategies to search for relevant presenters for a target attendee. Then, the tie strength of the (searched) presenter and target attendee is computed to generate reliable social (conference session) recommendations for the target attendee. Through the utilization of a relevant (real-world) dataset, our benchmark experiments reveal that, in comparison with other contemporary methods, SARVE-2 exhibits better performance in terms of effective social recommendation search, as well as social recommendation quality, coverage and accuracy.

C. **Asabere, N. Y.,** Torgby, W. K., Acakpovi, A., Enguah, S. E., & Asare, I. O. (**2021**). Mapping and Auditing Internet Addiction in Technical Education. *International Journal of Technology and Human Interaction (IJTHI)*, *17*(1), 14-31.

Web of Science Core Collection: Emerging Sources Citation Index; **Scopus Index**

The current proliferation of social networking sites (e.g., Facebook), electronic devices (e.g., smartphones and tablets), and the internet has paved the way for a charge in promoting the phenomenon of internet addiction (IA). This paper analyzed and examined the validity and appropriateness of a well-established instrument for measuring IA among technical education students in Ghana, specifically students of Accra Technical University (ATU). Using a quantitative research method involving questionnaires, data collected from 260 (n=260) students in ATU was used to validate the research objectives and also measure the levels of IA among the students. The principal component tool in statistical package for social sciences (SPSS) was employed to analyze the received data. Analytical results of the study showed that a sizeable majority of students in ATU, especially male students, suffer frequent addiction problems due to the use of the internet. Additionally, results of the study showed that IA psychometric constructs in the Western world differ from those in the African context.

D. **Asabere, N. Y.,** Acakpovi, A., Agyiri, J., Awuku, M. C., Sakyi, M. A., & Teyewayo, D. A. (**2021**). Measuring the Constructs That Influence Student and Lecturer Acceptance of an E-Library in Accra Technical University, Ghana. *International Journal of Online Pedagogy and Course Design (IJOPCD)*, *11*(1), 53-72.

Web of Science Core Collection: Emerging Sources Citation Index; **Scopus Index**

Even though many universities across the world have incorporated internet-based educational and academic systems, the success of their implementation requires an extensive understanding of the end user acceptance process. Access to academic resources for teaching and learning using technology (electronic library) has become a popular approach within higher education institutions due to the continuous growth of internet innovations and technologies. This case study research, conducted at Accra Technical University uses the technology acceptance model (TAM) as a theoretical framework. The study investigates the effects of the system characteristics such as appropriate user interface (UI), software design, and relevance towards the perceived ease of use and perceived usefulness on intention to use the proposed e-library system. Two hundred (200) students and sixteen (16) lecturers participated in this quantitative study. Results show that improvement of the existing e-library system in ATU will enable students to utilize digital learning resources for effective teaching and learning, especially during the current global COVID-19 pandemic.

E. **Asabere, N.Y.,** Agyiri, J., Tenkorang, R., and Darkwah, A. (**2021**). Learning management system (LMS) development for higher technical education in Ghana. *International Journal of Virtual and Personal Learning Environments* (*IJVPLE*), *11*(2), 87-109.

Scopus Index, **Google Scholar** - Publisher: IGI Global

In developing nations such as Ghana, traditional face-to-face (F2F) mode of education is challenged when physical classroom (academic) resources are not available for all students in a particular tertiary institution. Globally, education modes have improved through learning management systems (LMSs) as a result of technological advancements. Accra Technical University (ATU) in Ghana is currently facing the problem of turning away qualified applicants due to the fact that the academic resources in ATU are not enough to accommodate all qualified applicants. Using a quantitative research instrument (questionnaire) in accordance to the five-point Likert scale and components of

the technology acceptance model (TAM) framework, this paper tackled the problem above by proposing and developing an LMS to support the education of students in ATU. Analytical results of data responses from 200 lecturers and 16 students in ATU, showed that majority of these stakeholders are willing to embrace technology and the developed LMS in ATU.

F. **Asabere, N. Y.,** Acakpovi, A., Ofori, E. K., Torgby, W., Kuuboore, M., Lawson, G., & Adjaloko, E. (**2020**). SARPPIC: Exploiting COVID-19 Contact Tracing Recommendation through Social Awareness. *Computational and Mathematical Methods in Medicine*, Article ID 3460130, 1-14.

Web of Science Core Collection: Science Citation Index Expanded; **Scopus Index**

Globally, the current coronavirus disease 2019 (COVID-19) pandemic is resulting in high fatality rates. Consequently, the prevention of further transmission is very vital. Until vaccines are widely available, the only available infection prevention methods include the following: contact tracing, case isolation and quarantine, social (physical) distancing, and hygiene measures (washing of hands with soap and water and using alcohol-based hand sanitizers). Contact tracing, which is key in preventing the spread of COVID-19, refers to the process of finding unreported people who may be infected by using a verified case to trace back possible infections of contacts. Consequently, the wide and fast spread of COVID-19 requires computational approaches which utilize innovative algorithms that build a memory of proximity contacts of cases that are positive. In this paper, a recommender algorithm called socially aware recommendation of people probably infected with COVID-19 (SARPPIC) is proposed. SARPPIC initially utilizes betweenness centrality in a social network to measure the number of target contact points (nodes/users) who have come into contact with an infected contact point (COVID-19 patient). Then, using contact durations and contact frequencies, tie strengths of the same contact points above are also computed. Finally, the above algorithmic computations are hybridized through profile integration to generate results for effective contact tracing recommendations of possible COVID-19-infected patients who will require testing in a healthcare facility. Benchmarking experimental results in the paper demonstrate that, using two interconnected relevant real-world datasets, SARPPIC outperforms other relevant methods in terms of suitable evaluation metrics such as precision, recall, and F-measure.

G. Acakpovi, A., Ternor, A. T., **Asabere, N. Y.,** Adjei, P., & Iddrisu, A. S. (**2020**). Time series prediction of electricity demand using Adaptive Neuro-Fuzzy Inference Systems. *Mathematical Problems in Engineering*, Article ID 4181045, 1-14.

Web of Science Core Collection: Science Citation Index Expanded; **Scopus Index**

This paper is concerned with the reliable prediction of electricity demands using the Adaptive Neuro-Fuzzy Inference System (ANFIS). The need for electricity demand prediction is fundamental and vital for power resource planning and monitoring. A dataset of electricity demands covering the period of 2003 to 2018 was collected from the Electricity Distribution Company of Ghana, covering three urban areas namely Mallam, Achimota, and Ga East, all in Ghana. The dataset was divided into two parts: one part covering a period of 0 to 500 hours was used for training of the ANFIS algorithm while the second part was used for validation. Three scenarios were considered for the simulation exercise that was done with the MATLAB software. Scenario one

considered four inputs sampled data, scenario two considered an additional input making it 5, and scenario 3 was similar to scenario 1 with the exception of the number of membership functions that increased from 2 to 3. The performance of the ANFIS algorithm was assessed by comparing its predictions with other three forecast models namely Support Vector Regression (SVR), Least Square Support Vector Machine (LS-SVM), and Auto-Regressive Integrated Moving Average (ARIMA). Findings revealed that the ANFIS algorithm can perform the prediction accurately, the ANFIS algorithm converges faster with an increase in the data used for training, and increasing the membership function resulted in overfitting of data which adversely affected the RMSE values. Comparison of the ANFIS results to other previously used methods of predicting electricity demands including SVR, LSSVM, and ARIMA revealed that there is merit to the potentials of the ANFIS algorithm for improved predictive accuracy while relying on a quality data for training and reliable setting of tuning parameters.

H. Asabere, N. Y., & Acakpovi, A. (**2020**). ROPPSA: TV Program Recommendation Based on Personality and Social Awareness. *Mathematical Problems in Engineering*, Article ID 1971286, 1-15.

Web of Science Core Collection: Science Citation Index Expanded; **Scopus Index**

The rapid growth of mobile television (TV), smart TV, and Internet Protocol Television (IPTV) content due to the convergence of broadcasting and the Internet requires effective recommendation methods to select appropriate TV programs/channels. Many previous methods have been proposed to address this issue. However, imperative factors such as the utilization of personality traits and social properties to recommend programs for TV viewers remain a challenge. Consequently, in this paper, we propose a recommender algorithm called Recommendation of Programs via Personality and Social Awareness (ROPPSA) for TV viewers. ROPPSA utilizes normalization and folksonomy procedures to generate group recommendations for TV viewers who have common similarities in terms of personality traits and tie strength with a Target TV Viewer (TTV). Therefore, ROPPSA improves TV viewer cold-start and data sparsity situations by utilizing their personality traits and tie strengths. We conducted extensive experiments on a relevant dataset using standard evaluation metrics to substantiate our ROPPSA recommendation method. Results of our experimentation procedure depict the advantage, recommendation accuracy, and outperformance of ROPPSA in comparison with other contemporary methods in terms of precision, recall, f-measure (F1), and arithmetic mean (AM).

TORGBY, WISDOM K

A. Asabere, N. Y., Acakpovi, A., Yeboah-Boateng, E. O., **Torgby, W. K.,** & Amoako, E. (**2021**). Towards Career Development for High School Students: A Case Study of a Web-Based Expert System in Ghana. In *Developing Countries and Technology Inclusion in the 21st Century Information Society*, IGI Global, 56-86.

Scopus Index, **Google Scholar** - Publisher: IGI Global

Globally, choosing the right tertiary programme for university (higher) education is quite a difficult task for students. A wide range of programmes are offered by the individual universities which differ in terms of delivery modes and entry requirements. Technology inclusion in the 21st century has paved the way for the proliferation of electronic/computing systems such as electronic counseling (e-counseling) and

electronic learning (e-learning). By employing a quantitative research instrument (questionnaire) to ascertain technology acceptance of Senior High School (SHS) in Ghana, this chapter proposes a web-based (e-counseling) expert system which will match students' backgrounds with the right tertiary programme towards career development. Evaluation of our proposed approach suggests that majority of the selected students (80%) out of 100 who used the system accepted and embraced it. Such a system will therefore solve and improve career guidance, counseling, and development problems of SHS students in Ghana.

B. Asabere, N. Y., **Torgby, W. K.,** Acakpovi, A., Enguah, S. E., & Asare, I. O. (**2021**). Mapping and Auditing Internet Addiction in Technical Education. *International Journal of Technology and Human Interaction (IJTHI)*, *17*(1), 14-31.

Web of Science Core Collection: Emerging Sources Citation Index; **Scopus Index**

The current proliferation of social networking sites (e.g., Facebook), electronic devices (e.g., smartphones and tablets), and the internet has paved the way for a charge in promoting the phenomenon of internet addiction (IA). This paper analyzed and examined the validity and appropriateness of a well-established instrument for measuring IA among technical education students in Ghana, specifically students of Accra Technical University (ATU). Using a quantitative research method involving questionnaires, data collected from 260 (n=260) students in ATU was used to validate the research objectives and also measure the levels of IA among the students. The principal component tool in statistical package for social sciences (SPSS) was employed to analyze the received data. Analytical results of the study showed that a sizeable majority of students in ATU, especially male students, suffer frequent addiction problems due to the use of the internet. Additionally, results of the study showed that IA psychometric constructs in the Western world differ from those in the African context.

C. Asabere, N. Y., Acakpovi, A., Ofori, E. K., **Torgby, W. K.,** Kuuboore, M., Lawson, G., & Adjaloko, E. (**2020**). SARPPIC: Exploiting COVID-19 Contact Tracing Recommendation through Social Awareness. *Computational and Mathematical Methods in Medicine*, Article ID 3460130, 1-14.

Web of Science Core Collection: Science Citation Index Expanded; **Scopus Index**

Globally, the superfluity of scholarly research conferences in varying disciplines has introduced the issue of scholarly big data and information overload related to both research papers and conference proceedings/sessions. This evident scholarly expansion in different disciplines has increased the collaborative importance of conferences. Consequently, the problem regarding attendees selecting the right conference session(s) to attend in academic conferences requires further and urgent attention. Using a smart conference scenario, this paper aims to address the problem above by proposing an improved venue recommender algorithm called Socially-Aware Recommendation of Venues and Environments-2 (SARVE-2). Using a closeness centrality approach, SARVE-2 initially employs Breadth First Search (BFS) and Depth First Search (DFS) strategies to search for relevant presenters for a target attendee. Then, the tie strength of the (searched) presenter and target attendee is computed to generate reliable social (conference session) recommendations for the target attendee. Through the utilization of a relevant (real-world) dataset, our benchmark experiments reveal that, in comparison with other contemporary methods, SARVE-2 exhibits better performance in terms of

effective social recommendation search, as well as social recommendation quality, coverage and accuracy.

FACULTY OF BUSINESS

DEPARTMENT OF MARKETING

ADDAI, MICHAEL (PhD)

A. Hu, X., Danso, B. A., Mensah, I. A., & **Addai, M.** (**2020**). Does innovation type influence firm performance? A dilemma of star-rated hotels in Ghana. *Sustainability*, *12*(23), 1-27.

Web of Science Core Collection: Science Citation Index Expanded, Social Sciences Citation Index; **Scopus Index**

Innovation, which leads to process changes and product development, tends to increase the sustenance of companies and helps firms to expand faster and more effectively, eventually more profitably than non-innovators. Innovation is commonly seen as a key source of sustainable competitive advantage in a changing environment. However, the success of the hospitality industry relies a lot on how well they gear their innovations towards preserving the natural and cultural attractions that make tourist/customers to visit their destinations. This study, therefore, is empirically designed to explore how innovation types, which include process, product, marketing, and organizational innovation, impact performance of hotel firms in Ghana. With top-level managers being our target respondents, 680 star rated hotels were purposely sampled from the hospitality industry, among which 550 hotel firms provided valid and accurate responses. Data obtained from the survey through the administration of a well-structured questionnaire was analyzed through SPSS statistical package. Through the estimation of series of regression models using the Hierarchical regression method of analysis, we witnessed that process, product, marketing, and organizational innovation employed as innovation types have palpable and statistically significant liaison with performance of hotel firms in Ghana. We, therefore, conclude that, for hotels to achieve high firm performance, personnel within the firm should be encouraged and empowered to develop innovative mentalities and abilities. In addition, hotel firms and the industry at large should be abreast of current trends of sustainability and endeavor to gear their innovation operations towards a more sustainability-oriented firm since incorporating sustainable innovative strategies into firms' operations will not only create a good image and reduce cost but would also safeguard the natural attractions that guests patronize.

B. **Addai, M.,** Hu, X., Spio-Kwofie, A., Ocloo, C.E. & Musah, A.I. (**2020**). Impact of the Interactive Mechanism between Resource Transfer and Absorptive Capacity on Innovation Performance: Evidence from two Ghanaian Automobile Clusters. [Accepted and in press: *European Journal of International Management*. DOI:10.1504/EJIM.2020.10024842].

Web of Science Core Collection: Science Citation Index Expanded, Social Sciences Citation Index; **Scopus Index**

This study examined the impact of the interactive mechanism between resource transfer and absorptive capacity on innovation performance. The significance of this study is to expatiate on the knowledge, the positioning and the role of absorptive capacity in the process of resource transfer and innovation performance. Data was procured through questionnaire administration using a two-stage cluster sampling procedure in selecting 561 small-scale automobile firms from two automobile clusters in Ghana. We employed the Structural Equation Modelling analytical tool for our analysis. Our result explicitly revealed that the interactive mechanism (A_X_B) between resource transfer and AC

results in a far more positive and significant impact on innovation performance than AC acting as a mere moderator. We recommended that Ghanaian automobile cluster-based firms should develop their absorptive capacity to ensure that, at all times they possess the capacity to identify resources that only have the grounded potential to enhance innovation performance.

APPIAH-GYIMAH, REGINA (PhD)

A. Boohene, R., **Appiah-Gyimah, R.,** & Osei, M. B. (**2020**). Social capital and SME performance: the moderating role of emotional intelligence. *Journal of Entrepreneurship in Emerging Economies, 12*(1), 79-99.

Web of Science Core Collection: Emerging Sources Citation Index

Purpose

Lack of extant studies on the moderating role of emotional intelligence on the relationship between social capital and firm performance necessitated this study. The purpose of this paper is to examine the extent to which emotional intelligence moderates the relationship between social capital and small and medium-scaled enterprises' (SMEs') performance.

Design/methodology/approach

A total of 1,532 SMEs were selected through simple random sampling technique from a population of 5,009 SMEs. Structural equation modelling using AMOS was used to analyse the relationship between the variables.

Findings

The results revealed that social capital has a positive and significant relationship with emotional intelligence. Moreover, the study also showed that emotional intelligence has a positive and significant relationship with SME performance. Finally, the study found that emotional intelligence enhances the relationship between social capital and SME performance.

Practical implications

SME owner/managers are advised to enact policies that encourage the establishment of meaningful social networks and also help employees understand their emotions while creating social capital as both would help improve the performance of their firms.

Originality/value

This paper breaks new ground by identifying emotional intelligence as an enabler of SMEs performance where there is adequate social capital.

OPUNI, FRIMPONG FRANK

A. Asiamah, N., **Opuni, F. F.,** Mends-Brew, E., Mensah, S. W., Mensah, H. K., & Quansah, F. (**2021**). Short-Term changes in behaviors resulting from COVID-19-Related social isolation and their influences on mental health in Ghana. *Community Mental Health Journal*, *57*(1), 79-92.

Web of Science Core Collection: Emerging Sources Citation Index; **Scopus Index**

This study assessed the behavioral outcomes of Coronavirus 2019 (COVID-19) social distancing protocols and their influences on mental health. An online survey hosted by Survey Monkey was utilized to collect data from residents of three Ghanaian cities of Accra, Kumasi and Tamale. A total of 621 surveys were analyzed, with a sensitivity analysis utilized to select covariates for the regression model. The average age of participants was about 36 years. Findings indicate that reduced physical activity time and a change in sexual activity and smoking frequency are some short-term changes in

behavior resulting from social isolation during the lockdown. An increase in sedentary behavior had a negative influence on mental health. For the most part, changes in behaviors in the short-term were associated with lower mental health scores. The study implied that COVID-19 social distancing measures should be implemented alongside public education for discouraging unhealthy changes in behaviors.

B. Asiamah, N., **Opuni, F. F.,** Muhonja, F., Danquah, E., Agyemang, S. M., Agyemang, I., ... & Manu, C. A. (**2021**). The relationship between job components, neighbourhood walkability and African academics' physical activity: a post-COVID-19 context. *Health Promotion International*.

Web of Science Core Collection: Emerging Sources Citation Index; **Scopus Index**

Research to date suggests that physical activity (PA) among academics is insufficient globally. Academics in many African countries were recently required to resume work while observing social distancing protocols. Physical inactivity (PI) was, therefore, expected to increase in such academics. Interestingly, walkable neighbourhoods are resources that could discourage excessive sitting and PI in this situation. This study, therefore, assessed the moderating role of neighbourhood walkability in the relationship between core job components (i.e. on-site teaching, online teaching, research and student assessment) and PA among academics. The study adopted a cross-sectional design that utilized an online survey hosted by Google Forms to gather data. Participants were volunteer full-time academics in Nigeria, Ghana, Kenya and Tanzania. A total of 1064 surveys were analysed, with a sensitivity analysis utilized to select covariates for the ultimate hierarchical linear regression model. After controlling for the ultimate covariates (e.g. gender, education and income), PA was found to be positively associated with the job component 'research work' but negatively associated with student assessment. Neighbourhood walkability increased the positive relationship of research work with PA and reduced the negative relationship of student assessment with PA. The non-significant negative relationship between 'teaching online' and PA was made positively significant by neighbourhood walkability. We conclude that research as a job component is positively associated with PA, but online teaching is negatively associated with PA among African academics in a post-COVID-19 context.

C. Asiamah, N., **Opuni, F. F.**, Mends-Brew, E., Mensah, S. W., Mensah, H. K., & Quansah, F. (**2020**). Short-term changes in behaviors resulting from COVID-19-related social isolation and their influences on mental health. *Community Mental Health Journal, 56*(4)1-14.

Web of Science Core Collection: Emerging Sources Citation Index; **Scopus Index**

This study assessed the behavioral outcomes of Coronavirus 2019 (COVID-19) social distancing protocols and their influences on mental health. An online survey hosted by Survey Monkey was utilized to collect data from residents of three Ghanaian cities of Accra, Kumasi and Tamale. A total of 621 surveys were analyzed, with a sensitivity analysis utilized to select covariates for the regression model. The average age of participants was about 36 years. Findings indicate that reduced physical activity time and a change in sexual activity and smoking frequency are some short-term changes in behavior resulting from social isolation during the lockdown. An increase in sedentary behavior had a negative influence on mental health. For the most part, changes in behaviors in the short-term were associated with lower mental health scores. The study

implied that COVID-19 social distancing measures should be implemented alongside public education for discouraging unhealthy changes in behaviors.

D. Asiamah, N., **Opuni, F.F.**, Aggrey, M., Adu-Gyamfi, K. (**2020**). ADAPTED SERVQUAL: A Health Service Quality Scale Incorporating Indicators of Sanitation and Hygiene. *Quality Management in Health Care, 29*(3), 184-193.

Web of Science Core Collection: Science Citation Index Expanded, Social Sciences Citation Index; **Scopus Index**

Many scales have been developed to measure health care quality over the years, but no scale available today incorporates all important indicators of sanitation and hygiene in health care. This study therefore assessed the psychometric properties of an adapted scale, hereby called ADAPTED SERVQUAL, in an attempt to provide a scale that includes relevant indicators of hospital hygiene and sanitation.

Methods

The setting of the study was low- and medium-capacity hospitals in the Greater Accra Region of Ghana. Patients in wards and outpatient departments in the hospitals participated in the study. We used relevant statistical tools to estimate the psychometric properties of ADAPTED SERVQUAL. To understand the relative importance of the new scale, we compared and related it to a recent scale, HEALTHQUAL.

Results

Principal component analysis yielded 6 factors: "tangibles," "reliability," "responsiveness," "assurance," "empathy," and "sanitation and hygiene," which explained 84% of the total variance. ADAPTED SERVQUAL has a good internal consistency (Cronbach α = 0.96). Confirmatory factor analysis confirmed the 6-factor solution and produced satisfactory discriminant validity and convergent validity indicators. The adapted scale was highly correlated with all dimensions of HEALTHQUAL, including continuous quality improvement (r ≥0.75, P < .001). In multiple linear regression, the 5 domains of HEALTHQUAL explained 59% of the variance in ADAPTED SERVQUAL (P < .001).

Conclusions

The study concluded that 8 items that make up a single factor (ie, sanitation and hygiene) and contribute most of the total variance satisfactorily fit into the SERVQUAL scale as additional indicators of health care quality.

OCLOO, ELIKEM CHOSNIEL (PhD)

A. Ocloo, C.E., Hu, X., Ocloo, Akaba, S., & Worwui-Brown, D. & Junguo, S. (**2020**). The determinants of business-to-business e-commerce adoption in small and medium-sized manufacturing enterprises. *Journal of Global Information Technology Management, 23(3),* 191 – 216.

Web of Science Core Collection: Social Sciences Citation Index; **Scopus Index**

This research examines the relationships between technological, organizational, and environmental (TOE) factors on different levels of B2B e-commerce adoption. A survey of 315 Ghanaian manufacturing SMEs was validated and tested using partial least squares structural equation modeling. The research findings indicate that perceived desirability, organization's readiness, and competitive pressure positively and significantly influence the different B2B e-commerce adoption levels. Likewise, top management support and government support partially had a significant impact on the

various levels of B2B e-commerce adoption, whereas the business partner's pressure has no significant influence on B2B e-commerce adoption levels. This research's results confirm that the TOE factors influence B2B e-commerce adoption levels in the Ghanaian manufacturing SMEs. The results reveal that the various contextual factors have a different effect on the different levels of B2B e-commerce adoption. Also, the implications of this study are subsequently discussed.

B. **Addai**, M., Hu, X., Spio-Kwofie, A., **Ocloo, C.E.** & Musah, A.I. (**2020**). Impact of the Interactive Mechanism between Resource Transfer and Absorptive Capacity on Innovation Performance: Evidence from two Ghanaian Automobile Clusters. [Accepted and in press: *European Journal of International Management*. DOI:10.1504/EJIM.2020.10024842].

Web of Science Core Collection: Science Citation Index Expanded, Social Sciences Citation Index; **Scopus Index**

This study examined the impact of the interactive mechanism between resource transfer and absorptive capacity on innovation performance. The significance of this study is to expatiate on the knowledge, the positioning and the role of absorptive capacity in the process of resource transfer and innovation performance. Data was procured through questionnaire administration using a two-stage cluster sampling procedure in selecting 561 small-scale automobile firms from two automobile clusters in Ghana. We employed the Structural Equation Modelling analytical tool for our analysis. Our result explicitly revealed that the interactive mechanism (A_X_B) between resource transfer and AC results in a far more positive and significant impact on innovation performance than AC acting as a mere moderator. We recommended that Ghanaian automobile cluster-based firms should develop their absorptive capacity to ensure that, at all times they possess the capacity to identify resources that only have the grounded potential to enhance innovation performance.

WORWUI-BROWN, DAVID K.

A. Ocloo, C.E., Hu, X., Ocloo, Akaba, S., & **Worwui-Brown, D.** & Junguo, S. (**2020**). The Determinants of Business-to-Business E-commerce Adoption in Small and Medium-sized Manufacturing Enterprises. *Journal of Global Information Technology Management, 23(3),* 191 – 216.

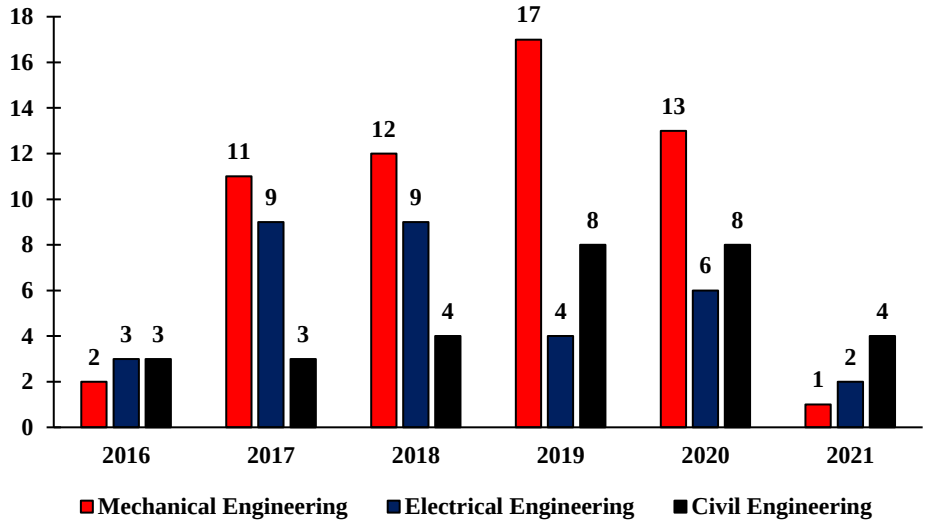
Web of Science Core Collection: Social Sciences Citation Index; **Scopus Index**

This research examines the relationships between technological, organizational, and environmental (TOE) factors on different levels of B2B e-commerce adoption. A survey of 315 Ghanaian manufacturing SMEs was validated and tested using partial least squares structural equation modeling. The research findings indicate that perceived desirability, organization's readiness, and competitive pressure positively and significantly influence the different B2B e-commerce adoption levels. Likewise, top management support and government support partially had a significant impact on the various levels of B2B e-commerce adoption, whereas the business partner's pressure has no significant influence on B2B e-commerce adoption levels. This research's results confirm that the TOE factors influence B2B e-commerce adoption levels in the Ghanaian manufacturing SMEs. The results reveal that the various contextual factors have a different effect on the different levels of B2B e-commerce adoption. Also, the implications of this study are subsequently discussed.

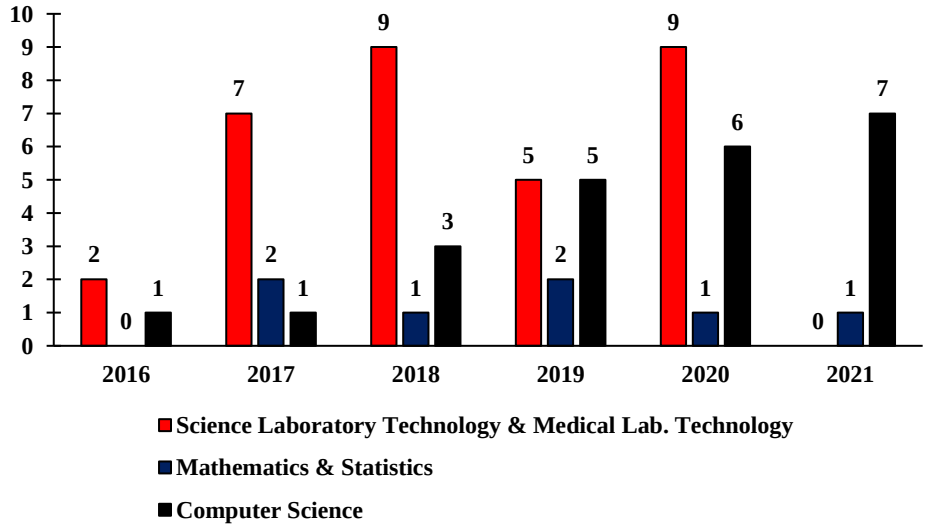
ATU -DRIPTT

SUMMARY OF RESEARCH OUTPUTS BASED ON WEB OF SCIENCE COLLECTIONS, SCOPUS AND OTHER TOP JOURNALS FROM 2016 TO DATE

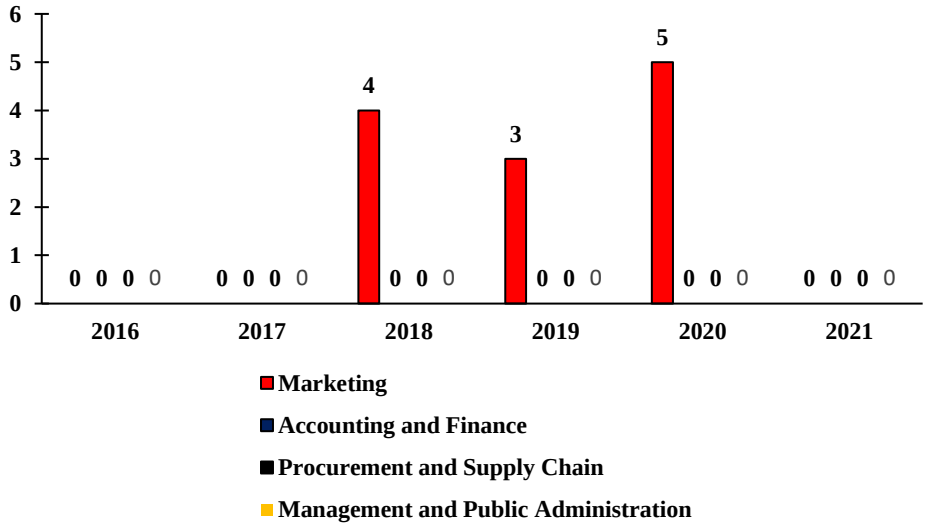
FoE - Journal Publications in Scopus and Web of Science (2016 - Date)



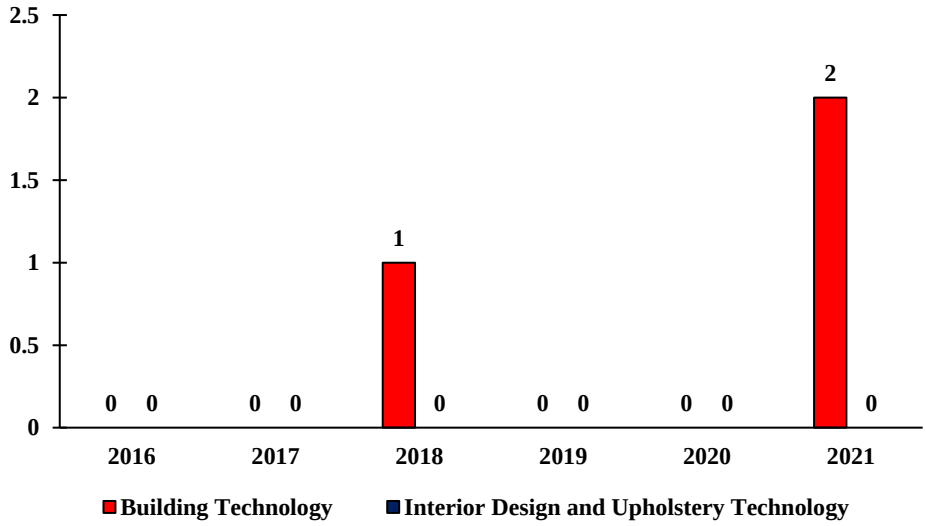
FoAS - Journal Publications in Scopus and Web of Science (2016 - Date)



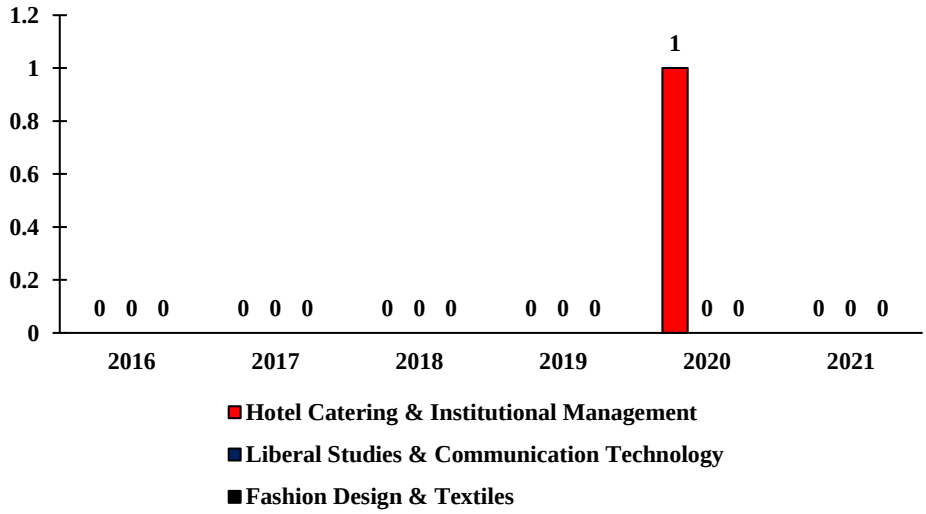
FoB - Journal Publications in Scopus and Web of Science (2016 - Date)



FoBE - Journal Publications in Scopus and Web of Science (2016 - Date)



FoAA - Journal Publications in Scopus and Web of Science (2016 - Date)



b) GRANTS WON/ATTRACTED, 2020/2021 ACADEMIC YEAR

S/N	TITLE OF PROJECT	PROJECT PERIOD	PROJECT PARTNERS	ATU PROJECT TEAM	GRANT AWARD
1.	Enhancing Graduate Employability in Ghana. Embedding Social Enterprise Skills Within Higher Education Framework	January – September, 2022	University of Huddersfiled, University of Bolton, Accra Technical University, Achievers Ghana	**Prof. Samuel Nii Odai**, Dr. Ernest Christian Winful, Dr. Chosniel Ocloo, Mr. Frank Frimpong Opuni, Dr. Emelia Ohene Afriyie, Dr. Kofi Opoku-Asante	₵60,000
2.	Developing ATU staff competences to design a commercial Agri-business course targeted at female entrepreneurs	1 April 2021 to 31 March 2022	Maastricht School of Management, Netherlands	**Prof. Samuel Nii Odai**, Prof. Amevi Acakpovi, Prof. Felix Kutsanedzie, Mr. Martin Owusu Amoamah, Dr. Nana Yaw Asabere	€74,413.12
3.	**Hosting of Sustainable Energy Services Center (SESC)** The Republic of Ghana and the United States of America acting through the Millennium Challenge Corporation ("MCC") have entered into a Millennium Challenge Compact on August 5, 2014 under which MCC will provide funding to the Government of Ghana (the "Government"), to facilitate poverty reduction through	January 2020 - Now	This grant is part of the MCC fund and project and it is coordinated by MiDA, Energy Commission and the Development Enviroenergy services (DESL), an international consulting service provider.	**Prof. Amevi Acakpovi,** Dr. Moro Adams, Mr. Mathias Bennet Michael, Mrs. Patricia Kwakye-Boateng, Dr. Stephen Edem Komla Bani, Mr. Emmanuel Kabu Oman, Mr. Sydney Lloyd Abbey, Engr. Mrs. Miriam Eduful,	1,100 000.00 USD

	economic growth (the "Compact"). ***Current Status**: We are part of the three shortlisted team and we have reached the final stage awaiting the declaration of the winners (two teams shall be selected per the CFP*			Mrs. Sakeena Twumasi.	
4.	Curriculum Co-development for integrating MOOCs in Engineering Education; Collaborative research to evaluate the effectiveness of using MOOCS to support engineering education; and building Capstone project supervision capacity at the Accra Technical University-Phase II"	Jan 2020 to August 2021	Carnegie African Diaspora Fellowship Program, Fall 2020 Grant – Prof. Robert	**Prof. Amevi Acakpovi**	25,000 USD
5.	Business and Management Studies Curriculum Review and Research Capacity Building	Jan 2020 to August 2021	Carnegie African Diaspora Fellowship Program, Fall 2020 Grant. Receiving two fellows from Quinnipiac University and the University of Maryland Eastern Shore respectively in the persons of Prof. Iddrisu Awudu and Prof. Rexford Abaidoo to	**Prof. Amevi Acakpovi**	50,000 USD

			carry a collaborative project on the topic		

c) ARIF 2020 Full Proposal Submissions – Departmental Data

S/N	DEPARTMENT	NUMBER OF SUBMISSIONS	PI	PROJECT TITLE	FUNDING STATUS	PROJECT STATUS
1.	Science Laboratory Technology (SLT)	1	Mr. Gideon Adotey	Enhancing the Nutritional Profile of Ghanaian Tiger Nut, Green Cocoa Beans and Locust Beans ("Dawadawa") Through Myceliation with Edible and Medicinal Mushrooms Towards the Development of Functional Health Products	Approved	Ongoing (Second Phase)
2.	Civil Engineering	1	Dr. Prodeo Yao Agbotui	Characterization of Tropical Hard Rock Aquifers Using Ambient Borehole Dilution Testing	Approved	Ongoing (Third Phase)
3.	Computer Science	1	Dr. Nana Yaw Asabere	Classification of Public Health Centres in Accra Through a Web-Based Portal Integrated With Geographical Information System (GIS)	Approved	**Completed**
4.	Fashion Design and Textiles	1	Mrs. Vivian Biney-Aidoo	Development of Garment Size Chart for Ghanaian school children using Anthropometric Statistics for Production Management Strategies	Approved	Ongoing (Second Phase)
TOTAL		**4**				

d) ARIF 2021 Full Proposal Submissions – Departmental Data

S/N	DEPARTMENT	NUMBER OF SUBMISSIONS	PI	PROJECT TITLE	FUNDING STATUS	PROJECT STATUS
1.	Science Laboratory Technology (SLT)	1	Dr. George Osei-Adjei	Development of a Paper Microfluidic Device for Quality Control of Food Products	Approved	Ongoing (Second Phase)
2.	Science Laboratory Technology (SLT)	1	Mrs. Phyllis Otu	Development of a Nutraceutical Snack From Wild Ghanaian Mushrooms With Anticancer Properties	Approved	Ongoing (First Phase)
3.	Science Laboratory Technology (SLT)	1	Mr. Bright Kojo Azumah	Bioactive Profile of *Sorghum Bicolor* Leaf Sheath Carbohydrate Extract and Ganoderma-Metabolized Carbohydrate Extract Products: Antioxidant, Anticancer and Anti-Inflammatory Activities	Approved	Ongoing (First Phase)
4.	Computer Science	1	Mr. Joseph Eyram Dzata	Improving Patient's Data Collection and Tracing in Ghana Through a Computerized Application Integrated with Geographic Information System (GIS)	Approved	Ongoing (Second Phase)
5.	Computer Science	1	Mr. Wisdom Torgby	Maximizing Consumer Conversion Cycle on E-Commerce Site, Using Machine Learning Techniques	Approved	Ongoing (First Phase)
6.	Applied Mathematics and Statistics	1	Dr. (Mrs.) Alice C. Mensah	Tracer Study of Accra Technical University Graduates	Approved	Ongoing (First Phase)
7.	Science Laboratory Technology (SLT)	1	Mrs. Florence Ayirezang	Development of a Bioactive Flavoured Sorghum Beer	Approved	Ongoing (First Phase)
TOTAL		**7**				

2. RESEARCH AREAS

- Over the years, DRIPTT has enabled ATU staff to engage in cutting-edge applied research in the fields *of* ***Engineering*** *(civil, mechanical and electrical),* ***Applied Sciences*** *(computer science, ICT, statistics, mathematics, science laboratory technology, medical laboratory science)* ***Applied Arts*** *(fashion, textiles, communication, liberal arts, hospitality),* ***Business and Humanities*** *(procurement, supply chain, management, marketing, accounting, finance, public administration),* and technology to tackle ***Built Environmental*** and other socio-economic challenges in the country.
- Some Staff members have conducted innovative research and published their findings in high-impact journals.
- Additionally, ATU staff are also cited in Google Scholar, Web of Science, and Scopus and it is the current mandate of DRIPTT to put in measures that will improve the research visibility, research impact, and overall ranking of ATU.
- DRIPTT is committed to ensuring that applied research in ATU is conducted most effectively and efficiently by providing the needed support services and by extension, identifying, developing, and protecting ATU's intellectual property and promoting technology transfer with the public and private sector.
- **The mission of DRIPTT** is to provide effective and efficient research and innovation support services that are consistent with world-class universities to staff and students in ATU.