JOURNAL OF COMMUNICATION TECHNOLOGY BUSINESS

GHANA COMMUNICATION TECHNOLOGY UNIVERSITY

A PUBLICATION OF THE DIRECTORATE OF RESEARCH INNOVATION & CONSULTANCY(GCTU)

Journal of Communication Technology and Business

A Publication of the Directorate of Research Innovation and Consultancy

Ghana Communication Technology University

ISSN: 2637-3505 (Print)

NMC/CI / /

Published for the Directorate of Research Innovation and Consultancy, Ghana Communication Technology University, Tesano- Ghana by the

Phone:

Website: https://jctb.gctu.edu.gh/

Email: jctb@gctu.edu.gh

EDITOR'S NOTE TO CONTRIBUTORS AND READERS

Journal of Communication Technology and Business continues its goal of trying to publish quality articles submitted for consideration. We continue to underscore our commitment to intellectual engagement and academic discourse and intend to ensure and maintain continuity in our interrogation of issues relating to African's Technological advancement, Communication and Business. We are excited by the challenge of serving you and are gratified by the increasing level of interest in the journal. We feel it is critical that the journal continues to remain truly interdisciplinary, though not every article submitted need to be interdisciplinary in orientation. We are mindful though that most of our volumes may be dominated by papers from technology, communication, and business experts. We are interested in papers by junior scholars, senior scholars and graduate students as well. In short, we are looking for polished and "uncut diamonds" because we want to provide a platform for people to disseminate the results of their research. The present volume of Journal of Communication Technology and Business like the previous one, covers a very broad range of topics. Given the politics of the academy, we have taken the extraordinary step of publishing this volume, at considerable expense to the journal and the people who work on it, with an academic printing press in the glorious capital of Ghana. We wish to thank the members of the Editorial Board and the Editorial Advisory and Review Board for working assiduously on this volume. It is, indeed, a labour of love. Above all, we thank all the contributors to this volume, those who have contributed to the next volume (a remarkable effort indeed) and those who are looking forward to making contributions in the future.

Prof. George Kofi Amoako

(Editor-in-Chief)

1. **Prof. Robbert Ebo Hinson,** Pro-VC- Ghana Communication Technology University, Tesano-Accra, Ghana.
2. **Prof. Isaac Abeku Blankson,** President- African Communication University College, Accra, Ghana.
3. **Prof. George Oppong Appiadjei Ampong,** Dean, GCTU Business School, Ghana Communication Technology University (GCTU), Tesano-Accra, Ghana.
4. **Prof. Samuel Bonsu,** Ghana Institute of Management and Public Administration (GIMPA).
5. **Prof. Stephen Asunka,** Dean, GCTU Engineering, Ghana Communication Technology University (GCTU), Tesano-Accra, Ghana.
6. **Prof. Ebenezer Malcam,** Dean, GCTU Graduate School, Ghana Communication Technology University (GCTU), Tesano-Accra, Ghana.
7. **Dr Kofi Osei-Frimpong,** Senior Lecturer in the Marketing Department University of Professional Studies Accra Ghana.
8. **Prof. Saeed Akbar,** Wilfred Laurier University, Canada.
9. **Prof. MsG. Steve Ntim,** Catholic University College, Ghana.
10. **Prof. Dr. George Oduro,** Associate Professor and Director of Institute of Applied Science and Technology, University of Ghana, Legon, Ghana.
11. **Prof. Dr. Rishi Balkaran,** Deputy Vice Chancellor, Cape Peninsula University of Technology, Cape Town, South Africa.
12. **Prof. Dr. Samuel Adjei-Nsiah,** Associate Professor and Head of Forest and Horticultural Crops Research Centre, Kade, School of Agriculture, University of Ghana, Legon. Ghana.

13. **Prof. Dr. Shabana Mazhar**, Associate Professor and Head of Joseph School of Business Studies, SHUATS, Allahabad, U.P., India.

CONTRIBUTORS

Bismark Asare, Directorate of Research, Innovation and Consultancy

Andrew Amanor Sackitey, Directorate of Research, Innovation and Consultancy

EDITORIAL POLICY AND AUTHOR GUIDELINES:

Journal of Communication Technology and Business of the Directorate of Research Innovation and Consultancy, Ghana Communication Technology University, Ghana, is a peer-reviewed multidisciplinary journal committed to publishing well-researched academic, scholarly or technical articles in any of the fields pertaining to African Communication, Technology and African Business with the wider world.

The Editorial Board welcomes manuscripts, which should be in the English language, and must be typed, double-spaced (including footnotes, endnotes and bibliography) using Times New Roman Font size 12. Manuscripts must not exceed 25 pages (or 6,250 words) and should be in Chicago Manual Style (16th Edition) or APA Referencing and Citation Styles (6th Edition). All submissions must be accompanied by a statement that the manuscript has not been previously published or submitted for publication elsewhere. The Editorial Board also welcomes newly published books from authors and publishers for review. Electronic submissions are to be made in Microsoft Word format, with the file name clearly indicated.

Each manuscript should be accompanied by an abstract of not more than 150 words. All works consulted should be listed serially at the end of each article under the headline BIBLIOGRAPHY. Manuscripts must also be accompanied by a separate (cover) sheet indicating the title of the paper, the author's name in the form it should appear in print, current academic or professional position, field of interest, institutional affiliation and address of the author(s). For the purposes of blind peer-review, the first page of the manuscript should not bear the name(s) of the author(s).

All manuscripts and enquiries should be sent to: The Editor, Journal of Communication Technology and Business of the Directorate of Research Innovation and Consultancy, Ghana Communication Technology University, Ghana or via email to:

Table of Content

ARTICLE 1

1. The impact of perceived organisational support on employee career satisfaction and commitment among health professionals

Evans Sokro
Department of Human Resource Management
Central University, Ghana
Email: esokro@central.edu.gh

Theresa Obuobisa-Darko
Department of Management and Human Resource
Ghana Communication Technology University
Email: tobuobisa@gmail.com

Ophelia Delali Dogbe Zungbey
Department of Human Resource Management
Central University, Ghana
Email: opszungbey@gmail.com

Abstract

The aim of this study was to explore the relationship between perceived organizational support, career satisfaction and commitment among healthcare professionals and administrators. The study adopted a quantitative, explanatory and cross-sectional research design. A structured questionnaire was used to collect data from a sample of 144 healthcare professionals and administrative staff to explore how employees' perceptions of support from the organisation influence their career satisfaction and commitment to the organisation. The results show that perceived organizational support has a positive significant relationship with employees' career satisfaction and commitment. This implies that, when an organisation provides support that meets the needs of its employees, it raises the employees' desire to give back to the organisation. Employees become satisfied with their careers and demonstrate their commitment to the organisation. The findings also suggest that, at the individual/employee level, perceived organizational support highly predicts employees' affective commitment, followed by normative commitment and then continuance commitment on the job. Hence, perceived organizational support can influence career satisfaction and organizational commitment. The study recommends that interventions from leadership in healthcare facilities to enhance career satisfaction and organisational commitment of its employees must focus on the implementation of policies that provide adequate organisational support.

Keywords: Perceived organisational support, career satisfaction, commitment, healthcare professionals

Introduction

Employers and employees have a long-lasting employment bond based on positive social exchange approaches where the needs of both parties are addressed (Coyle-Shapiro & Diehl, 2018; Maan, Abid, Butt, Ashfaq, & Ahmed, 2020). In this exchange relationship, the employer is concerned about the employees' commitment, and trustworthiness, while employees are conscious of how the employer caters for their needs and well-being (Kurtessis et al., 2017; Rhoades & Eisenberger, 2002). When employees feel that they are provided with good support from the organization, they feel obliged to reciprocate this, gesture by their organization. The feeling of this obligation increases the employees' commitment to the organization (Eisenberger et al., 2001). The perception of organizational support is likely to increase if organizations implement a good reward system, provide opportunities for advancement, and implement positive policies in the workplace (Pack, 2005; Chernyak-Hai et al., 2023) which impacts positively on the level of the organization and employee commitment (Guntuku et al., 2022; Doğan & Ötken, 2011; Gündüz, 2014; Rahman & Karan, 2012).

Employee commitment to the organization is essential because it affects their work engagement and contributes to their retention (Abualigah et al., 2023; Allen & Meyer, 1996; Ghazzawi, 2008; Teo, Bentley, & Nguyen, 2020; Tuna et al., 2011). Employees are more willing to invest in their work when they feel that the organization supports their psychological need to feel safe and supported (Abualigah et al., 2023; Kahn, 1990). Kreitner and Kinicki (2003) describe how organizational commitment reflects the state in which an individual identifies with the organization and the extent to which that individual is bound by its objectives. Employees who are committed to their organization and their work in general, tend to believe that the work is central to their lives. They also have a high level of involvement with the organisation's values and goals. When members of the organization feel well-treated and receive proper support from their organization, they feel satisfied and have an obligation to reciprocate the organization's good treatment (Ngadiman et al., 2013; Amos et al., 2015). This reinforces the workers' loyalty towards the organization and increases their sense of obligation to serve the organization (Ngadiman et al., 2013; Amos et al., 2015) which impacts positively their career satisfaction (Tansky & Cohen, 2001; Singh, 2022; Popoola & Fagbola, 2023)

Career satisfaction represents an indicator of employees' happiness with how they are managing their own careers (Strauss, Griffin, & Parker, 2012). An employee's satisfaction with various aspects of his/her career leads to the emergence of a strong commitment and positive attitude towards the organization. In other words, employees who are satisfied with their careers demonstrate greater commitment as compared to those who are not satisfied (Nanjundeswaraswamy et al., 2023; Amos et al., 2015). In this case, we argue that employees' positive evaluation of support received from the organisation would have a significant influence on their career satisfaction and a sense of commitment to their organization. The COVID-19 pandemic has underscored the critical role of POS in enhancing employees' commitment and career satisfaction. Yet, little is known about how healthcare facilities have supported their

employees to meet their socio-emotional needs and ultimately promote their commitment to the hospital. This study, therefore, examines the impact of POS on the commitment and career satisfaction of healthcare professionals.

Perceived organizational support (POS) has been defined as the perception of employees about the degree to which their contributions to the organization are valued, implying that their associated well-being is given full consideration (Alcover et al., 2018; Eisenberger et al., 1986). The POS framework presumes that employees evaluate the degree to which their respective organisations are interested in their general welfare through the establishment and implementation of various HRM policies, programs, practices, and support. It is assumed, employees on the other hand, reciprocate such gestures by the organisation with increased loyalty, commitment and performance (Hu et al., 2014; Kurtessis et al., 2017). Thus, favourable treatments such as rewards from the organization, beneficial working conditions and fairness received by employees are directly linked to POS (Gupta et al., 2023; Rhoades & Eisenberger, 2002). Thus, POS ultimately helps boost the employees' obligations toward the organization to reciprocate favourably.

The literature on POS reveals that organizations achieve favourable outcomes such as creativity (Shang et al., 2023) improved performance (Jeong & Kim, 2022) and also if workers feel superior treatment within the organization (Yin & Lawrence, 2011). The positive association of POS with job satisfaction, performance, organizational commitment, and turnover intention has gained attention in a number of employees–employer-related studies (Erdogan & Enders, 2007; Yih & Lawrence, 2011). According to Yu and Frenkel (2013), POS yields outcomes such as high job satisfaction, lower turnover, enhanced dedication, positive emotions and better performance. Other studies have also revealed a strong linkage between POS and job satisfaction (Erdogan & Enders, 2007; Maan et al., 2020; Ullah et al., 2020). Similar results were also found in studies conducted by Kuo et al. (2015), and Kurtessis et al. (2015). The potential explanation of this outcome is that POS can enrich individuals' trust and beliefs that their employer identifies and recompense their struggles to accomplish superior performance. Biswas and Bhatnagar (2013), suggest that POS starts as a social exchange process where individuals feel liable to support the organization in accomplishing its goals which leads to greater rewards. The authors explained that, when an employee associates positively with their job and organization, it strengthens the association between the employee and the organization within the realms of social exchange theory. Consequently, individuals reciprocate organizational support in numerous ways when they are more satisfied with their jobs. In addition, employees with POS sense an intrinsic compulsion to be socioemotionally devoted to the work and the organization, and they become highly loyal and satisfied with their job and organization (Gillet et al., 2013; Ridwan et al., 2020; Fitriyana et al., 2023).

The need for this support to employees in general and more importantly those who provide healthcare services has increased in the recent past. This is because healthcare professionals often experience burnout, characterized by emotional exhaustion, career de-prioritization, and loss of self-efficacy. The situation has been exacerbated by the COVID-19 pandemic, presenting a significant threat to the healthcare system (Lai et al., 2020; Shanafelt et al., 2010). Heavy workloads, changing clinical roles, reduced decision latitude (i.e., the ability to exercise control

over work-related responsibilities), and lack of support from supervisors and the organization have been cited as causes of increased occupational stress, a key predictor of burnout and career dissatisfaction (Cocker & Joss, 2016; Tessier et al., 2022). During the pandemic, additional stressors such as lack of personal protective equipment and fear of infection, have been shown to augment the risk for healthcare providers (Lai et al., 2020; Shanafelt et al., 2012; Reitz et al., 2021). Consequently, employee performance and quality service delivery may, in part, depend on how healthcare organizations manage to allocate resources and human capital and how they can effectively develop policies to adequately support their employees. When these are in place, employees will be satisfied, which will increase their commitment. With the formulation and implementation of policies which focuses on the investment of resources in human capital, employees will perceive the provision has been made to support their career development, ie. Perceived career support, is positively related to career satisfaction (Barnett & Bradley, 2007; Maan et al., 2020; Abu-Tineh et al., 2023). Using the organization theory as the theoretical lens, this study investigates the relationship between perceived organisational support on employee satisfaction and commitment among health professionals to contribute to theory and practice.

Literature Review

Organizational support theory

Organizational support theory rests on the assumption that employees develop a general perception of the extent to which their organization values their contributions and cares about their well-being (i.e., POS). In the same way that people try to gauge another person's level of commitment to a friendship, employees try to determine the organization's willingness to reward their efforts and meet their needs by making inferences about the organization's level of support for them (Eisenberger et al., 1986; Kurtessis et al., 2017). According to organisational support theorists, to fulfil their socio-emotional needs and determine the readiness of the organisation to remunerate enhanced work effort, employees develop a universal belief concerning the extent to which the organisation values their contributions and cares about their well-being (Eisenberger et al., 2004; Rhoades & Eisenberger, 2002). POS also rests on the assurance that assistance will be available from the organisation when it is needed to carry out one's job effectively or to deal with stressful situations such as the COVID-19 pandemic (Arnetz, Goetz, Arnetz, & Arble, 2020; Lee, 2021). As such, POS is likely to increase employees' feelings of obligation to help the organisation achieve its objectives, their affective commitment to the organisation and their belief that improved performance will be rewarded.

Based on such perception, employees view their favourable or unfavourable treatment as an indication that the organisation believes they are valuable, or otherwise. Consequently, employees feel obligated to reciprocate POS with increased loyalty, effort, commitment, and performance because of the norm of reciprocity (Kilroy et al., 2023; Sekhar & Patwardhan, 2023; Allen & Shanock, 2013; Coyle-Shapiro & Conway, 2005; Kraime & Wayne, 2004). Similarly, Chen, Aryee and Lee (2005, p.465) note that "the favourable treatment that employees receive from the organisation creates an opportunity for the organisation not only to initiate a social exchange relationship with its employees but also to demonstrate its trustworthiness in the eyes of employees".

Organizational support theory descends in part from social exchange theory, a theory that shadows many other theories under its umbrella (Ahmad et al., 2023) which explains the exchange of goods or services, thus, tangible or intangible, between people (Blau, 1964). Individuals are motivated to enter and develop relationships with others when the relationship promises something valuable in return (Zhu et al., 2023; Kilroy et al., 2023; Blau, 1964). High-quality, mutually beneficial relationships evolve only when parties abide by accepted norms, or "rules of exchange" (Cropanzano & Mitchell, 2005). We can readily apply the tenets of social exchange theory to organizations by viewing the employment relationship as one in which an employee offers effort and loyalty in exchange for rewards from the organization. These rewards may be tangible (e.g., pay, benefits, and promotions) or social (e.g., recognition, support, esteem). By offering rewards or by providing positive treatment to employees, organizations can enhance employee POS and facilitate the norm of reciprocity, which is the social expectation that when we receive positive treatment from someone else, we should return, or reciprocate, the favour by treating that person well (Stotsky et al., 2020; Wang et al., 2023; Gouldner, 1960; Eisenberger & Stinglhamber, 2011; Kurtessis et al., 2017). In sum, when employees feel supported by their organization, they feel compelled to return the favour by demonstrating greater commitment and effort in their careers.

Although organizational support theory draws heavily from social exchange theory, it also underscores self-enhancement processes as an important component of the employee-employer relationship (Kurtessis et al., 2017). Self-enhancement helps maintain our social identities, which embody the aspects of our self-image that come from the social categories or groups to which we perceive that we belong. Fundamentally, humans have a need to see themselves in a positive light,

and group identification helps satisfy this need by giving us a sense of belonging and the perception that we are valued by others (Froehlich et al., 2023; Meyer et al., 2006). Possessing socioemotional needs (e.g., needs for approval, affiliation, esteem, and emotional support) make us responsive to cues that help us develop and maintain personal identities (Meyer et al., 2006; Kurtessis et al., 2015). Thus, when employees feel supported by the organization, they develop identification with the organization in which their organizational membership becomes a meaningful, positive part of their personal identities. Identification builds as employees recognize the distinctiveness of the organization's values and practices, as they perceive that the organization is prestigious or attractive, as they become satisfied with the organization, as they compare the organization to outside groups, and as they accumulate experiences and feelings (e.g., increased interaction, liking, similarity, shared values, a common fate) that draw them closer to the organization. The perceptions of identification in turn give rise to positive attitudes, the strongest of which is affective organizational commitment, in which employees feel a strong emotional bond with the organization (Meyer et al., 2006; Riketta, 2005). Indeed, meta-analytic data has demonstrated that organizational identification partially mediates the relationship between POS and affective commitment (Kurtessis et al., 2015). In summary, organizational support theory maintains that POS contributes to an affective organizational commitment not only by promoting social exchanges between employees and their organisation but also, by helping to fulfill employees' socioemotional needs.

Antecedents of POS

In line with the fundamental assumptions of organisational support theory (OST), three general forms of favourable treatment—fairness, supervisor support and appropriate human resource practices—received from the organisation are likely to enhance POS (Eisenberger et al., 1986; Eisenberger et al., 2004; Rhoades & Eisenberger, 2002). The contributions of these three antecedents to POS are briefly discussed here.

Fairness of treatment: Fairness is often discussed in terms of distributive, interactional and procedural justice. Distributive justice primarily relates to fairness regarding the distribution of outcomes such as pay, promotion (Colquitt et al, 2001; Hazeen Fathima & Umarani, 2023) while procedural justice concerns the fairness of a decision process and is used to explain employee

reactions to what they perceived as fair or unfair decision processes (Greenberg, 1990), interactional justice describes employees perception of fairness regarding the interpersonal treatment of persons who distribute the resources (Hazeen Fathima & Umarani, 2023). Fairness is thus operationalized as an employee's perception of being treated impartially, justly and fairly thus receiving what he deserves in terms of procedure followed, distribution of outcomes and resources and relationship. Hazeen Fathima and Umarani (2023) proposed that fair treatment is expected to have a strong cumulative effect on POS by indicating a concern for the employees' welfare. There is therefore the probability of procedural justice having a stronger effect on POS than distributive justice. This is because employees frequently do not benefit from organisational outcomes such as promotions and pay rises as much as they are exposed to instances of unfair procedural justice daily. Other studies have however found procedural justice does not contribute more strongly to POS than distributive justice when the two dimensions of fairness are compared (Dawud et al., 2018) which is the opposite of the findings of Wayne et al (2002).

Supervisor Support: Supervisor support describes an employee's perception in terms of the extent to which their supervisors value their contributions to the job and care about their well-being (Lussier et al 2022). It is an employee's perception that supervisors value their contribution and welfare (Arici, 2018). Supervisor support thus describes the employee's perception of the level and quality of support received from the supervisor in the organization. Employees form global beliefs relating to the extent to which supervisors value their contributions and care about their well-being (Kottke & Sharafinski, 1988). In the view of OST, employees integrate the favourable treatment received from different organisational agents and units into an overall perception of organisational support. This is because supervisors, acting as representatives of the organisation, are mandated to provide leadership (Penning de Vries et al., 2022) and evaluate subordinates' job-related performance. Employees, on the other hand, perceive their supervisors' favourable or unfavourable orientation toward them as indicative of the organisation's support (Eisenberger et al., 1986; Eisenberger et al., 2004 Penning de Vries et al., 2022). Even though employees may differ in their perceptions of their supervisor's support (Penning de Vries et al., 2022), Eisenberger et al. (2004) suggest that such treatments received from an organisational agent contribute to POS to the extent that the actions of the agent are believed to be authorised and encouraged by the organisation rather than ascribed to the personal motives and the self-interest of the agent.

In addition, employees understand that top management receives feedback from supervisors relating to the evaluation of their performance, which further strengthens the employees' association of supervisor support with POS. This is because Supervisor support helps in the development of shared perceived perception between employees and between employees and their supervisor (Penning de Vries et al., 2022). Furthermore, the perceived status of an agent would be greatly influenced by the agent's official position in the organisational hierarchy. This status is also influenced by the degree to which positive evaluation and regard are extended to the employees by the organisation, the degree of job autonomy afforded them and how influential the agent is in terms of organisational decisions (Eisenberger et al.,2002; Eisenberger et al., 2004). Fair or unfair treatment received from high-status representatives, who are highly identified with the organisation, would have an increased influence on POS. Consistent with this observation, Eisenberger et al. (2002) found that the relationship between perceived supervisor support and POS increased with the status employees attributed to their superiors.

Human resource practices: Human resource practices are a part of Human Resource Management which is defined as the policies and practices implemented in an organisation to ensure the performance of the human resource (Armstrong 2010). These HR practices include selecting human resource needs, screening, recruiting, training, rewarding, appraising, and ensuring safety and health, and other concerns of employees (Dessler, 2007). Human Resource practices can thus be explained as the activities of the organisation focused on managing the human resource to ensure the achievement of organisational goals. These may include attracting, motivating, retaining, appraising, training and rewarding deserving employees in a fair manner. HR practices have, to a large extent, the potential to either positively or negatively contribute to POS because they are specifically focused on the employee. HR practices that are perceived to be favourable, leading to investment in human capital, and which demonstrate recognition of employee contributions have been found to promote POS (Desa & Asaari, 2020; Mayes, Finney, Johnson, Shen, Yi, 2017; Saks, 2022). Studies have found a strong association between POS and HR practices such as recognition, training, job security, autonomy, participation in decision-making and opportunities for rewards and promotions (Allen et al., 2003; Pungnirun, Techarattanased, & Mutakalin, 2020). Eisenberger et al. (2004) argue that the positivity of a specific HR practice should enhance POS to the point that it is attributed to the voluntary, intentional actions of the organisation. Furthermore, Ho and Kuvaas (2020) established that employees who reported strong

mutual obligations between themselves and their organisations had higher levels of POS than employees who reported low mutual obligations.

POS and career satisfaction

Career satisfaction is a subjective measure, s the extent to which employees believe that their career progress is aligned with their own goals, values, and preferences and as a result, can learn new things and achieve what they desire (Mansour et al., 2023; Bauer et al., 2006). Thus, goal-specific environmental support and resources that provide social and material provision for employees' personal goals predict career satisfaction (Barnett & Bradley, 2007) as well as wages and salaries, promotions, work environment, working hours, leaders, organisational culture, organisational justice, and emotional attachment (Mansour et al., 2023). In addition to these Kundi et al., (2023) suggest that discretionary human resource practices are significantly associated with employee commitment and satisfaction. Thus there are several antecedents to employees' career satisfaction including their perception of the organisation's support (Pinnington et al., 2023; AKKOCA, 2023).

POS has emerged as a consistent contributor to employee well-being, as studies have shown that it can enhance mood (Eisenberger et al., 2001), career satisfaction (Kurtessis et al., 2015; Rhoades & Eisenberger, 2002), organization-based self-esteem (Kurtessis et al., 2015), and work-family balance (Eisenberger & Stinglhamber, 2011; Kurtessis et al., 2015). According to organizational support theory, POS boosts employee wellness by enhancing self-esteem, fulfilling socioemotional needs, and providing the expectation that employees will be rewarded for their efforts (Eisenberger & Stinglhamber, 2011; Kurtessis et al., 2015). POS also signifies the availability of the organization's instrumental support. Employees with high POS feel confident that their organization will provide help and support should they need it, and this expectation puts employees at ease in the face of stressors (Eisenberger & Stinglhamber, 2011; Kurtessis et al., 2015).

Just as employees with high POS feel happier in their careers, it contributes to employees' career satisfaction. POS contributes to career satisfaction by fulfilling employees' socioemotional needs, signalling that the organization will provide help when needed, and strengthening employees' confidence that they will be rewarded for good performance (Eisenberger & Stinglhamber, 2011; Kurtessis et al., 2015; Rhoades & Eisenberger, 2002). Therefore, consistent with organizational support theory, POS improves employees' happiness (career satisfaction) at work by helping to

meet needs for approval and esteem, by increasing the expectation that the organization will eventually provide the recognition and assistance that employees need, and by promoting a positive emotional attachment to the organization.

Previous empirical studies found that perceptions of organizational support are related to employee performance, career satisfaction, affective commitment and career-induced tension (Yu, 2011). Several studies have also found a positive relationship between POS and career satisfaction and a meta-analysis conducted by Riggle et al. (2009) confirmed the findings related to POS with attitudinal outcomes. Similar results were also found in studies conducted by Beheshtifar et al. (2012), Kuo et al. (2015); and Kurtessis et al. (2015). Riggle et al. (2009) conducted a meta-analysis examining the effects of perceived organizational support on four employee outcomes: organizational commitment, career satisfaction, performance, and intention to leave. They found that career satisfaction exhibits strong positive relationships with POS. In the study by Kwak, et al. (2010), the authors also confirmed career satisfaction (i.e., subjective career success) was directly correlated with organizational support. Given the positive effect of POS on career satisfaction (DeConinck, 2010), the study posits that employees with high POS will be more satisfied with their careers, over and above the effect of POS.

POS and organisational commitment

Organisation commitment (OC) refers to a force that binds a person to an organisation (Afshari, 2023). It is "the relative strength of an individual's identification with and involvement in a particular organization" (Mowday et al., 1979; Faloye, 2014; Meyer & Allen, 1991). It thus describes the employee's state of commitment to the organization, as well as the employee's identification with the organization's values and goals. The concept of OC has become the focus of managers in general and human resources departments in many organizations (Idris, 2014; Pimenta et al., 2023). As a result, managers have adopted socially responsible human resource management strategies to contribute to higher levels of POS, engagement and commitment (Pimenta et al., 2023).

The globalization of the workforce through advances in computer technology and telecommunication has created more challenges for managers as their role in attracting talents and ensuring an environment where those employees can contribute as long-term assets to the organization (Singh & Gupta, 2015) is becoming increasingly difficult. Tuna et al. (2016) and

Afshari (2023) noted that the extent of how strongly an individual identifies with an organization is a predictor of the individual's OC.

OC is conceptualised as a multidimensional construct encompassing three dimensions: (1) Affective Commitment (AC); (2) Normative Commitment (NC): and (3) Continuance Commitment (CC). The three-dimensional model of AC, NC and CC includes a psychological state that links the employee to the organization (Allen & Meyer, 1997; Gupta & Singh, 2015; Stinglhamber et al., 2015). While the affective attachment of an employee is determined by the choice to remain committed to the organization due to some emotional identification (Singh & Gupta, 2015; Mercurio 2015), a normative commitment is the feelings of obligation of the individual based on perceived attachment to the organization goals (Singh & Gupta, 2015; Afshari, 2023). This is less of a personal commitment, but rather a perceived societal expectation, in which one remains loyal to the employer who provides compensation for services rendered (Singh & Gupta, 2015). Messner (2013) described NC as the work behavior of individuals, guided by a sense of duty, obligation, and loyalty toward the organization. Finally, a continuance commitment is the extent to which an employee feels committed due to the perceived cost of leaving an organisation (Allen & Meyer, 1991; Afshari, 2023). It relates to a cost-benefit analysis of the employee, such as the loss of economic investments and difficulties in finding a new job (Allen & Meyer, 1991; Singh & Gupta, 2015).

One of the most well-established outcomes of POS is increased commitment to the organization (Kurtessis et al., 2015; Meyer et al., 2002; Rhoades & Eisenberger, 2002). Organizational support theory explains that POS strengthens affective commitment via social exchange and self-enhancement processes (Pimenta et al., 2023; Kurtessis et al., 2015). Therefore, POS strengthens affective commitment based on these processes. First, POS prompts positive social exchanges between the employee and the organization. When the organization indicates its readiness to increase support in the future, employees may be more willing to develop an emotional bond with the organization as part of this investment in their future. By indicating that it will increase its provision of support in the future, an organization is still demonstrating that it cares for its employees and their future with the organization. This signal of caring from the organization motivates employees to reciprocate this care in the form of affective organizational commitment (Kurtessis et al., 2015).

Further, organizational support serves to meet employees' socioemotional needs. POS represents an expectation that the organization will be able to increase the extent to which it is able to fulfil individual needs and reward employees for their efforts (Kurtessis et al., 2015). By demonstrating a high potential to fulfill future employee needs, organizations convey that they care about employee welfare and have supportive values and practices (Obuobisa-Darko, 2020). Given some of the mechanisms by which organizational identification (for example, as employees see the organization as more attractive, as they become satisfied with the organization, as they develop shared values and a sense of common fate with the organization, and as they recognize the distinctiveness of the organization's values and practices) develops employees who perceive that their organization will increasingly care about them and fulfil future needs, should develop identification with and, subsequently, develop affective attachment toward the organization (Kurtessis et al., 2017; Chernyak-Hai et al., 2023).

Methodology

The cross-sectional survey approach was used to gather data from the respondents. Using the convenience sampling technique due to the ease of accessibility and availability of the participants (Etikan et al., 2016), data was gathered using a structured questionnaire. The structured questionnaire was used dues to the relative ease of administering, takes a relatively short time to develop, is cost-effective and allows a broad range of data to be collected within a short period of time (Nueman, 2011; Sheppard, 2020). Data for the demographic characteristics was presented using descriptive statistics while multiple regression analysis was used to establish the inter-relationship among the constructs.

Measures

The following are the different measures for the different constructs of the study.

Perceived organizational support was assessed using an 8-item scale adapted for the study (Kraimer et al., 2011). Respondents were asked to indicate their responses to statements regarding their organization's support towards their career success. Items were measured on a 5-point Likert scale from 1 - strongly disagree to 5 - strongly agree.

Career satisfaction was assessed using a 5-item scale adapted from Greenhaus et al. (1990). The scale measures the subjective career satisfaction of respondents on a 5-point Likert scale from 1 - strongly disagree to 5 - strongly agree.

Organizational commitment was measured as a multi-dimensional construct comprising affective, continuance and normative commitment (Meyer, Allen, & Smith, 1993). Respondents were asked to indicate their responses to statements regarding their perception of organizational support towards their career success. Items were measured on a 5-point Likert scale from 1 - strongly disagree to 5 - strongly agree.

Results

Respondents' Characteristics

The respondents were made of 58% males and 42% females. The majority of the respondents (86%) were below 40 years of age, representing the middle-age labour population in Ghana's healthcare sector. 65% of the employees surveyed were married. The respondents cut across a range of operations areas, with the majority being customer care/marketing personnel (25%), followed by accounts and finance personnel (19%) and administrative (21%) personnel. Related to time worked with their respective organisations, results showed that 3% have worked for between 11-15 years, with the majority of 58% working between 1-5 years.

Descriptive and Reliability Statistics

The descriptive statistics for the variables measured in the study are shown in Table 1. The results indicate that the average of responses for POS is the highest converging closer to "agree" (mean = 3.91; standard deviation = 1.185) on the 5-point Likert scale. While the responses for Affective Commitment (mean = 3.88) and Career Satisfaction (mean = 3.74), also converge closer to "agree" showing similar descriptive statistics. On the other hand, the average response for Continuance Commitment (mean = 3.45) and Normative Commitment (mean = 3.30) converge closest to "neutral" showing similar descriptive details.

Table 1: Descriptive Statistics

	Minimum	Maximum	Mean	Std. Deviation
POS	1	5	3.91	1.185
Affective Commitment	1	5	3.88	1.258
Continuance Commitment	1	5	3.45	1.416
Normative Commitment	1	5	3.30	1.381
Career Satisfaction	1	5	3.74	1.294

Cronbach's alpha criterion was used to further assess the reliability of the measurement scale. This was to examine whether the items have internal consistency and converge to properly measure the construct they measure. Results in Table 2 show that Cronbach's alpha values meet the recommended threshold of 0.70 (Chin, 1998). The results show a Cronbach's alpha value between 0.755 and 0.947 and a standardised Cronbach's alpha value of between 0.787 and 0.885.

Table 2: Reliability Statistics

Variable	Items	Cronbach's Alpha
POS	10	0.865
Affective Commitment	6	0.857
Continuance Commitment	6	0.787
Normative Commitment	5	0.839
Career Satisfaction	5	0.885

The inter-item correlation matrix depicted in Table 3 shows that the diagonal values (i.e., the square root of the average variance extracted, AVE) are greater than the off-diagonal values (i.e.,

the pair-wise correlation between factors). This implies that the variables show acceptable validity according to recommendations by Chin (1998).

Table 3: Inter-item correlation matrix

	1	2	3	4	5
1. POs	1				
2. Affective Commitment	0.581	1			
3. Continuance Commitment	0.271	0.533	1		
4. Normative Commitment	0.473	0.679	0.517	1	
5. Career Satisfaction	0.551	0.280	0.187	0.260	1

Regression analysis

Multiple regression analysis was run to determine the causal effects between variables of interest in the study. The results of the regression analysis are presented. The tables are constructed from the outputs of the regression analysis (i.e., model summary, coefficients, ANOVA etc.) in SPSS indicating the unstandardized coefficient (B), standard errors, standardized regression coefficients (beta) and the t-statistic.

POS and Career Satisfaction

Table 4 shows the outputs of multiple regression analysis for the impact of POS on employees' career satisfaction. The results suggest that the overall POS (B = 0.370, p-value = 0.001), has a moderately positive and significant impact on employees' career satisfaction. This implies that an increase in POS increases career satisfaction by 0.370 units among employees at a 1% significance level. Hence, the results demonstrate that supporting employees in their career development and endeavour improve the career satisfaction of employees in organisations. Subsequently, POS explains about one-third (R Square = 0.304) of the variance in employee career satisfaction which only reduces to about 29.4% (Adjusted R-Square = 0.294) when adjusted for degrees of freedom.

The ANOVA results for model fit (F Statistic = 30.569, p-value ≤ 0.001) indicate that the regression model fitted the data reasonably well.

Table 4: Regression Results for POS and Career Satisfaction

Variable	B	S.E	T	Prob.
Constant	4.235	2.663	1.590	0.116
POS	0.370	0.067	5.529	0.001*
S.E of estimate	4.477			
R-Square	0.304		**F-statistic**	30.569
Adj. R-square	0.294		**Prob. (F-stats.)**	0.001*

*Note: * p < 0.01 level; **p < 0.05 level; *** p < 0.10 level*

POS and Employee Commitment

Table 5 shows the outputs of multiple regression analysis for the impact of (POS) on the commitment of employees. The results suggest that overall, POS (B = 0.945, p-value = 0.001, significant) has a highly positive and significant impact on employee commitment at the Trust Hospital. This implies that an increase in career support increases employee commitment by 0.945 units among employees at the health facility surveyed. Hence, the results suggest that when employees are given the necessary support from the organization, it helps improves the commitment of individuals in the organisation. Incidentally, POS explains only about 27% (R Square = 0.270) of the variance in employee commitment, reducing only slightly to about 26% (Adjusted R-Square = 0.259) when adjusted for degrees of freedom.

Table 5: Regression Results for POS and Employee Commitment

Variable	B	S.E	T	Prob.
Constant	23.471	07.405	3.170	0.002*
POS	0.945	0.186	5.084	0.001*
S.E of estimate	12.449			

R-Square	0.270	**F-statistic**	25.851
Adj. R-square	0.259	**Prob.(F-stats.)**	0.001

*Note: * p < 0.01 level; **p < 0.05 level; *** p < 0.1 level*

For the overall model:

Let X_1 = career support

Y_1 = employee commitment

Then:

$Y_1 = 23.471 + 0.945X_1$ -------- *Equation 2*

Hence, *Employee Commitment = 23.471 + 0.945 Career Support*

Table 6 shows the results of the regression to ascertain the impact of POS on the various dimensions of employee commitment (i.e., affective, continuance and normative). The results suggest that POS has a moderately positive impact on two dimensions of employee commitment, namely affective commitment (B = 0.424, p-value = 0.001) and normative commitment (B = 0.319, p-value = 0.001). It is worth noting that. although the coefficients of affective and normative commitment are significant at a 1% significance level, the effect of POS is greater on affective commitment than on normative commitment. This is further depicted in the R-Square values where career support explains about 33% of the variance in affective commitment (R Square = 0.338) whilst it explains about 22% of the variance in normative commitment. On the other hand, POS exhibits the lowest impact on continuance commitment (B = 0.202, p-value = 0.021, significant) although positive, it is only statistically significant at a 5% significance level. It also shows that POS only explains about 7% of the variance in continuance commitment (R Square = 0.0.073). The ANOVA results for the model fit of the three dimensions, affective (F Statistic = 35.733, p-value = 0.001), continuance (F Statistic = 5.535, p-value = 0.021), and normative (F Statistic = 20.205, p-value = 0.001) all indicate that the regression model fitted the data reasonably well.

Table 6: Regression Results for POS and Affective Commitment

Variable	B	S.E	T	Prob.
Constant	6.735	2.823	2.385	0.020**
POS	0.424	0.071	5.978	0.001*

S.E of estimate	4.747		
R-Square	0.338	**F-statistic**	35.733
Adj. R-square	0.328	**Prob.(F-stats.)**	0.001*

*Note: * p < 0.01 level; **p < 0.05 level; *** p < 0.1 level*

Table 7: Regression Results for POS and Continuance Commitment

Variable	**B**	**S.E**	**T**	**Prob.**
Constant	12.779	3.420	3.736	0.001*
POS	0.202	0.086	2.353	0.021**
S.E of estimate	5.750			
R-Square	0.073		**F-statistic**	5.535
Adj. R-square	0.060		**Prob. (F-stats.)**	0.021*

*Note: * p < 0.01 level; **p < 0.05 level; *** p < 0.1 level*

Table 8: Regression Results for POS and Normative Commitment

Variable	**B**	**S.E**	**T**	**Prob.**
Constant	3.955	2.831	1.398	0.167
Career Support	0.319	0.071	4.495	0.001*
S.E of estimate	4.759			
R-Square	0.224		**F-statistic**	20.205
Adj. R-square	0.213		**Prob.(F-stats.)**	0.001*

*Note: * p < 0.01 level; **p < 0.05 level; *** p < 0.1 level*

For the impact of POS on the individual dimensions of commitment, the models are given below:

Let X_1 = POS

Y_1 = Affective Commitment

Y_2 = Continuance Commitment

Y_3 = Normative Commitment

$Y_1 = 6.735 + 0.424X_1$ -------- *Equation 3* Hence, the impact of career support on affective commitment is given as:

Affective commitment = 6.735 + 0.424 POS

$Y_2 = 12.779 + 0.202X_1$ -------- *Equation 4*

Hence, the impact of career support on continuance commitment is given as:

Affective Commitment = 12.779 + 0.202 POS

$Y_3 = 3.955 + 0.319X_1$ -------- *Equation 5*

Hence, the impact of career support on normative commitment is given as:

Employee Performance = 3.955 + 0.319 POS

Discussion and Implications

The results reveal that POS has a moderately positive and significant impact on the career satisfaction of employees, supporting the study's hypothesis. The results lend credence to previous studies which assert that POS is a significant predictor of career satisfaction (Pinnington et al., 2023; AKKOCA, 2023; Bahadır et al., 2022; Jehanzeb & Mohanty, 2018; Kurtessis et al., 2015). The finding provides evidence suggesting that support provided to employees at the workplace tends to boost employee wellness and helps employees to fulfil their socioemotional needs and the expectation that they will be rewarded for their efforts (Eisenberger & Stinglhamber, 2011; Kurtessis et al., 2015).

Employees with high POS feel confident that their organization will provide help and support should they need it, and this expectation puts employees at ease in the face of stressors (Eisenberger & Stinglhamber, 2011; Kurtessis et al., 2015). As such, the findings suggest that employees are confident in the level of support provided by the hospital. This demonstrates that the hospital treats its employees well, who in turn develop high POS and greater satisfaction with their careers. This finding also supports Kurtessis et al.'s (2017) and Ho and Chan's (2022) assertion that organizational support theory underscores the self-enhancement of employees. For example, by providing adequate support to its employees, the hospital has helped employees to enhance their career progressions which is an important component of career satisfaction.

Additionally, the findings also indicate that employees surveyed tend to receive favourable treatment from other members of the hospital (e.g., supervisor support, transformational

leadership, leader-member exchange and coworker support) which has contributed to the positive relationship between POS and career satisfaction. Additionally, the results follow earlier assertions of Lamprinou, Tasoulis and Kravariti (2021) and Maan et al., (2020) that fairness and positive treatment for employees by providing benefits, developmental opportunities, autonomy, and policies that support a healthy work-life balance, are key to POS and ultimately career satisfaction.

The results further demonstrate that POS (B = 0.945, p-value = 0.001, significant) has a highly positive and significant impact on employee commitment. This supports the findings of studies that favourable treatments such as rewards from the organization, beneficial working conditions and fairness received by employees are directly linked to POS (Rhoades & Eisenberger, 2002; Maan et al., 2020). Thus, POS ultimately helps boost the employees' obligations toward the organization to reciprocate favourably. In other words, by providing adequate support to employees, the organization generates employees' zeal for effectiveness in carrying out the mission and vision of the organizational leadership. In addition, employees feel well-treated and receive proper support, which invokes a sense of obligation to reciprocate the company's good treatment. This reinforces the employees' commitment towards the organization.

The results suggest that POS has a moderately positive impact on two dimensions of employee commitment, namely affective commitment (B = 0.424, p-value = 0.001, significant) and normative commitment (B = 0.319, p-value = 0.001, significant). On the other hand, POS exhibits the lowest impact on continuance commitment (B = 0.202, p-value = 0.021, significant) although positive, is only statistically significant at the 5% significance level. The study revealed that employees identify and involve themselves within the company and its activities, thereby indicating a strong affective commitment to the company. It is possible to speculate that the company meets the socioemotional needs (e.g., needs for approval, affiliation, esteem, and emotional support) of employees which makes them develop and maintain a personal identity with the organization (Kurtessis et al., 2015).

Additionally, the results imply that employees feel supported by the organisation, so they identify wholly with and recognize the distinctiveness of the company's values and practices. This high level of affective commitment leads employees to be brand ambassadors of the hospital as they deem it prestigious or attractive, and as they accumulate experiences and feelings (e.g., increased interaction, liking, similarity, shared values, a common fate) that draw them closer to the

organization. In summary, the results support the organizational support theory which maintains that POS contributes to an affective organizational commitment not only by promoting social exchanges between employees and their organisation but also by helping to fulfill employees' socioemotional needs.

Normative commitment reflects an employee's sense of commitment due to a feeling of obligation. Noting that the perceived career support has a moderately positive and significant relationship with normative commitment demonstrates that employees remain loyal to their organisation which provides compensation for services rendered. As such, employees are likely to demonstrate higher levels of work behaviour, a higher sense of duty, obligation, and loyalty toward the hospital. Additionally, this result explains the fact that employees continue to stay in the organisation because it is perceived by them as morally right regardless of how much status or satisfaction the organization provides over the years. The result enforces a strong reciprocal relationship between the employees. The result of this study supports the concept of reciprocity, which suggests that a person receiving a benefit is under a strong normative obligation to repay the benefit in some way (Singh & Gupta, 2015; Bahadır et al., 2022). This result suggests that employees remain committed to their organisations from a perceived obligation to repay them for investing in them.

Continuance commitment relates to a cost-benefit analysis of the employee, such as the loss of economic investments and difficulties in finding a new job (Afshari, 2023; Al-Jabari & Ghazzawi, 2019; Gupta, & Singh, 2015). The results propose a rather low continuance commitment of employees, which implies that the commitment of employees is dependent on the positive extrinsic rewards obtained without necessarily identifying with the organization's goals and values. A rather low continuance commitment has a positive implication for organisations as it demonstrates that its employee's continuance commitment is not because of the rewards and benefits, although to some extent, but rather more because they identify with the organisation and feel obligated to reciprocate the good benefits they have enjoyed from it.

Conclusion and managerial implications

The aim of the study was to examine the impact of POS on employee career satisfaction and commitment. The findings suggest that POS has a positive significant relationship with the career satisfaction and commitment of employees. At the individual level, POS highly predicts employees' affective commitment, followed by normative commitment and then continuance

commitment. This implies that when managers within an organization provide support that meets the needs of its employees, it raises the employees' desire to reciprocate by being committed to the organisation. Employees become satisfied with their careers at the organization and demonstrate their commitment to the organization, not only based on their needs (continuance commitment) but also based on their sense of obligation (normative commitment) and their desire to achieve the organizational goals (affective commitment). Managers should therefore ensure employees' perception of support is raised to guarantee they are well committed. Hence, POS can increase employees' career satisfaction and organizational commitment.

References

Abu-Tineh, A. M., Romanowski, M. H., Chaaban, Y., Alkhatib, H., Ghamrawi, N., & Alshaboul, Y. M. (2023). Career advancement, job satisfaction, career retention, and other related dimensions for sustainability: A perception study of Qatari public-school Teachers. *Sustainability*, *15*(5), 4370.

Abualigah, A., Darwish, T. K., Davies, J., Haq, M., & Ahmad, S. Z. (2023). Supervisor support, religiosity, work engagement, and affective commitment: Evidence from a Middle Eastern emerging market. *Journal of Asia Business Studies*, (ahead-of-print).

Afshari, L. (2023). Identification through meaning-making: identity enactment towards organizational commitment. *Human Resource Development International*, *26*(1), 7-28.

Ahmad, R., Nawaz, M. R., Ishaq, M. I., Khan, M. M., & Ashraf, H. A. (2023). Social exchange theory: Systematic review and future directions. *Frontiers in Psychology*, *13*, 1015921.

AKKOCA, Y. (2023). The mediation of job satisfaction between perceived organizational support and organizational commitment. *Ahi Evran Üniversitesi Sosyal Bilimler Enstitüsü Dergisi*, *9*(1), 350-362.

Al-Jabari, B., & Ghazzawi, I. (2019). Organizational commitment: A review of the conceptual and empirical literature and a research agenda. *International Leadership Journal*, *11*(1).

Allen, N. J., & Meyer, J. P. (1996). Affective, continuance, and normative commitment to the organization: An examination of construct validity. *Journal of Vocational Behavior*, *49*(3), 252-276.

Arici, H. E. (2018). Perceived supervisor support and turnover intention: Moderating effect of authentic leadership. *Leadership & Organization Development Journal*, *39*(7), 899-913.

Armstrong, M. (2010). *Armstrong's essential human resource management practice: A guide to people management*. Kogan Page Publishers

Arnetz, J. E., Goetz, C. M., Arnetz, B. B., & Arble, E. (2020). Nurse reports of stressful situations during the COVID-19 pandemic: Qualitative analysis of survey responses. *International Journal of Environmental Research and Public Health*, *17*(21), 8126.

Bahadır, F., Yeşiltaş, M., Sesen, H., & Olaleye, B. R. (2022). The relation between perceived organizational support and employee satisfaction: the role of relational psychological contract and reciprocity ideology. *Kybernetes*, (ahead-of-print).

Barnett, B. R., & Bradley, L. (2007). The impact of organisational support for career development on career satisfaction. *Career Development International*, 4(1), 22–38.

Blau, P. M. (1964). Justice in social exchange. *Sociological Inquiry*, *34*(2), 193-206.

Chernyak-Hai, L., Bareket-Bojmel, L., & Margalit, M. (2023). A matter of hope: Perceived support, hope, affective commitment, and citizenship behavior in organizations. *European Management Journal,*

Colquitt, J. A., Conlon, D. E., Wesson, M. J., Porter, C. O. L. H., & Ng, K. Y. (2001). Justice at the millennium: A meta-analytic review of 25 years of organizational justice research. *Journal of Applied Psychology, 86*(3), 425-445.

Coyle-Shapiro, J. A., & Diehl, M. R. (2018). Social exchange theory: Where is trust? In *The Routledge Companion to Trust* (pp. 197-217). Routledge.

Dawud, J., Pradesa, H. A., & Afandi, M. N. (2018). Distributive and procedural justice, perceived organizational support, and its effect on organizational commitment in public organization. *International Journal of Academic Research in Business and Social Sciences*, *8*(12), 1675-1188.

Desa, N. M., & Asaari, M. H. A. H. (2020). Mediation of perceived organizational support between human resources practices and job performance among engineers in the Penang Free Trade Zone. *International Journal of Asian Social Science*, *10*(7), 368-380.

Dessler, G. (2007). *Human resource management*, 11th ed., Prentice-Hall, Englewood Cliffs,

Doğan, U. Ç. A. R., & Ötken, A. B. (2011). Perceived organizational support and organizational commitment: The mediating role of organization-based self-esteem. *Dokuz Eylül Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi*, *25*(2), 85-105.

Eisenberger, R., & Stinglhamber, F. (2011). Perceived organizational support. In R. Eisenberger & F. Stinglhamber, *Perceived organizational support: Fostering enthusiastic and productive employees* (pp. 25–60). *American Psychological Association.* https://doi.org/10.1037/12318-002.

Eisenberger, R., Huntington, R., Hutchison, S., & Sowa, D. (1986). Perceived organizational support. *Journal of Applied psychology*, *71*(3), 500-515.

Eisenberger, R., Stinglhamber, F., Vandenberghe, C., Sucharski, I. L., & Rhoades, L. (2002). Perceived supervisor support: Contributions to perceived organizational support and employee retention. *Journal of applied psychology*, *87*(3), 565.

Fitriyana, F., Astuti, H. W., Rahman, A., Werdiningsih, R., & Idrus, S. (2023). Servant leadership and perceived organizational support for lecturer loyalty through empowerment. *Tafkir: Interdisciplinary Journal of Islamic Education*, *4*(1), 113-127.

Froehlich, L., Brokjøb, L. G., Nikitin, J., & Martiny, S. E. (2023). Integration or isolation: Social identity threat relates to immigrant students' sense of belonging and social approach motivation in the academic context. *Journal of Social Issues*, *79*(1), 264-290.

Gouldner, H. P. (1960). Dimensions of organizational commitment. *Administrative Science Quarterly*, 468-490.

Gündüz, Y. (2014). The effect of organizational support on organizational commitment. *The Anthropologist*, *18*(3), 1041-1057.

Guntuku, R. K., Boini, S., Mukherjee, K., & Kummeta, R. S. (2022). Effect of employer-employee relationship on employee engagement and task performance. *Facta Universitatis, Series: Economics and Organization*, 19(2),111-124

Gupta, B., Sihag, P., & Pangtey, R. S. (2023). If I feel valued, I am committed to change: Role of workplace dignity and perceived supervisor support. *International Journal of Organizational Analysis*.

Hazeen Fathima, M., & Umarani, C. (2023). Fairness in human resource management practices and engineers' intention to stay in Indian construction firms. *Employee Relations: The International Journal*, *45*(1), 156-171.

Ho, H., & Kuvaas, B. (2020). Human resource management systems, employee well-being, and firm performance from the mutual gains and critical perspectives: The well-being paradox. *Human Resource Management*, *59*(3), 235-253.

Ho, H. C., & Chan, Y. C. (2022). Flourishing in the workplace: A one-year prospective study on the effects of perceived organizational support and psychological capital. *International Journal of Environmental Research and Public Health*, *19*(2), 922.

Idris, A. (2014). Flexible working as an employee retention strategy in developing countries: Malaysian bank managers speak. *Journal of Management Research*, *14*(2), 71-86.

Jehanzeb, K., & Mohanty, J. (2018). Impact of employee development on job satisfaction and organizational commitment: Person–organization fit as moderator. *International Journal of Training and Development*, *22*(3), 171-191.

Jeong, Y., & Kim, M. (2022). Effects of perceived organizational support and perceived organizational politics on organizational performance: Mediating role of differential treatment. *Asia Pacific Management Review*, *27*(3), 190-199.

Kilroy, J., Dundon, T., & Townsend, K. (2023). Embedding reciprocity in human resource management: A social exchange theory of the role of frontline managers. *Human Resource Management Journal*, *33*(2), 511-531.

Kraimer, M. L., Seibert, S. E., Wayne, S. J., Liden, R. C., & Bravo, J. (2011). Antecedents and outcomes of organizational support for development: The critical role of career opportunities. *Journal of Applied Psychology*, *96*(3), 485.

Kundi, Y. M., Baruch, Y., & Ullah, R. (2023). The impact of discretionary HR practices on knowledge sharing and intention to quit–a three-wave study on the role of career satisfaction, organizational identification, and work engagement. *The International Journal of Human Resource Management*, 1-27.

Kuo, C. F., Grainge, M. J., Zhang, W., & Doherty, M. (2015). Global epidemiology of gout: Prevalence, incidence and risk factors. *Nature Reviews Rheumatology*, *11*(11), 649-662.

Kurtessis, J. N., Eisenberger, R., Ford, M. T., Buffardi, L. C., Stewart, K. A., & Adis, C. S. (2017). Perceived organizational support: A meta-analytic evaluation of organizational support theory. *Journal of Management*, *43*(6), 1854-1884.

Kurtessis, J. N., Eisenberger, R., Ford, M. T., Buffardi, L. C., Stewart, K. A., & Adis, C. S. (2017). Perceived organizational support: A meta-analytic evaluation of organizational support theory. *Journal of Management*, *43*(6), 1854-1884.

Kwak, C., Chung, B. Y., Xu, Y., & Eun-Jung, C. (2010). Relationship of job satisfaction with perceived organizational support and quality of care among South Korean nurses: A questionnaire survey. *International Journal of Nursing Studies*, *47*(10), 1292-1298.

Lamprinou, V. D. I., Tasoulis, K., & Kravariti, F. (2021). The impact of servant leadership and perceived organisational and supervisor support on job burnout and work-life balance in the era of teleworking and COVID-19. *Leadership & Organization Development Journal,* 42(7), 1071-1088.

Lee, H. (2021). Changes in workplace practices during the COVID-19 pandemic: the roles of emotion, psychological safety and organisation support. *Journal of Organizational Effectiveness: People and Performance*. Lussier, B., Chaker, N. N., Hartmann, N. N., & Rangarajan, D. (2022). Lone wolf tendency and ethical behaviors in sales: Examining the roles of perceived supervisor support and salesperson self-efficacy. *Industrial Marketing Management*, *104*, 304-316.

Maan, A. T., Abid, G., Butt, T. H., Ashfaq, F., & Ahmed, S. (2020). Perceived organizational support and job satisfaction: A moderated mediation model of proactive personality and psychological empowerment. *Future Business Journal*, *6*(1), 1-12.

Mansour, M., Alaghbari, M. A., Beshr, B., & Al-Ghazali, B. M. (2023). Perceived CSR on career satisfaction: A moderated mediation model of cultural orientation (collectivism and masculinity) and organisational pride. *Sustainability*, *15*(6), 5288.

Mayes, B. T., Finney, T. G., Johnson, T. W., Shen, J., & Yi, L. (2017). The effect of human resource practices on perceived organizational support in the People's Republic of China. *The International Journal of Human Resource Management*, *28*(9), 1261-1290.

Mercurio, Z. A. (2015). Affective commitment as a core essence of organizational commitment: An integrative literature review. *Human resource development review*, *14*(4), 389-414.

Nanjundeswaraswamy, T. S., P, N., Bharath, S., & KM, V. (2023). The mediating role of self-efficacy in the relationship between job satisfaction and commitment of employees working in the textile industry. *Research Journal of Textile and Apparel.*

Obuobisa-Darko T. (2020). Leaders' behaviour as a determinant of employee performance in Ghana: The mediating role of employee engagement. *Public Organization Review, 20*(3), 597-611.

Pimenta, S., Duarte, A. P., & Simões, E. (2023). How socially responsible human resource management fosters work engagement: the role of perceived organizational support and affective organizational commitment. *Social Responsibility Journal.*

Penning de Vries, J., Knies, E., & Leisink, P. (2022). Shared perceptions of supervisor support: What processes make supervisors and employees see eye to eye? *Review of Public Personnel Administration*, *42*(1), 88-112.

Pinnington, A., Mir, F. A., & Ai, Z. (2023). The significance of general skills training for early career graduates: relationships with perceived organizational support, job satisfaction and turnover intention. *European Journal of Training and Development.*

Popoola, S. O., & Fagbola, O. O. (2023). Work motivation, job satisfaction, work-family balance, and job commitment of library personnel in Universities in North-Central Nigeria. *The Journal of Academic Librarianship*, *49*(4), 102741.

Pungnirun, B., Techarattanased, N., & Mutakalin, G. (2020). The Effects of human resource practices on peprceived organizational support and job satisfaction in pharmacy industry of Bangkok City in Thailand. *Systematic Reviews in Pharmacy*, *11*(1), 506-514.

Rahman, M. S., & Karan, R. (2012). Perceived organizational support and organizational commitment: Bangladesh perspective. *The Chittagong University Journal of Business Administration, 27*, 2012, pp. 205-220.

Ridwan, M., Mulyani, S. R., & Ali, H. (2020). Improving employee performance through perceived organizational support, organizational commitment and organizational citizenship behavior. *Systematic Reviews in Pharmacy*, *11*(12).

Rhoades, L., & Eisenberger, R. (2002). Perceived organizational support: A review of the literature. *Journal of Applied Psychology*, *87*(4), 698-712.

Saks, A. M. (2022). Caring human resources management and employee engagement. *Human Resource Management Review*, *32*(3), 100835.

Sekhar, C., & Patwardhan, M. (2023). Flexible working arrangement and job performance: The mediating role of supervisor support. *International Journal of Productivity and Performance Management*, *72*(5), 1221-1238.

Singh, A., & Gupta, B. (2015). Job involvement, organizational commitment, professional commitment, and team commitment: A study of generational diversity. *Benchmarking: An International Journal, 22*(6), 1192-1211.

Singh, A. (2022). Work engagement, affective commitment, and career satisfaction: the mediating role of knowledge sharing in context of SIEs. *Benchmarking: An International Journal*, *29*(10), 3302-3332.

Shang, Y., Jiang, Y., Pan, Y., & Yan, Q. (2023). Leader's relational power and follower creativity: The mediating role of follower relational identification and the moderating role of perceived organizational support for creativity. *European Management Journal*. https://doi.org/10.1016/j.emj.2023.04.013.

Sheppard, V. (2020). Research methods for the social sciences: An introduction. *Vancouver: BCCampus*.

Stinglhamber, F., Marique, G., Caesens, G., Desmette, D., Hansez, I., Hanin, D., & Bertrand, F. (2015). Employees' organizational identification and affective organizational commitment: An integrative approach. *PloS one*, *10*(4), e0123955.

Stotsky, M. T., Bowker, J. C., & Etkin, R. G. (2020). Receiving prosocial behavior: Examining the reciprocal associations between positive peer treatment and psychosocial and behavioral outcomes. *Journal of Research on Adolescence*, *30*(2), 458-470.

Strauss, K., Griffin, M. A., & Parker, S. K. (2012). Future work selves: how salient hoped-for identities motivate proactive career behaviors. *Journal of applied psychology*, *97*(3), 580.

Tansky, J. W., & Cohen, D. J. (2001). The relationship between organizational support, employee development, and organizational commitment: An empirical study. *Human resource development quarterly*, *12*(3), 285-300.

Teo, S. T., Bentley, T., & Nguyen, D. (2020). Psychosocial work environment work engagement, and employee commitment: A moderated, mediation model. *International Journal of Hospitality Management*, *88*, 102415.

Tessier, A. J., Moyen, A., Lawson, C., Rappaport, A., Yousif, H., Fleurent-Grégoire, C., ... & Chevalier, S. (2022). Adopting a less healthy lifestyle pattern during the COVID-19 pandemic is modulated by body image dissatisfaction and increased stress in adults of the Canadian COVIDiet study. *Current Developments in Nutrition*, *6*(Supplement_1), 230-230.

Ullah, I., Elahi, N. S., Abid, G., & Butt, M. U. (2020). The impact of perceived organizational support and proactive personality on affective commitment: Mediating role of prosocial motivation. *Business, Management and Economics Engineering*, *18*(2), 183-205.

Wang, H., Zhang, Y., Li, P., & Henry, S. E. (2023). You raise me up and I reciprocate: linking empowering leadership to organizational citizenship behavior and unethical pro-organizational behavior. *Applied psychology*, *72*(2), 718-742.

Zhu, N., Liu, Y., Zhang, J., Raza, J., & Cai, Y. (2023). How do generalized reciprocity and negative reciprocity influence employees' task performance differently? the mediating role of social exchange and the moderating role of emotional labor. *The Journal of Social Psychology*, *163*(5), 605-622.

ARTICLE 2

2. Entrepreneurial orientation, business acumen and SME sustainability among women in rural Ghana: the moderation effect of government intervention

George Oppong Appiagye Ampong
GCTU Business School
Ghana Communication Technology University, Accra, Ghana

Richard Plange-Rhule
School of Public Service and Governance,
Ghana Institute of Management and Public Administration, Accra, Ghana

Florence Antwiwaah Aboh
Office of Research, Innovation and Consultancy
University of Mines and Technology, Tarkwa, Ghana

Desmond Kwadjo Kumi
DAL *Consultancy Company Limited, Accra, Ghana*

Abstract

Lack of a business acumen to handle operational functions results in business failure to achieve business sustainability in micro and small enterprises. Thus, business acumen is important in the field of business of women in rural Ghana because it may lead to sustainability of their business, especially in a fluctuating environment such as the Covid 19 era. Analysis of research gaps has been afforded limited attention in the extant literature on entrepreneurial women business acumen in the light of female business service strategy and industry dynamics for the sustainability of their business. The study sought to examine the relationship between entrepreneurial orientation and SME sustainability, exploring the roles of government interventions and business acumen on the relationship, among women in rural Ghana. Four hundred and twenty-three (423) women entrepreneurs were selected based on snowballing sampling techniques from rural communities of the Greater Accra region of Ghana. The findings showed that entrepreneurial orientation positively affects business acumen and SME sustainability. Also, business acumen mediates entrepreneurial orientation and SME sustainability. Finally, government intervention positively moderates the effect of entrepreneurial orientation on SME sustainability.

Key words: Entrepreneurial orientation; Business acumen; SME sustainability; Government; Ghanaian women entrepreneurs.

1. Introduction

Sustainable entrepreneurship is increasingly being witnessed within the female entrepreneurship circle. This falls in-between the extremes of approach-men's adoption of vigorous market research character and women's collaborative sales strategy at the marketplace. Analysis of research gaps has been afforded limited attention in the extant literature on entrepreneurial women business acumen in the light of female business service strategy and industry dynamics.

Strategy-making practice and management philosophy of women entrepreneurs in the rural area is of the scope of their indigenous knowledge management, from their female circle. Clearly, indigenous business strategy of women is spurred by survivalist mentality and cultural underpinnings. Cultural underpinning of indigenous business strategy stem from a combination of other roles in their lives of rural women entrepreneurs embracing reproductive and community positions socially appropriate, conduct and feature (Ayela, Ikkrisu & Dittoh, 2019; Azzahra'Johari, Rashid, Safian & Nasuredin, 2023).

In cultural context, the indigenous business or enterprise of women is the only place their decision reigns, controls and leads to consequences. In sub-Saharan Africa, because women provide labour, majority of them make household decisions (Aslam, Anjum, Anjum, Kiran, Ahmed & Rehman, 2022; Boserup & Kanji, 2007; Yap, Keling & Ho, 2023). Yet, it has been shown that Knowledge management mediates the relationship between entrepreneurial behavior and engagement in sustainable development (Iqbal & Malik, 2019; Mashapure, Nyagadza, Chikazhe, Mazuruse & Hove, 2023).

However, entrepreneurs are confronted with the survival of their business through sustainability (Neneh, 2011; Mashapure, Nyagadza, Chikazhe, Mazuruse & Hove, 2023). Aiming for survival and independent decision-making makes entrepreneurial women create collaborative sales strategy. Rural women entrepreneurial sales strategy is not problematic, for it encourages collaboration and taps into opportunities present in their rural setting. Their adherent position is not too much of analysis and sales forecast or promotion and distribution strategies but on a female service and "mono" sales strategy. They increasingly rely on long-term relationships built with clients; most informal enterprises in Africa are based on relationships built with clients over time (Ma & Guo, 2018; Mashapure, Nyagadza, Chikazhe, Mazuruse & Hove, 2023; Otieno & Owuor, 2019; Otoo, Fulton, Ibro & Lowenberg-DeBoer, 2011).

In Ghana, the effect of enterpreneurial orientation on SMEs has not been given the needed attention on its enterpreneurial landscape characterized by women forming more than half of the general population. In addition, entrepreneurial orientation's effect on their business acumen has also been given little research attention. SMEs impact significantly on national economies, including East Asia (Azzahra'Johari, Rashid, Safian & Nasuredin, 2023; Rodgers, 2010). However, Government's intervention, arguably, is key to the survival of a business in its environment (Helfaya & Aboud, 2023; Vijfvinkel, Bouman & Hessels, 2011). Therefore, the study sets out to examine the relationship between entrepreneurial orientation and SME sustainability; between entrepreneurial orientation and business acumen; between business acumen and SME sustainability and explores the degree to which government interventions and business acumen moderates or mediates the relationship between entrepreneurial orientation and SME sustainability among women in rural Ghana.

2. Literature review

Entrepreneurial orientation and SME sustainability: Entrepreneurial orientation, proactiveness and competitive aggressiveness has been found to be related to organizational performance (Adams et al., 2017; (Mozumdar, Hagelaar, Materia, Omta, van der Velde & Islam, 2023). Proactiveness and problem-solving entrepreneurs, risk taking, bold and daring as well as green entrepreneurial orientation is related to green innovation that affect SME business performance and impact on society and contributes to SME innovation in general (Altantsetseg et al., 2020; Kim, Fang, Pang & Su, 2023; Roxas, 2021; Susanto, Hoque, Shah, Candra, Hashim & Abdullah, 2023; Wang, Hermens, Huang & Chelliah, 2015; Zhai, Sun, Tsai, Wang & Chen, 2018).

Entrepreneurial orientation positively impacts environmental collaboration with supplier (Azzahra'Johari, Rashid, Safian & Nasuredin, 2023; Bouguerra et al., 2023). A recent study has also shown that entrepreneurial orientation influenced sustainable performance in terms of high environmental and economic performance of SMEs in a manufacturing sector (Permatasari, Dhewanto & Dellyana, 2023; Silva et al., 2021). In the same vein, social entrepreneurial orientation (SEO) gives a measure of social development by tapping business acumen for adjustment within volatile business environment (Permatasari, Dhewanto & Dellyana, 2023; Kraus et al., 2017; Shet & Pereira, 2021). Moreover, sustainable entrepreneurial orientation also contributes to business sustainability (Criado-Gomis et al., 2017; Permatasari, Dhewanto & Dellyana, 2023).

Another study by Susanto et al., (2023) also posited that entrepreneurship orientation has a significant and positive effect on an SMEs performance, but the outcomes are conditional on the role of media and marketing capabilities. However, it has been established that entrepreneurial orientation is related to non-financial measures (Adams et al., 2017; Purnomo, Maulina, Damayanti, Ramadhan, Alamsah, Shalihah & Komariah, 2023).In contrast, entrepreneurial orientation has been shown to moderate the relationship between entrepreneurial ability (EA) and SME sustainability (Hooi et al., 2016; Munjal, 2023).

Considering the moderating role of entrepreneurial orientation on the relationship between entrepreneurial ability and SME sustainability may explain the strategic making practice of women entrepreneurs. Rural women entrepreneurial services strategy appears stable because of their ability to take operational decisions. For example, they have a greater opportunity, taking decisions related to farming operations. However, industry parameters may be in the categories of traditional and agricultural business sectors. Indigenous business strategy of rural entrepreneurial women capsulate, naturally, character, survival, agricultural techniques, and street vending; with too much cultural underpinnings, decisions display and perceptions. Rural women entrepreneurial managerial philosophy emerges from their ability to take operational decisions.

Indigenous knowledge management of women entrepreneurs can be expressed though behavior, thus defining their enterprise or firm behavior. Guiding survivalist intentions lead rural entrepreneurial women to African cultural agricultural techniques and methods which impact the yielded productivity. In a similar manner, guiding survivalist intentions continuously glide to street food vending. Street food vending by women entrepreneurs is crucial for economic development and poverty alleviation in West Africa; and significant to poverty alleviation and economic

development (Martins & Anelich, 2000; Ifeoma et al., 2018; Ranaldo, Dicuonzo & Donofrio, 2023). Thus, firm behavior expresses entrepreneurial will.

Entrepreneurial will (EW) embrace entrepreneurial ability for executing long-term strategic business plans, adoption of sustainable SME behaviors, such as improving or implementing Corporate Social Responsibility (CSR), related to neo-institutional and entrepreneurial theories (Als, 2010; Inyang, 2013; Mahmood et al., 2021; Monyei et al, 2021; Rodgers, 2010; Schroeder, 2012; Spence et al., 2011).

EW which characterizes entrepreneurial orientation may be linked to organizational learning by way of the character of entrepreneurs. Most women build the character of resource control, child education and health responsibility, business decisions, skills development, and income building (Cetindamar et al., 2012).

Women, especially rural entrepreneurial women's economic activities and earnings outside the household are relevant to the nature of freedom, power, and status they enjoy vis-à-vis, adult men. They develop a character which helps them to contend that income generated from these activities usually falls well below a minimum income standard and thus are unable to sustain a basic living; yet they expand and diversify illumined so many hitherto experiences of increase in their incomes and improving their life quality (Sofer & Saada, 2017) through sustainability of their business.

Entrepreneurial orientation and SME growth through sales growth (relative performance) is linked to intervening variables of historical aspiration level (low) and lower levels of sales growth conditions (Ok & Ahn,2019).

However, entrepreneurial orientation of social media and marketing capabilities is improving SME performance (Agrawal, Gandhi & Khare, 2023; Susanto et al, 2023).
Accordingly, it is hypothesized that:

H1: Entrepreneurial orientation has a positive effect on SME sustainability

Entrepreneurial orientation and business acumen: Entrepreneurial orientation of aspiring managers needs to be tapped in the direction of their business acumen (Kundu & Rani, 2004; Malik, Batool & Afzal, 2023) However, there is lack of business acumen if there is lack of the right entrepreneurial orientation (Hughes, et al., 2007; Malik, Batool & Afzal, 2023). Personal and behavior control developed, by character, addresses ill-effects of cultural bias. For instance, using the radio to highlight women role models may erode female discrimination at all levels towards encouraging their economic achievement (Hampel-Milagrosa, 2009; Heywood & Ivey, 2021).

Nevertheless, the principal importance of rural women's entrepreneurial characters is self-confidence and a high optimism to succeed in their entrepreneurial venture. In marginalized situations, rural women's success emerges from high need for achievement among women entrepreneurs which is associated with self-confidence, desire for independence, responsibility, innovation, openness, venture success optimism, persistence, and motivation (Sabiu et al, 2017; Yap, Keling & Ho, 2023).

Self-confidence does not unduly ignore the desire for independence and responsibility in women. Self-confidence directed at making ends meet as result makes them overcome situations of business failure (Agrawal, Gandhi & Khare, 2023; Javadian & Singh, 2012). Self-confidence is also critical to develop other character sets, all things being equal (Agrawal, Gandhi & Khare, 2023; Hughes et al., 2007).

The need for women to achieve, pushes them to adopt an entrepreneurial orientation which drives their marketing success. With all its manifold aspects, women entrepreneurial character is fueled by trading belongingness which remains the providence of personal and behavior control. The dominant women entrepreneurial character in every conceivable way derives from the need to cater for themselves or children financially. This character is self-confidence (Ekpe et al, 2010; Favaro, 2017; Idris & Tan, 2017; Mininni, 2022).

Drive for marketing success is an essential character feature of a rural entrepreneurial woman and obvious in the understanding of their quest to supplement household income. Although these entrepreneurs have limited resources, their cultural character of providing food on the table becomes handy to strive to work hard with all they know to make their enterprise work to produce food on the table; meeting the need to satisfy family and work define the entrepreneurial character of women in the informal sector (Abubakar, Abubakar & Gaiya, 2023; Nukpezah & Blankson, 2017).

Therefore, enterpreneurial sustainability orientation reflects their marketing practices as a tool to tackle sustainability (Feng, Ahmad & Zheng, 2023; Vătămănescu et al., 2017). Their salient entrepreneurial character is high optimism to succeed in their ventures; despite their cultural system such as the patriarchal system observed by Brush et al. (2006). Despite being relegated to the background in the entrepreneurial ventures, there is clear evidence of self-empowerment, self-motivated and working hard in several ways to make their business yield profits, towards financial independence among women. This forces them to embrace ideas for product success through cost-effective or efficient ways (Abubakar, Abubakar & Gaiya, 2023; Wong, 2014).

Proactive and innovative behavior of entrepreneurs goes beyond their business acumen (Abubakar & Gaiya, 2023; Acheampong, 2017; Gellynck et al., 2015). The orientation of managers, bold and daring mindset, is linked with innovative business acumen (Roxas, 2021). The innovative business acumen of entrepreneurs features their creativity. Rural women entrepreneurs rely on their creativity to establish agricultural and non-agricultural based enterprise to make ends meet. To take charge, persistence and motivation is the key in the informal sector. Because women want to succeed in their entrepreneurial ventures, they put in high levels of persistence and motivation. The motivation sums; in need to be financially independent. Financial independence yields inner drive and empowerment to rural entrepreneurial women.

Not only creativity, but specialization of entrepreneurs is borne from their innovative business acumen. Specialization gained in a specific field of knowledge becomes the basis of women entrepreneurial acumen. These specialized fields include catering, dressmaking, fashion, marketing, and accounting. Entrepreneurial rural women business acumen is, largely dependent on specialized field knowledge, cut across a wide scope of business sectors. It is apparent only a few women gain specialized field knowledge from vocational and polytechnic education (Serafimova & Petrevska, 2018; Yap, Keling & Ho, 2023).

This makes them competitive. Pertinent competitiveness and industry dynamics of entrepreneurial women partly define their acumen and character towards business sustainability. The business acumen of rural entrepreneurial women dwells on their experience, knowledge and skills set. Entrepreneurial orientation of women entrepreneurs is associated with their business acumen driving entrepreneurial success which influence social wealth of family business (Akhtar, & Bakar, 2022).

Thus, it can be stated that:

H2: Entrepreneurial orientation has a positive effect on business acumen

Business Acumen and SME sustainability: In Botswana, business acumen of entrepreneurs has impacted on family business sustainability through knowledge transfer (Azzahra'Johari, Rashid, Safian & Nasuredin, 2023; Gumbo, 2015).

Similarly, in South Africa, business acumen of entrepreneurs has been conducive to SME sustainability; and has created employment in the textile and clothing industry (Mokwana, 2021; Erasmus et al., 2019).

Indigenous knowledge or business acumen of tribal artisans and medical doctors influenced innovation of their business or livelihood activities in a sustainable way (Anderson, 2016; Jena, 2013).

Business acumen and age characterized by succession planning has been related with entrepreneurial success or business sustainability in family-owned SMEs (Akhtar & Bakar, 2022).

Sustainable family business, headed by women entrepreneurs impacts economically. Sustainable business of women entrepreneurs contributes to the economic improvement of their household, community, and economy. For instance, incomes earned from these entrepreneurial activities contribute directly to health, education and needs of their families ((Mozumdar, Hagelaar, Materia, Omta, van der Velde & Islam, 2023; Otoo et al., 2011).

Rural women are major contributors to household income in Ghana (Nukpezah & Blankson, 2017). Related to female entrepreneurs' critical role of providing food, the World bank observes that it is not only household food and nutrition security but the general welfare of family members (Ayela et al., 2019; Malik, Batool & Afzal, 2023). Rural entrepreneurial women largely in the informal sector contribute to domestic financial affairs and their community. Economic contributions of women are made through their support and participation in community organizations as well as work activities. Entrepreneurial women have great potential to contribute to economic development (Malik, Batool & Afzal, 2023; Otoo et al., 2011). Clearly, women entrepreneurs contribute to the economy of their country, house, and other areas in their rural settings.

The evidence that business acumen of women yields successful business impact, economically, contradicts the perceptions of women and their capability to handle business. Advocating support for entrant behavior, women entrepreneurs, strive to address background of low education, start-

up, land or property, funding, work or employment challenge issues by inclusion in an entrepreneurial circle of rural women entrepreneurs is maintained by pushing away the pressure of its non-formal opportunity and form a character pursuant to supplementing family income or food provision is largely the quality of returns of discrimination, religious bias and domestic chores articulating persistence, optimism and purposefulness. Nevertheless, there is a gap between the recognized acumen of women entrepreneurs and the growing perception that they are inefficient in running a business. Perhaps momentously exciting is the *business acumen – inefficiency gap* of rural women entrepreneurs.

Related to capability to handle a business, entrepreneurial orientation (embracing business strategy) may have been an important factor in business acumen (including financial literacy) which leads to SME sustainability (Bag & Wood, 2022; Guliman, 2020; Pillai, 2022; Taslim & Kadiyono, 2023).

SME sustainability, lacking because of business failure, evidenced in a lot of developing countries including South Africa, is linked to lack of business acumen or weak entrepreneurial skills (Anderson, 2016; Fatoki, 2014; Malik, Batool & Afzal, 2023). For illustration, accountant's role and skills set, through the lens of business acumen drives sustainability of business in the current global business environment (Okoye et al., 2017; Tesfayohannes,2012; Ishara et al., 2021).

Business acumen of women entrepreneurs such as business transparency plays a role in the sustainability of small and medium enterprises in Thailand, especially for accessing credit which impacts on SME sustainability (Coetzee, 2017; Karnreungsiri & Praditsuwan, 2017; Malik, Batool & Afzal, 2023). Another important factor of business acumen, in terms of capability to handle a business, is that it leads to sustainable entrepreneurship and sales. Sustainable rural women entrepreneurs forcefully adopt an indigenous market research and sales approach. Sales strategy, in rural setups, is by conventional wisdom. Occurring natively is a market research character that impacts on sales (Bertoldi, 2018; Kalvelage et al., 2021; Smith-Hunter, 2006).

As a sales strategy, women entrepreneurial market research character is rigorous and informal. The rigorous nature of informal market activities of these women brings a lot to their sales; or most women thus exceed financial and material gains. The entrepreneurial circle of women is more of business acumen and collaborative sales strategy. They sell with mindsets charged to address scars of their background. Another charged influence on entrepreneurial woman's behavior, in the entrepreneurial circle of women, is that of another woman. The entrepreneurial circle of women influences their behavior; this is related to the social identity theory by Tajfel (1981) that a person's identification with a social group has a powerful influence on behavior. They give little or no attention to sales forecasting, they go to the street to sell. Street vending of cowpea-based foods serves as an income-generating activity especially for women (Cohen, 2000; Kasimba et al., 2022).Thus, sales forecast is not the concentration of rural entrepreneurial women. These insights hold for an emerging framework for thinking about and organizing an understanding of an indigenous marketing plan for rural entrepreneurial women.

One may ponder how achieving the goal of surviving and independent decision-making qualifies an indigenous business strategy. Business strategy refers to meeting customer expectations, business goals, organizational goals, actions performed, decisions taken, as well as competitive moves which relate to a road map on how to achieve a goal. This indigenous business strategy is

entrepreneurship and relates to business scholars' conceptualization of entrepreneurship (Obeng et al., 2014; Yap, Keling & Ho, 2023). Thus, decision-making towards profitability. This is an important entrepreneurial activity (Adjei & Arthur, 2022; Dossou, Adeoti, Aoudji & Djana, 2023; Tinker, 2003).

Making income on their own helps women to take decisions and act in their favor. Indigenous business strategy becomes completely deployed not only based on cultural underpinnings but a survivalist decision. They take advantage of other marketing factors related to location to improve business success (Amoah, Bankuoru Egala, Keelson, Bruce, Dziwornu & Agyemang Duah, 2023; Otoo et al., 2011). Thus, sustainable rural women entrepreneurship can be fostered by advocating a nexus between indigenous market research decisions, approach and adoption of sales forecast tools and techniques. In addition, capability of women entrepreneurs to handle a business leading to sustainable entrepreneurship and operations is clear. Rural entrepreneurial women's endeavors have been variously described but remain indigenous in operations. Rogerson (1997) describes the indigenous operations or informal enterprise as survivalist enterprises. For illustration, rural women engaged in agricultural business have not fully modernized and transformed their agricultural techniques and methods (Ayela et al., 2019; Sanusi & Ibrahim, 2023). Old techniques are used for Crop production in Ho, Ghana, which serves as the principal economic activity undertaken in the rural communities of Ho.

Women who stay in rural areas dominate food crop production. Women carry out over 80% of food production activities and 90% of processing activities related to agricultural produce, including fish (Agboli, 2007; Budiarto, Prabowo & Azman, 2023; Doss, 2014; Mercy et al., 2021). Their productive activities concentrate on enterprises that are conformed to their traditional gender roles such as food processing (Ayatakshi-Endow & Steele, 2021; Otoo et al., 2011). The main food crops grown are cassava, cowpeas, maize, yams, and rice. Cassava (i.e., gari) and palm oil (dzomi) are processed in the community using traditional methods (Nukpezah & Blankson, 2017; Kazmi et al., 2022).

Seamstresses, grilled plantain sellers, school owner, licensed chemical dealer, handicraft sellers, herbal medicine manufacturer, and household-items sellers characterize their operations with indigenous ways of doing business. As it turns out, enterprise description of the rural entrepreneurial women is home-based with limited owner skills, in representation; but informal, low in income and female gender biased. These businesses have owners with limited skill training. Moreover, entrepreneurial women in rural areas make sales from selling by the road, prepared food, or raw food from crop production. Others operate from the home, in front of their house, because marketplace stalls were unavailable (Akbar & Preston, 2020; Otoo, et al., 2011).

Women typically run survivalist enterprises because they are unable to secure regular wage employment or access an economic sector of their choice (Otoo et al., 2011). The street food sector provides employment for women and inexpensive and nutritious food for the urban poor. At issue here is provenience of entrepreneurial women business acumen identified in several business sectors including trading, services, agro processing, manufacturing, textiles and fabrics, agriculture, education and construction: in order of prevalence (Feng, Ahmad & Zheng, 2023; Serafimova & Petrevska, 2018). Honig (1998) argued for street food enterprises, noting basic literacy and numeracy as sufficient for day-to-day operations; not requiring higher educational level as a prerequisite.

Demonstrated capability of women to handle a business successfully is shown in several sustainable indigenously family-owned businesses. Their business acumen is linked to building sustainability in an indigenous family-owned SME (Malik, Batool & Afzal, 2023; Pearson et al., 2011). It is argued that through a flexibly developed SME skills program, business acumen helps entrepreneurs to build a sustainable Micro and SME tourism enterprise (Mlitwa & Kachunda, 2021). The business acumen of founders has been related to sustainability of family business in the UK and financial performance of small and medium enterprises in Plateau state (Dobson & Swift, 2008; Ogidi & Peterson, 2021; Permatasari, Dhewanto & Dellyana, 2023).

Entrepreneurs relying on their business acumen may lead to sustainability of their business, especially in a fluctuating environment such as the Covid 19 era (Koumproglou et al., 2021). Lack of a business acumen to handle operational functions results in business failure to achieve business sustainability in micro and small enterprises (Venugopal & Das, 2022). Poor business acumen is related to lack of financial resources which does not guarantee SME sustainability. Thus, the business acumen of entrepreneurs requires boosting to attain sustainable SME mission (Mozumdar, Hagelaar, Materia, Omta, van der Velde & Islam, 2023; Sulaiman, Parimoo & Banga, 2016; Zhou, 2015).

Therefore, it is hypothesized that:

H3: Business acumen has a positive effect on SME sustainability.

Business Acumen and Government intervention: Government intervention in terms of implementing support and funding policies, regulations and improvement in SME conditions is critical to ensuring the sustainability of SMEs (Eton et al., 2018). For instance, the government can help SMEs to secure loans through government intervention of debt financing (Agrawal, Gandhi & Khare, 2023; Du et al., 2017). Governmen'st intervention includes addressing issues of market failures (Agrawal, Gandhi & Khare, 2023; O'Rafferty & O'Connor, 2006).

Moreover, an intervention of SME strategic planning drives SMEs' growth and sustainability by addressing issues and challenges affecting growth and sustainability of SMEs (Gatukui & Katuse, 2014). Government's intervention influences the growth of SMEs by way of leading them towards sustainability, even during Covid-19 pandemic era (Das et al., 2021; Pu et al., 2021). Shiyhare and Shunmugasundaram (2023) further argue that government support, and technology affected startup business sustainability by fostering startup enterprise performance and entrepreneurial satisfaction, while market orientation does not mediate business sustainability using startup enterprise performance as the mediator, and technology orientation affected startup business sustainability with entrepreneurial satisfaction as the mediator.

Government's intervention through policy can promote sustainability among SMEs in Asia as shown in Saudi Arabia, where government paid greater attention towards SME development and Kwazulu-Natal SMEs (Almahdi, 2020; Das et al., 2020; Okeke-Uzodike et al., 2018). Entrepreneurs of SMEs have the right orientation, but the government should provide them with SME sustainable business model (Bakar & Senin, 2016; Malik, Batool & Afzal, 2023). Although most entrepreneurs exhibit the appropriate levels of business acumen, SME policy which guides by way of institutional support is critical for sustainability of SMEs. For example, street

entrepreneurship in Zimbabwe, Bulawoyo; moreover, policy interventions foster sustainability and business growth of SMEs in India (Bakar & Senin, 2016; Thebe & Ncube, 2015). Good governance and success-management is beneficial to SMEs (Guliman, 2020; Monyei et al., 2021; Taslim & Kadiyono, 2023).

The net result of this business acumen-inefficiency gap dilemma is that the matter seems to be resting at its level until the World bank recently conducted research into some aspects of the matter. It is noted that adjustments and revisions are possible (Hampel-Milagrosa, 2009). Adjustments go hand in hand with reforms. This brings the relevance of World Bank's Doing Business style reforms for the economic participation and productivity of women in Ghana (Hampel-Milagrosa, 2009). Indigenous business cannot survive reforms without considering regulations concerning starting a business, registering property, getting credit, employing workers, and paying taxes (Hampel-Milagrosa, 2009). This implies that women need greater access to a wider range of technical skill in accommodating their ongoing commitments. Another way of empowering women can be through community development projects (Turner, 1984; Olaniran & Perumal, 2021; Purnomo, Maulina, Damayanti, Ramadhan, Alamsah, Shalihah & Komariah, 2023).

Equipping rural entrepreneurial women with managerial support and knowledge will help them adopt mixed cropping methods appropriate to match position and competition dynamics of their entrepreneurships. The question remains, however, whether Ghana's reforms have really created a difference among small and medium enterprises, and particularly among women, who continue to live with traditional boundaries in a quickly modernizing society (Hampel-Milagrosa, 2009; Morhe et al., 2019). Management support needed by rural entrepreneurial women is related to business upkeep and sustainable policy. Managerial support is needed for women engaged in entrepreneurship, although they could have a strong family support system. This alarming fact is that they lack a business plan and social networks that could help them in business development (Chea, 2008; Bayisenge et al., 2020; Ilmiyah, Puspitaningtyas, Poernomo & Murdyastuti, 2023).

Women in businesses suggests that whenever women are engaged in economic activities, they are empowered (Peprah, 2012; Ilmiyah, Puspitaningtyas, Poernomo & Murdyastuti, 2023). Therefore, Gender equality and women empowerment should be promoted as espoused in the Millennium Development Goals (MDGs) (Konwar, 2019; Malik, Batool & Afzal, 2023; Peprah, 2012). Recommendations to promote the economic empowerment of women include policies aimed at keeping young girls in school, introducing entrepreneurship education in secondary, technical and vocation curricula and government support for training and entrepreneurship programmes that increase women's financial and business management skills (Hampel-Milagrosa, 2009; Yap, Keling & Ho, 2023).

Certainly, sustainability of the entrepreneurial venture of rural women calls for empowerment and managerial insights. Women, despite their efforts in the past decade, remain the nation's single greatest untapped resources for small business growth and development (Kusi et al., 2019). For women to come out of poverty they need social empowerment in the direction of changing institutions and addressing challenges (De et al., 2021; Permatasari, Dhewanto & Dellyana, 2023; Pincha, 2010). It is a fact that educating females will bring about change in their locale (Owusu-Kwarteng, 2019). Given a little education, they will be able to raise their children. But the lack of education makes it more difficult for women to understand say regulations that influence their businesses or to seek ways for obtaining information (Hampel-Milagrosa, 2009; Ahmed et al., 2020). This

implies that women need greater access to a wider range of technical skill in accommodating their ongoing commitments. Another way of empowering women can be through community development projects (Turner, 1984; Olaniran & Perumal, 2021; Permatasari, Dhewanto & Dellyana, 2023).

Empowering women can also be achieved by way of government interventions towards the stability of their business. Indigenous business of rural women entrepreneurs can be kept stable because there are comprehensive possibilities and reform indicators, despite the expression of concerns. Indigenous way of doing business can be addressed by a little change in the polices and support environment. This will help them generate standard income. In South Africa, government's intervention improved the effectiveness of business development service providers (BDS) in improving start-up's access to debt finance (Mazanai & Fatoki, 2011; Feng, Ahmad & Zheng, 2023).

Women in rural areas need loans to start up their enterprise yet rely on volatile informal sources of finance which restrict enterprise performance and expansion as smaller amounts of investment capital limit the acquisition of minimal capital outlays, tools and equipment (Otoo et al., 2011). Otoo et al., 2011 notes the loan solicited is to serve as capital injection to commence their small business. However, the picture of any successful business is not complete without financial capital or loan (Otoo et al., 2011). In the Middle East and North Africa (MENA) countries government's interventions has been demonstrated through mobilization of private resources for SME finance (Saleem, 2013). Such financial interventions on the part of government builds the market of women entrepreneurs. Access to capital is an external factor affecting business success and markets (Otoo et al., 2011; Mwirigi et al., 2019).

In Ghana, the banking Act creates rigidities for rural areas – (Banking Act 2004, Act 673). Osei (1997), quoted in Kusi, et al., (2019), speaking on the topic 'Rural Banks should support Women' implored rural banks in the country to establish programs to meet the credit needs of women, although there is substantial disparity between men and women regarding access to as well as the use of finance. In Lagos state government's interventions promote the activities of SMEs via the establishment of agencies, programs, provision of financial assistance, social infrastructure, and favorable tax policies (Agwu & Emeti, 2014; Ifekwem & Adedamola, 2016; Mozumdar, Hagelaar, Materia, Omta, van der Velde & Islam, 2023).

Majority of these women do not have access to formal banking institutions. However, enterprise success of rural women entrepreneurs has been expressed in terms of external factors and accessibility to micro-credit. Women face difficulty accessing credit, majority get access to credit in Nigeria (Mira & Kennedy, 2013). In Ghana, women do not have access to credit because they do not own titled land to use as collateral (Hampel-Milagrosa, 2009; Ankrah, et al., 2020).

Lack of access to startup capital is strongly related to access to credit, which in turn is correlated with formal property ownership (Hampel-Milagrosa, 2009). About 74% of the women farmer-entrepreneurs interviewed used no other source of credit except the WHO credit scheme (Nukpezah & Blankson, 2017). Therefore, few women obtain credit from formal lending institutions (Maitha, 1986; Shipton, 1986; Wellalage & Thrikawala, 2021). Unfortunately, rural women in the developing world do not know about their rights when applying for loans (Boros et al., 2002; Salawu et al., 2019). This means that entrepreneurs identifying lack of financial resources as a constraint are less successful than their counterparts who have financial resources (

(Mozumdar, Hagelaar, Materia, Omta, van der Velde & Islam, 2023; Otoo et al., 2011; Kabange & Simatele, 2022).

Government's intervention towards building the financial base of women entrepreneurs can be made through micro-finance schemes. Promotion of micro-finance systems could increase women's access to credit (Hampel-Milagrosa, 2009; Jain, 2020; Ranabahu & Tanima, 2021). Ledgerwood (1999) stated that MFIs distribute micro-saving to allow the poor and low-income earners to preserve their money safe and permit them to earn a return on their savings. However, Esnard (2023) opined that public policy can sustain or disrupt the marginalized positioning of women entrepreneurs in that, the direction and nature of this influence depends on the dialogic process, and, more specifically, the type and status of actors that are included within the design-making and implementation process.

Towards equipping government for SME interventions, academic institutions should contribute with research support. Despite the growing activities and interest in small business development in sub-Saharan Africa, and Ghana in particular, scholars pay little attention to microfinance as a tool for entrepreneurship development in rural Ghana (Nukpezah & Blankson, 2017). Instead, they focus on small urban business owners and not rural women farmer-entrepreneurs (Nukpezah & Blankson, 2017). This brings bad tidings to rural entrepreneurs who are women. Despite the presence of entrepreneurial orientation, government's intervention to attain required resources for SME's financial sustainability is critical (Msomi & Olarewaju,2021; Taslim & Kadiyono, 2023).

Where credit has been accessible to street food entrepreneurs, there has been an "enviable record of success" in their enterprises (Dovi, 2006). Where there are loan opportunity women entrepreneurs identify with each other by cross-guaranteeing loans for each other and holding each other accountable for the repayment of loans (Nukpezah & Blankson, 2017). Aimed at creating a sustainable SME, with government support, there ought to be an active role of accountants in a sustainability movement focused on SMEs. In the US, the government intervenes in business practices (Agrawal, Gandhi & Khare, 2023; Kasiri et al., 2020). In Toronto there are a range of sustainability interventions (Ranaldo, Dicuonzo & Donofrio, 2023; Westman et al., 2021).

These governments ensure that smaller firms meet environmentally sustainable goals (Blundel et al., 2013). For example, five- year government's intervention in SMEs yielded sustainable competitive advantage in Malaysia (Yatim et al., 2019); there is also intervention of strategic innovation practices contributing to SME sustainability in the area (Islam & Abd Wahab, 2021; Joo & Min, 2022). In contrast, Hossain et al., (2023) claimed that Government support does not play a role between resources and small firm growth.

The moderating role of government intervention is also seen in the adoption of green innovation among SMEs (Kousar et al, 2017). An appropriate level of entrepreneurial orientation might be present but government intervention of helping SMEs to internationalize their business leads to sustainability as in the case of Nigeria (Okorie et al., 2014; Taslim & Kadiyono, 2023). Government intervention is effective towards implementation and realizing sustainability (Das et al., 2019; Wong, 2014; Ranaldo, Dicuonzo & Donofrio, 2023).

In Korea, government environmental practices have impacted on environmental sustainability of SME related to their expert performance (Joo & Min, 2022). In contrast, government's

intervention by engaging SMEs in sustainable practices has been argued as having a limited impact on SME sustainability in the US. Thus, the need for improved strategies to drive adoption of intervention practices (Ilmiyah, Puspitaningtyas, Poernomo & Murdyastuti, 2023; Lamoureux et al., 2019).

Moreover, government's intervention failed to impact on SME sustainability in Nigeria (Aremu & Adeyemi, 2011; Ranaldo, Dicuonzo & Donofrio, 2023). Government support must therefore be intended for safeguarding various challenges and obstacles of startups, and further technology should encompass entrepreneurship programmes for startups to support at an early stage (Shivhare & Shunmugasundaram, 2023).

The findings on government interventions are mixed; and so, it is hypothesized that:

> **H4:** Government's intervention moderates the positive effect of entrepreneurial orientation on SME sustainability; the relationship is stronger with high government intervention than low government's intervention

Business acumen: entrepreneurial orientation and SME sustainability: Business acumen has not been recognized as an intervening factor in the relationship between entrepreneurial orientation and SME sustainability. What has been recognized is that entrepreneurial orientation is somewhat relates to business acumen, focusing on knowledge, skills and ability to address constraints. By the beginning of the year 2010, it had been recognized that entrepreneurial orientation influence business acumen in terms of knowledge; the entrepreneurial orientation of women helps them to develop the right business acumen although traditions are important determinants of women's economic participation and productivity in Ghana (Hampel-Milagrosa, 2009).

It had been later recognized that entrepreneurial orientation influence business acumen in terms of skills; women perform the bulk of domestic tasks despite having responsibilities in their enterprises and employment (Nukpezah & Blankson, 2017). Ghanaian girls tend to work disproportionately longer hours undertaking unpaid domestic chores than boys. They tend to be child laborers with significantly less hours allotted for study homework and self-study (Frempong & Stadelmann, 2021; Hampel-Milagrosa, 2009; Wijayawardhana & Siriwardhane, 2022). Entrepreneurial orientation of female entrepreneurs, fueled by tradition, charged their business acumen in terms of skills. Traditions, customs norms, practices of cultural setting relegate women to the background (Ayela et al., 2019; Malik, Batool & Afzal, 2023).

It appears that the entrepreneurial orientation of women helps them build business acumen to address constraints they encounter. However, the entrepreneurial process of women may be the same in many developing countries, but specific constraints faced by women entrepreneurs vary in dimension and magnitude (Andriamahery & Qamruzzaman, 2021; Chowdhury & Ahmed, 2018; Tinker 2003). Entrepreneurial orientation of female entrepreneurs shapes their business acumen to address constraints. Women entrepreneurs with children create for themselves a strong mindset and business acumen to withstand the pressures of socio-cultural factors that affect them. Some socio-cultural factors impede the development of women entrepreneurs (Agrawal, Gandhi & Khare, 2023; Kusi et al., 2019). For example, the demand to reproduce heirs for the lineage and to augment family income at an early age pulls young women out of schools leaving them less

qualified for formal employment (Alam & Hoque, 2022; Hampel-Milagrosa, 2009; Siregar et al., 2022).

The constraints addressed by the business acumen of women entrepreneurs, dependent on their entrepreneurial orientation, include land or property challenge. Despite their significant contributions, women still have weak access to and control over land (Ayaaba, 2022; Hampel-Milagrosa, 2009; Shahzad et al., 2021). Ghanaian tradition concerning land inheritance contains built-in discrimination towards female land ownership (Daibu et al., 2018; Hampel-Milagrosa, 2009; Peterman, 2012). Based on traditional inheritance practices women rarely own formal property that they could use to obtain commercial credit (Hampel-Milagrosa, 2009; (Mashapure, Nyagadza, Chikazhe, Mazuruse & Hove, 2023).

An independent review of the property collateral-credit nexus in the context of the condition of the national banking system will shed light on women's poor credit access (Mittal & Raman, 2021; Otoo et al., 2011). Thus, women are not allowed access and control of productive resources in rural setting. Startup challenge is another constraint addressed with the business acumen of women driven by their entrepreneurial orientation. To cater for herself and children, in most cases they muster the courage to approach their husbands, partners and relatives for startup capital (Agrawal, Gandhi & Khare, 2023; Owusu-Kwarteng, 2019).

What comes to light in the female entrepreneurial circles is that of startup challenges and regulations. Less rigid labor regulations increased probability of formal business start-ups (Islam, Muzi & Amin, 2019; Stel et al., 2006; Yap, Keling & Ho, 2023). Unfortunately lack of education makes it more difficult for rural women to understand regulations that influence their businesses or ways to obtaining information (Hampel-Milagrosa, 2009; Kaka, 2022). Women will be able to start their business given business registration steps, business start-up procedure, property and capital (Hampel-Milagrosa, 2009; Braunmiller & Dry 2022; Taslim & Kadiyono, 2023).

Reviews should be conducted on legislations, customs and traditions that restrict women's access to property and credit (Nukpezah & Blankson, 2017). Rather individuals with higher educational levels could wait for good jobs, losing the seed for business cultivation and growth. Quagrainie, et al. (2018) suggest that women rely on other capital sources such as a church or a micro woman entrepreneurial development-based organization, probably in a patriarchal system grandiose with less support to start up women in business. In a similar way, women entrepreneurs address start-up challenges using tapping on their business acumen. Downgrading of entrepreneurial women is characterized by not valuing their work, this perception has been handed down by traditions and its associated socio-cultural factors. Indigenous African women entrepreneurial activities experienced perceptional challenges (Buttner & Rosen, 1992; Jones & Solomon, 2019). Increasingly, the work of women is not valued in monetary terms and their production level is often underestimated (Donahoe, 1999; Sunstein, 2022; Uma & Pal, 2021).

Women entrepreneurs also address sales challenges tapping on their business acumen. Rural women entrepreneurs face the challenge of promotion and distribution. There are lapses in promotion and distribution. Promotion and distribution challenge gaps of women are linked to their limited access to education, which is not approved of, however, there is a certain level of unwillingness attached to educating females; which has been absent in many African families; little female education is provided by third parents or teachers (Owusu-Kwarteng, 2019). The

promotion and distribution challenge gap of women can be addressed providing practical advice and skills (Capel et al., 2021; Owusu-Kwarteng, 2011). Promotion and distribution challenge of women entrepreneurs may be because of limited knowledge and business skills acquisition.

Despite the various challenges faced by women in their quest to be entrepreneurial, their business acumen appears to ride them through, spurred by their entrepreneurial orientation to be self-employed. Backgrounds of self-employment in the informal sector become sole-option for African women with low educational levels as well as challenges presenting them with slim wage income (Bari et al., 2021; Grashuis, 2021; Otto et al., 2011). It is observed that women, including Ghanaian women, primarily have access to formal employment only through wage employment in the public sector or formal self-employment (Heintz, 2005; Hoehn-Velasco et al., 2021; Jara & Rattenhuber, 2022). The informal sector is constituted by many females in West African cities (Diallo, 2017; Joseph & Nwolisa, 2022).

Dynamics of the rural service industry landscape is characterized by traditional and non-traditional business sectors (Anna et al., 2000). With respect to trading and agriculture, years of surveys and research indicate the pivotal role of women entrepreneurs in agriculture and economic development, especially in developing countries (Anker et al., 2012). It may be said that rural women entrepreneurs develop a service strategy on agricultural and non-agricultural settings in the rural areas. In processing agricultural produce in Ghana, women have demonstrated a service strategy and dominated in the role (Okorley et al., 2004). This strategy may be developed with learning methods or organizational methods (Gray & Jones, 2016). Engaged in a wide variety of goods and services, these entrepreneurs display varying degrees of business acumen (Blackburn, 2014). Therefore, the review suggests that:

> **H5:** Business acumen mediates the relationship between entrepreneurial orientation and SME sustainability

3. Methods and Data Collection

The study employed a quantitative research approach to investigate the relationship between entrepreneurial orientation, business acumen and SME sustainability among women in rural Ghana. Primary data was collected from rural women in the Shai-Osudoku district of the Greater Accra using a questionnaire. Participants of the study were women entrepreneurs who had started their own business on a micro level and those that had taken it to the SME level with at least 5 employees. Due to the impact of the COVID-19 pandemic, and difficulty in getting women volunteers to participate in the data collection, the researchers adopted snowballing sampling through a process that lasted 3 months (November 2021-January 2022).

Data was analyzed using SmartPLS 3 (Ringle *et al*, 2015) and involved Partial least squares. Partial least squares SEM estimations are not affected by the distribution of data or the sample size (Hair et al., 2016). Analysis was done on data collected from 423 women entrepreneurs from the Shai-Osudoku district. This falls in line with the sample size of at least 150 participants required for SEM analysis (Kline, 2005).

Respondents answered questions on constructs of entrepreneurial orientation, business acumen, government intervention, and SME sustainability, amongst others as shown in Table 1.

Table 1. Scales of Variables in the model

Constructs	**Variables**	Source
Entrepreneurial Orientation	1.1 In general, the top managers of this organisation favour a strong emphasis on the marketing of tried-and-true products or services	Covin and Slevin (1989)
	1.2 In the past 5 years, new lines of products or services has been marketed by my organisation	
	1.3 My organisation typically responds to actions which competitors initiate	
	1.4 My organisation is very seldom the first business to introduce new products/services, administrative techniques, operational technologies etc	
	1.5 Top managers of my organisation have a strong proclivity for low-risk projects with normal and certain rates of return	
	1.6 Top managers of my organisation believe that owing to the nature of the environment, it is best to explore it gradually via cautious, incremental behaviour	
	1.7 My organisation allows its employees the freedom and independence to decide on their own, how to go about their work	
	1.8 In the performance of their duties, we allow employees to act and think without interference	
Business Acumen	2.1 Women are good managers of businesses	
	2.2 Service strategy of women in entrepreneurship vary from one enterprise to another.	
	2.3 Positioning of service strategy of women in entrepreneurship is enhanced by changes in their industry.	
	2.4 Women are good at budget and also use resources judiciously.	
	2.5 Women are naturally prudent and take only calculated risks	
Government Intervention	3.1 Women entrepreneurs receive preferential support from government	
	3.2. Women entrepreneurs receive preferential support from banks	
	3.3 Ideally Ghanaian customers support and patronise goods and services by women	
	3.4 Women Entrepreneurs receive special rebate and tax cuts from GRA	

SME Sustainability	4.1 My business actively promotes good social and environmental behavior both within and outside our industry 4.2 Stakeholder interest especially employees, customers and government are included in my strategic planning process 4.3 Customer complaints are measured as part of the contribution to the firm's success 4.4 Changes in the environment such as COVID often gives me ideas on new products and services 4.5 I have written long range plans for our strategic function of my business	Adapted from; Stevenson, (1983); Stevenson & Gumpert (1985); Chen & Paulraj, (2004)

The questions were modelled on a 5-point scale ranging from 1=strongly disagree to 5= strongly agree.

Demographic variables for the study included age, position, sector, age of business and number of employees (Table 2). The majority of the participants (40%) are between the ages of 30-39 and about half have been in business between 6-10 years.

Table 2. Demographic characteristics of respondents.

Description	Number of respondents	Percent
Age		
20-29	112	26.5
30-39	171	40.4
40-59	92	21.7
50 and above	48	11.3
Position		
Owner-Manager	315	74.5
Executive	17	4
Manager	91	21.5
Sector		
Manufacturing	17	4
Service	183	43.3
Retail	212	50.1
Other	11	2.6
Age of business		
1-5yrs	157	37.1
6-10 yrs	182	43
11-20yrs	84	19.9
Number of employees		

1-5 (Micro)	188	44.4
6-29 (Small)	235	55.6
Total	**423**	**100**

4. Results

Structural Equation Model (SEM) analysis was used to determine the correlation among the variables considered for the study. Related to obtaining the results, factor loadings were obtained, and reliability of questions was also established using Cronbach's The measurement model was tested using the four main constructs on the questionnaire scale made up of entrepreneurial orientation, business acumen, government intervention and SME sustainability. During the measurement model analysis one item under business acumen (BA1) was deleted due to a low loading into the construct. The revised model had all the four constructs meeting the minimum of 0.7, 0.7, 0.7 and 0.5 for Cronbach's alpha, rho A, composite reliability, and average variance extracted respectively (Hair et al., 2016). Furthermore, each of the remaining item loadings was statistically significant based on bootstrapping procedure (5000 sub-samples) (Tortosa et al., 2009). Therefore, reliability and convergent validity are met as shown in Table 3.

Table 3. Construct Reliability Analysis and Convergent Validity

Variables	Item	Loading	Bootstrap t-values	Cronbach's Alpha	rho_A	CR	(AVE)
Entrepreneurial orientation	EO1	0.694	21.068	0.873	0.874	0.900	0.530
	EO2	0.682	16.077				
	EO3	0.699	21.364				
	EO4	0.717	23.363				
	EO5	0.758	26.757				
	EO6	0.809	39.321				
	EO7	0.752	27.937				
	EO8	0.704	23.394				
Business Acumen	BA2	0.691	17.172	0.792	0.805	0.865	0.617
	BA3	0.788	28.909				
	BA4	0.814	37.275				
	BA5	0.842	47.033				
Government Intervention	RI1	0.643	13.310	0.739	0.775	0.834	0.560
	RI2	0.827	35.115				
	RI3	0.802	24.778				
	RI4	0.707	15.408				
SME Sustainability	ES1	0.799	34.014	0.868	0.872	0.904	0.655
	ES2	0.791	33.856				
	ES3	0.815	41.685				
	ES4	0.829	40.801				
	ES5	0.811	37.080				

Note: All t-values are significant at $p<0.01$

Next, discriminant validity was met by the four-construct model using the Fornel-Larker Criterion (Fornell and Lacker, 1981; Hair et al., 2016) since all the inter-construct correlations were below

the square root of the AVEs (shown in diagonal) in table 4, and the heterotrait-monotrait ratio (HTMT0.85) (Henseler et al 2015), since all the HTMT correlations were below 0.85.

Table 4. Discriminant Validity

Factor	Fornell-Larcker Criterion				Heterotrait-Monotrait Ratio (HTMT) 0.85			
	1	2	3	4	1	2	3	4
1. Entrepreneurial orientation	**0.728**							
2. Business acumen	0.519	**0.786**			0.615			
3. Government intervention	0.403	0.317	**0.748**		0.491	0.413		
4. SME sustainability	0.440	0.349	0.395	**0.809**	0.493	0.411	0.477	

Note: square root of AVEs in diagonal (Bold)

Hypothesis among the constructs considered for the study were tested; and results of the study showing relationships between entrepreneurial orientation, business acumen, SME sustainability and government intervention is shown in Figure 1.

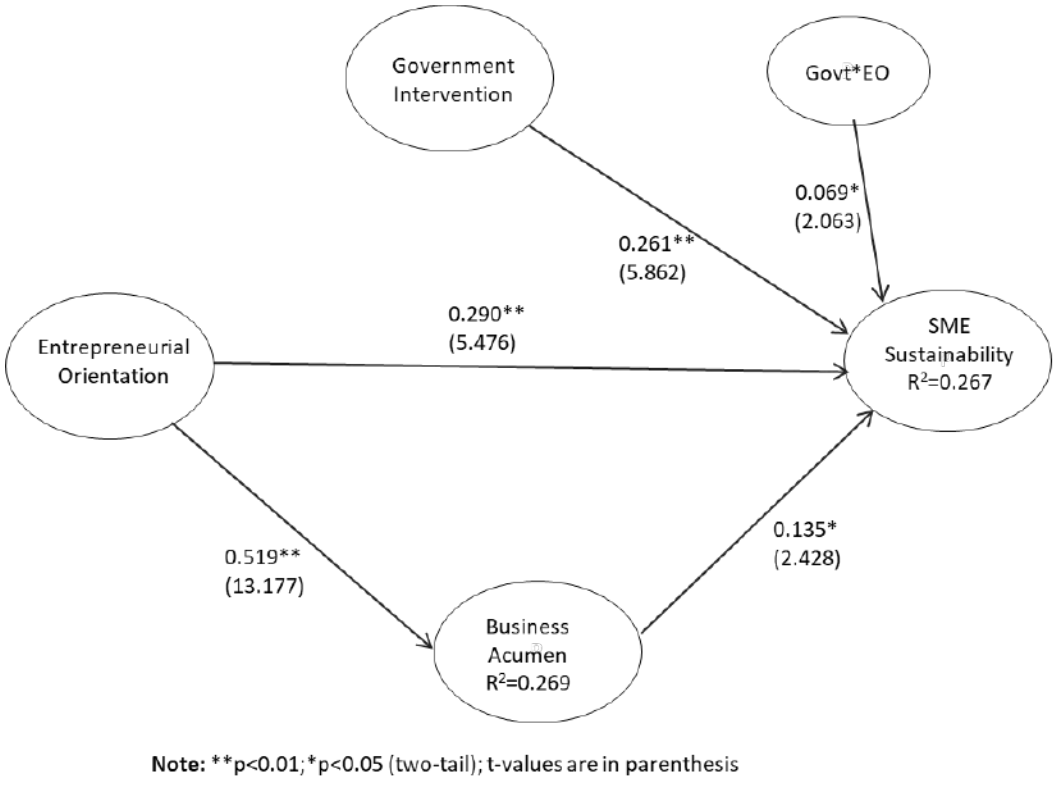


Figure 1. Results of the study showing relationships between Entrepreneurial orientation, Business acumen, SME sustainability and Government intervention.

All paths were statistically significant thus lending support to hypotheses H1, H2, H3, and H5. Specifically, a positive and significant relationship exists between entrepreneurial orientation and SME sustainability, entrepreneurial orientation and business acumen, and business acumen and SME sustainability. Table 5 provides a summary of the hypothesis's conclusions made.

Table 5. Hypotheses test results

Hypothesis	Structural path	Path coefficient	t-value (Bootstrap)	p	Hypothesis results
H1	Entrepreneurial orientation → SME Sustainability	0.290	5.476	0.000**	Supported
H2	Entrepreneurial orientation → Business Acumen	0.519	13.177	0.000**	Supported
H3	Business Acumen → SME Sustainability	0.135	2.428	0.015*	Supported
H5	Govt*EO → SME Sustainability	0.069	2.063	0.039*	Supported

Note: **p<0.01; *p<0.05

Additional results showed that the interaction between entrepreneurial orientation and government intervention has a significant positive effect on SME sustainability. This implies that the positive effect of entrepreneurial orientation on SME sustainability is stronger when government intervention is high rather than low. Figure 2 further explains the positive moderation effect.

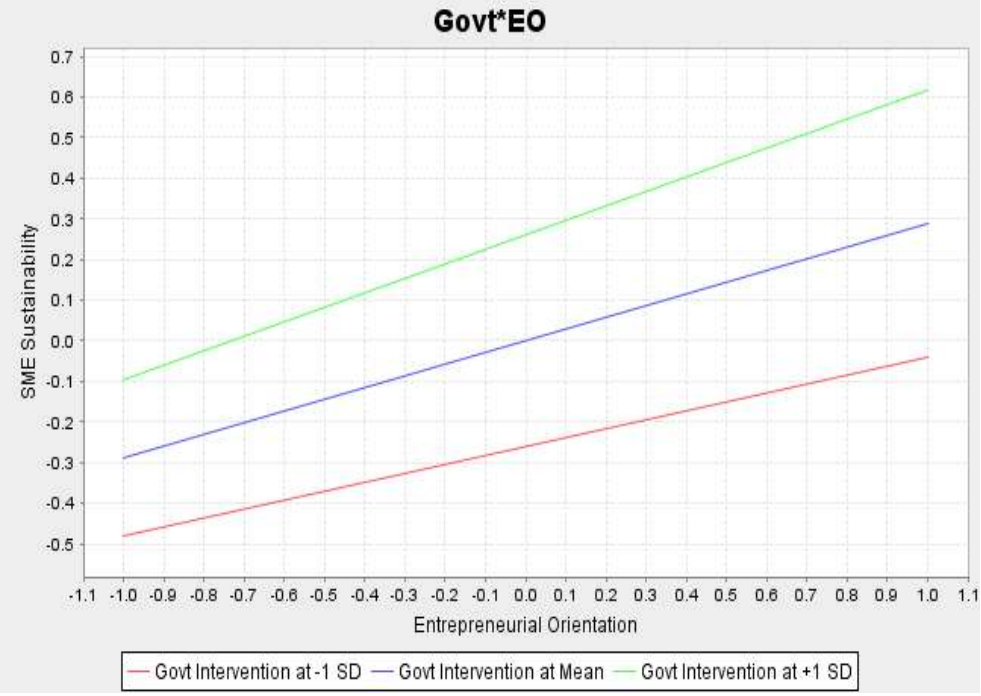


Figure 2. Government intervention positively moderates EO and sustainability

Finally, the indirect effect of entrepreneurial orientation on SME sustainability through business acumen was computed using recommendations by Nitzl et al. (2016) as shown in table 6. The results showed that business acumen partially mediates the positive relationship between entrepreneurial orientation and SME sustainability thus lending support to the hypothesis H4.

Table 6: Mediation of business acumen on entrepreneurial orientation and SME sustainability

Hypothesis	Mediation path	Indirect effect	SD	t	Mediation Type	Proportion of Mediation	Hypothesis results
H4	EO>BA>SS	0.070*	0.029	2.433	Partial	0.195	Supported

Note*p<0.05; EO (Entrepreneurial Orientation), BA (Business Acumen), SS (SME sustainability)

5. Discussion

The significant (positive) relationship between entrepreneurial orientation and SME sustainability of women entrepreneurs can be attributed to their strong decisions (Aslam et al., 2022; Boserup & Kanji, 2007; MUNJAL, 2023). This shows indigenous business strategy which embraces their reproductive and community positions (Ayela et al., 2019). In addition, the finding is consistent with the observation that business decision is part of the aspects that form the character of women entrepreneurs (Cetindamar et al., 2012; Mozumdar, Hagelaar, Materia, Omta, van der Velde & Islam, 2023). The finding suggests that the entrepreneurial orientation of women makes them strong to adopt ways and means to sustain their business. Entrepreneurial Will (EW) which characterizes entrepreneurial orientation may be linked to organizational learning by way of the character of entrepreneurs (Als, 2010; Inyang, 2013; Mahmood et al., 2021; Mashapure, Nyagadza, Chikazhe, Mazuruse & Hove, 2023; Monyei et al., 2021; Rodgers, 2010; Schroeder, 2012; Spence et al. 2011). Thus, exhibiting Entrepreneurial Will (EW) of females in the entrepreneurial circle.

The finding is related to the study of Adams et al. (2017) which shows that there is a significant relationship between entrepreneurial orientation and non-financial indicator of organizational performance, rooted in the social learning theory. However, indigenous knowledge management of women entrepreneurs can be expressed though behavior, thus defining their enterprise or firm behavior for poverty alleviation and economic development (Martins & Anelich, 2000; Ifeoma, et al., 2018; Taslim & Kadiyono, 2023). Their social learning experiences drives their entrepreneurial quest to increase their incomes and improving their life quality (Mozumdar, Hagelaar, Materia, Omta, van der Velde & Islam, 2023; Ok & Ahn,2019; Sofer & Saada, 2017).

The finding also confirms the finding that sustainable entrepreneurial orientation contributes to business sustainability (Criado-Gomis et al., 2017; Permatasari, Dhewanto & Dellyana, 2023).The significant relationship between entrepreneurial orientation and business acumen suggests that women who exhibited higher entrepreneurial orientation will have better business acumen. This confirms the findings that lack of business acumen indicates lack of appropriate entrepreneurial orientation (Hughes et al., 2007; Malik, Batool & Afzal, 2023).

The finding of a positive relationship between entrepreneurial orientation and business acumen implies that entrepreneurial orientation drives business acumen among women entrepreneurs to overcome situations of business failure (Javadian & Singh, 2012; Purnomo, Maulina, Damayanti, Ramadhan, Alamsah, Shalihah & Komariah, 2023). Therefore, to improve business acumen of women entrepreneurs, it is important to improve their entrepreneurial orientation. Using the mass media to highlight women's role models may erode female discrimination at all levels towards encouraging their economic achievement (Hampel-Milagrosa, 2009; Heywood & Ivey, 2021; Permatasari, Dhewanto & Dellyana, 2023). The finding implies that building the business acumen of women entrepreneurs will develop their character of self-confidence (Ekpe et al., 2010; Favaro, 2017; Idris & Tan, 2017; Mininni, 2022) which is key for marketing success and sustainability of SMEs (Malik, Batool & Afzal, 2023; Vătămănescu et al., 2017).

In addition, the finding relates to other studies that has shown that proactive and innovative behavior of entrepreneurs goes beyond their business acumen (Acheampong, 2017; Gellynck et al, 2015) and specialized knowledge (Serafimova & Petrevska, 2018) innovation (Roxas, 2021) and influence social wealth of family business (Akhtar & Bakar, 2022).

Moreover, results of the study confirm the relationship between business acumen and SME sustainability. This agrees with those obtained from Botswana ((Amoah, Bankuoru Egala, Keelson, Bruce, Dziwornu & Agyemang Duah, 2023; Gumbo, 2015) and South Africa (Mokwana, 2021; Erasmus, et al., 2019). This result means that women entrepreneurs with a higher business acumen were likely to have sustainable business (Anderson, 2016; Jena, 2013; Akhtar & Bakar, 2022).

The positive relationship between business acumen and SME sustainability can be explained by the fact that business acumen of women entrepreneurs, stem from their need to contribute to household income (Ayela et al., 2019; Mashapure, Nyagadza, Chikazhe, Mazuruse & Hove, 2023; Nukpezah & Blankson, 2017). The finding corroborates the observation of other researchers (Anderson, 2016; Coetzee, 2017; Fatoki, 2014; Karnreungsiri & Praditsuwan, 2017; Okoye et al., 2017; Tesfayohannes, 2012; Ishara et al., 2021) that business acumen plays a role in the sustainability of SMEs, and that business acumen is linked to building sustainability in micro and macro enterprises including family business.

The study also shows that entrepreneurial orientation and SME sustainability relationship is moderated by government intervention. This means that business acumen can influence the relationship between entrepreneurial orientation and SME sustainability. The findings suggest that funding policies and regulations is critical to ensuring SME sustainability (Almahdi, 2020; Das et al., 2020; Du et al, 2017; Eton et al, 2018; Okeke-Uzodike et al, 2018). The finding mirror those of previous studies (Gatukui & Katuse, 2014; Das et al. 2021; Pu, Qamruzzaman et al., 2021; Sanusi & Ibrahim, 2023).

Though most entrepreneurs exhibit the appropriate levels of business acumen, SME policy is critical for sustainability of SMEs (Bakar & Senin, 2016; Thebe & Ncube, 2015; Guliman, 2020; Monyei et al., 2021). The findings hint that indigenous business cannot survive without considering regulations concerning business start-up, registering property, getting credit, employing workers, and paying taxes (Hampel-Milagrosa, 2009) and social networks (Chea, 2008; Bayisenge et al., 2020). The findings implies that government of Ghana can intervene by

addressing the issue of banking rigidities for rural areas (Kusi et al, 2019) and increase women's access to credit (Hampel-Milagrosa, 2009; Jain, 2020; Lwesya & Mwakalobo, 2023; Ranabahu & Tanima, 2021). The finding is consistent with other research that found that government interventions impact on SME sustainability (Das et al., 2019; Joo & Min, 2022; Lamoureux et al., 2019; Wong, 2014); but contradicts the finding in Nigeria that government intervention does not impact on SME sustainability (Aremu & Adeyemi, 2011).

Furthermore, the study produces the result that business acumen mediates the relationship between entrepreneurial orientation and SME sustainability. This result agrees with those that found that entrepreneurial orientation influence business given the presence of skills (Nukpezah & Blankson, 2017; Taslim & Kadiyono, 2023). The finding suggest that business acumen is important to realize the full benefit of SME sustainability, especially those owned by women with limited formal educational background (Alam & Hoque, 2022; Hampel-Milagrosa, 2009; Siregar et al. 2022).

6. Theoretical Implications

This study contributes to the body of knowledge on entrepreneurial orientation, business acumen and SME sustainability by dwelling on the findings with women in a rural setting of Ghana, a developing economy. The findings showed that rural women who are mainly owners and owner managers of SMEs exhibited some degree of entrepreneurial orientation which was found to have a positive effect on SME sustainability. It reinforces the theory of social identity (Tajfel (1981) by unveiling that the entrepreneurial circle of women influences their behavior, just as a person's identification with a social group influences their behavior.

Knowledge on the social learning theory is augmented by this study which shows that there is a significant relationship between entrepreneurial orientation and non-financial indicator of organizational performance (Adams et al., 2017). However, indigenous knowledge management of women entrepreneurs can be expressed though behavior, thus defining their enterprise or firm behavior for poverty alleviation and economic development.

The study has also conformed to the social theory to explain how society changes and develops (Harrington 2004) so as the position of women in society. It is having been espoused those challenges of starting up an enterprise by the rural woman is an odious task, considering access and constraints of funding but increasingly, common practice is that ownership of property curbs turbulent and frustrated emotions of limited capital.

7. Practical and Managerial Implications

The study shows that in addition to proactiveness and completive aggressiveness, indigenous business knowledge and entrepreneurial will form the entrepreneurial orientation of women in rural Ghana and impacts motivation and society. Also, there is a positive relationship between entrepreneurial orientation and business acumen. Related to improving the entrepreneurial orientation, training focused on equipping women entrepreneurs with sustainability business orientation will yield results of SME sustainability. Importantly, the study confirms that business acumen is related to SME sustainability. Thus, more experienced women with higher business acumen are more likely to have a sustainable business. Therefore, it is not only entrepreneurial

orientation that leads to SME sustainability, but business acumen also leads to SME sustainability. However, the study broadly supports the argument that government intervention influences the relationship between entrepreneurial orientation and SME sustainability. Government interventions moderates the relationship between entrepreneurial orientation and SME sustainability. This means that the positive effect of entrepreneurial orientation on SMEs is stronger if the government provides a more conducive environment for business than when it does not, so government's role is key to ensuring that SMEs practicing entrepreneurial orientation are having the full effect on SME benefit. Therefore, business acumen is important to realize the full benefit of SME sustainability among women in rural Ghana. The study also emphasizes the need for government and other regulatory agencies to initiate and implement policies aimed at supporting women entrepreneurs to augment the positive effects of entrepreneurial orientation on the sustainability of women-led SMEs.

8. Limitations and Future research

Contextually, the study took place in the Shai-Osudoku District of the Greater Accra Region of Ghana. Future studies could extend the study to other districts and regions of Ghana. Also, future studies could explore the developmental impact of SME sustainability on the livelihoods of women folks in the rural areas of Ghana. This is because modern feminists reject the belief in a single all-embracing theory of society as the means of explaining the position of women. Challenges of starting up an enterprise by the rural woman is an odious task, considering access and constraints of funding but increasingly, common practice is that ownership of property curbs turbulent and frustrated emotions of limited capital. Again, future studies could include qualitative methods to explain the dispositions on rural women in entrepreneurship.

References

Abubakar, A. Y., Abubakar, S., & Gaiya, R. B. (2023). Effect Of Entrepreneurial Orientation On Poverty In Kaduna State.

Acheampong, G. (2017). Beyond the EJ model: entrepreneurial orientation and industry choice of Ghanaian entrepreneurs. *Journal of Global Entrepreneurship Research*, *7*(1), 1-10.

Adams, M., & Comber, S. (2013). Knowledge transfer for sustainable innovation: a model for academic-industry interaction to improve resource efficiency within SME manufacturers. *Journal of Innovation Management in Small & Medium Enterprises*, *2013*, 1.

Adams, S., Quagrainie, F. A., & Klobodu, E. K. M. (2017). Women entrepreneurial orientation, motivation, and organizational performance in Ghana. *Small Enterprise Research*, *24*(2), 189-205.

Adjei, M., & Arthur, C. (2022). Ghanaian Couples' Perceptions and Attitudes Towards Women's Participation in Family Fishery Decisions and Practices. *Journal of Comparative Family Studies*, e532070.

Agboli, M. (2007). Gender and economic growth assessment for Ghana 2007.

Agboli, M. (2007): Gender and Economic Growth Assessment for Ghana 2007, Washington DC: International Finance Corporation and the Ministry for Women and Children Affairs, Ghana

Agrawal, A., Gandhi, P., & Khare, P. (2023). Women empowerment through entrepreneurship: case study of a social entrepreneurial intervention in rural India. *International Journal of Organizational Analysis*, *31*(4), 1122-1142.

Agwu, M. O., & Emeti, C. I. (2014). Issues, challenges and prospects of small and medium scale enterprises (SMEs) in Port-Harcourt city. *European journal of sustainable development*, *3*(1), 101-101.

Ahmed, U., Yasin, G., Lak, T. A., Mushtaq, S. K., & Hussain, M. (2020). Reproduction Of Gender Inequality in Family Discourse: A Case Study of Rural Areas of District Jahlim, Pakistan. *Palarch's Journal of Archaeology of Egypt/Egyptology*, *17*(15), 98-109.

Akbar, M., & Preston, V. (2020). Labor Market Challenges and Entrepreneurial Activities of Bangladeshi Immigrant Women in Toronto: A Family Perspective.

Akhtar, T. D., & Bakar, L. J. B. A. (2022). State of Socio-Economic Wealth through Entrepreneurial Success: The Role of Age and Business Acumen. *Journal of Positive School Psychology*, *6*(3), 8975-8995.

Alam, M. M., & Hoque, M. N. (2022). The Personal, Social, and Cultural Perspectives on Female Secondary School Dropouts in Bangladesh: An Investigation into Pabna District. *South Asian Journal of Social Science and Humanities*, *3*(3), 73-93.

Aliyeva, N. (2021). Social entrepreneurship and sustainable development: The case of social enterprises in Azerbaijan. *European Scientific Journal*, *17*(12).

Aliyeva, N. (2021). Social entrepreneurship and sustainable development: The case of social enterprises in Azerbaijan. *European Scientific Journal*, *17*(12).

Almahdi, H. K. (2020). Assessing government intervention towards the development of entrepreneurship in Saudi Arabia. *Journal of Entrepreneurship Education*, *23*(3), 1-12.

Als, B. (2010). Csr-Driven Innovation-Combining Design and Business in A Profitable and Sustainable Way.

Altantsetseg, P., Dadvari, A., Munkhdelger, T., Lkhagvasuren, G. O., & Moslehpour, M. (2020). Sustainable development of entrepreneurial orientation through social drivers. *Sustainability*, *12*(21), 8816.

Aluko, T. O., & Bayai, I. (2023). Grant Amount and Firm Revenue Performance: Moderating Effects Of Government Financial Support Scheme. *Eurasian Journal of Business and Management*, *11*(1), 46-57.

Amoah, J., Bankuoru Egala, S., Keelson, S., Bruce, E., Dziwornu, R., & Agyemang Duah, F. (2023). Driving factors to competitive sustainability of SMEs in the tourism sector: An introspective analysis. *Cogent Business & Management*, *10*(1), 2163796.

Anderson, G. L. (2016). Developing Strategies of Organizational Sustainability for Solo and Small Business Medical Practices.

Anderson, G. L. (2016). Developing Strategies of Organizational Sustainability for Solo and Small Business Medical Practices.

Anderson, G. L. (2016). *Strategies to promote organizational sustainability of solo and small business medical practices* (Doctoral dissertation, Walden University).

Andriamahery, A., & Qamruzzaman, M. (2021). Do Access to Finance, Technical Know-How, and Financial Literacy Offer Women Empowerment Through Women's Entrepreneurial Development? *Frontiers in Psychology*, *12*.

Anggadwita, G., & Dhewanto, W. (2016). The influence of personal attitude and social perception on women entrepreneurial intentions in micro and small enterprises in Indonesia. *International Journal of Entrepreneurship and Small Business*, *27*(2-3), 131-148.

Anker, R., Buvinić, M., & Youssef, N. H. (Eds.). (2012). Women's roles and population trends in the Third World. London: Routledge.

Ankrah, D. A., Freeman, C. Y., & Afful, A. (2020). Gendered access to productive resources–evidence from small holder farmers in Awutu Senya West District of Ghana. *Scientific African*, *10*, e00604.

Anna, A. L., Chandler, G. N., Jansen, E., & Mero, N. P. (2000). Women business owners in traditional and non-traditional industries. *Journal of Business venturing*, *15*(3), 279-303.

Anugwo, I. C., & Shakantu, W. M. (2020). Critical review on SME contractors' capability to achieve economic sustainability beyond their first five years in the South African construction. *Journal of Critical Reviews*, *7*(19), 1930-1942.

Aremu, M. A., & Adeyemi, S. L. (2011). Small and medium scale enterprises as a survival strategy for employment generation in Nigeria. *Journal of sustainable development*, *4*(1), 200.

Aslam, M., Anjum, T., Anjum, F., Kiran, S., Ahmed, S. T., & ur Rehman, A. (2022). Comparison Of Issues and Challenges Faced by Teaching Graduates' And House Hold Women in Participatory Role in Domestic Practices and Earning in Lasbela District. *Webology (ISSN: 1735-188X)*, *19*(2).

Ayaaba, J. J. (2022). *The Effects of Gender and Its Distribution in Farm Production on Maize Productivity: The Case of Northern Ghana* (Doctoral Dissertation).

Ayatakshi-Endow, S., & Steele, J. (2021). Striving for balance: women entrepreneurs in Brazil, their multiple gendered roles and Covid-19. *International Journal of Gender and Entrepreneurship*.

Ayela, G. L., Ikkrisu, A., & Dittoh, S. (2019). Gender analysis of smallholder cropping systems in upper east and northern regions of Ghana.

Azzahra'Johari, S. F., Rashid, U. K., Safian, E. E. M., & Nasuredin, J. (2023). Conceptualizing entrepreneurial competencies (Ec) and entrepreneurial orientation (Eo) of women-owned smes performance. *resmilitaris*, *13*(1), 3806-3817.

Azzahra'Johari, S. F., Rashid, U. K., Safian, E. E. M., & Nasuredin, J. (2023). Conceptualizing entrepreneurial competencies (Ec) and entrepreneurial orientation (Eo) of women-owned smes performance. *resmilitaris*, *13*(1), 3806-

Bag, S., & Wood, L. C. (2022). Guest editorial: Human resource development in the digital age: recent issues and future research directions. *International Journal of Manpower*, *43*(2), 253-262.

Bakar, K. A., & Senin, A. A. (2016). Modelling Sustainability of SME Business in The New Economic Transition. *International Journal of Business, Economics and Law*, *11*(2), 31-37.

Bakar, M. F. A., Talukder, M., Quazi, A., & Khan, I. (2020). Adoption of sustainable technology in the Malaysian SMEs sector: does the role of government matter? *Information*, *11*(4), 215.

Bari, L., Turner, T., & O'Sullivan, M. (2021). Gender differences in solo self-employment: Gendered flexibility and the effects of parenthood. *Gender, Work & Organization*, *28*(6), 2180-2198.

Bayisenge, R., Shengede, H., Harimana, Y., Bosco Karega, J., Lukileni, M., Nasrullah, M., & Emmerance Nteziyaremye, B. (2020). Contribution of small and medium enterprises run by women in generating employment opportunity in Rwanda. *International Journal of Business and Management*, *15*(3), 1833-8119.

Berner, E., G. M. Gomez, P. Knorringa (2008): Helping a large number of people become a little less poor: the logic of survival entrepreneurs, UNU WIDER project workshop in Entrepreneurship and Economic Development, Helsinki, 21-23 August 2008.

Bertoldi, P. A. G. (2018). *Essays on Informal Labor Markets in Developing Countries*. Michigan State University.

Blackburn, R. (2014). Ten top tips for small to medium enterprise (SME) success: 21st century entrepreneurs are profiting from the SME owner-manager model. *Strategic Direction*, *30*(2), 14-17.

Blundel, R., Monaghan, A., & Thomas, C. (2013). SMEs and environmental responsibility: a policy perspective. *Business Ethics: A European Review*, *22*(3), 246-262.

Bocken, N. M. (2015). Sustainable venture capital–catalyst for sustainable start-up success? *Journal of cleaner production*, *108*, 647-658.

Boros, R., Murray, U., & Sisto, I. (2002). A guide to gender sensitive microfinance. SEAGA socio-economic and gender analysis programme. Paper prepared for international conference on Women's Empowerment or Feminisation of Debt? Towards a New Agenda in African Microfinance, London, England.

Boserup, E., & Kanji, N. (2007). Woman's role in economic development. London: Earthscan.

Bouguerra, A., Hughes, M., Cakir, M. S., & Tatoglu, E. (2023). Linking entrepreneurial orientation

Braunmiller, J. C., & Dry, M. (2022). Reforms to Enhance Gender Equality in the Democratic Republic of Congo: From Advocacy to Implementation.

Brush, C., Carter, N. M., Gatewood, E. J., Greene, P. G. and Hart, M. M. (2006). 'Growth oriented women entrepreneurs and their businesses: A global research perspective'. Edward Elgar, Cheltenham, UK.

Budiarto, D. S., Prabowo, M. A., & Azman, N. B. (2023). Evaluating the important role of women in maintaining the sustainability of SMEs. *Journal of Telecommunications and the Digital Economy*, *11*(2), 180-193.

Buttner, E. H., & Rosen, B. (1992). Rejection in the loan application process: Male and female entrepreneurs' perceptions and subsequent intentions. *Journal of Small Business Management*, *30*(1), 58

Capel, T., Ploderer, B., Brereton, M., & O'Connor Solly, M. (2021). The Making of Women: Creating Trajectories for Women's Participation in Makerspaces. *Proceedings of the ACM on Human-Computer Interaction*, *5*(CSCW1), 1-38.

Castano, E., Leidner, B., & Slawuta, P. (2008). Social identification processes, group dynamics and the behavior of combatants. International Review of the Red Cross, 90(870), 259–271.-

Cetindamar, D., Gupta, V. K., Karadeniz, E. E., & Egrican, N. (2012). What the numbers tell: The impact of human, family and financial capital on women and men's entry into entrepreneurship in Turkey. *Entrepreneurship & Regional Development*, *24*(1-2), 29-51.

Chea, A. C. (2008): Factors that influence the survival of women-owned small busienss startups in the city of Tema, Ghana International Business Research 1:3, 130-144

Chowdhury, T. Y., Yeasmin, A., & Ahmed, Z. (2018). Perception of women entrepreneurs to accessing bank credit. *Journal of Global Entrepreneurship Research*, *8*(1), 1-16.

Coetzee, F. (2017). Evaluating the independent review's impact on access to bank finance and consequent SME sustainability.

Cohen, M. (2000). Women Street Vendors: The Road to Recognition. SEED Publication No. 20.

Coughlin, E. (2022). *Improving Connections Among Entrepreneurial Support Programs to Increase the Impact of Start-ups* (Doctoral dissertation, Worcester Polytechnic Institute).

Covin, J. G., & Slevin, D. P. (1989). Strategic management of small firms in hostile and benign environments. *Strategic management journal*, *10*(1), 75-87.

Criado-Gomis, A., Cervera-Taulet, A., & Iniesta-Bonillo, M. A. (2017). Sustainable entrepreneurial orientation: A business strategic approach for sustainable development. *Sustainability*, *9*(9), 1667.

Daibu, A. A., Daibu, S. A., & Aimienrovbiye, J. (2018). Women's Right to inheritance in Africa: The Nigerian experience. *Africa Nazarene University Law Journal*, *6*(1), 28-56.

Das, M., & Rangarajan, K. (2020). Impact of policy initiatives and collaborative synergy on sustainability and business growth of Indian SMEs. *Indian Growth and Development Review*.

Das, M., Rangarajan, K., & Dutta, G. (2020). Corporate sustainability in SMEs: an Asian perspective. *Journal of Asia Business Studies*.

Das, M., Rangarajan, K., & Dutta, G. (2021). Network and government intervention influencing sustainability and business growth of SMEs: a study with Indian MSMEs. *International Journal of Enterprise Network Management*, *12*(2), 131-152.

DeBerry-Spence, B. (2010). Making theory and practice in subsistence markets: An analytic autoethnography of MASAZI in Accra, Ghana. Journal of Business Research, 63, 608–616.

Diallo, A. (2017). Assessing the socioeconomic impacts of the informal sector in Guinea, West Africa. *Open Access Library Journal*, *4*(01), 1.

Dink, M. S. & Budic, S. (2016), The Impact of Personal Attitude, Subjective Norm, and Perceived Behavioural Control on Entrepreneurial Intentions of Women, Eurosian Journal of Business and Economics, 9(17), 23-35.

Dobson, J. R., & Swift, J. S. (2008). The sustainability of family businesses: evidence from three UK case studies. *Journal of Business Management*, *1*, 57-72.

Donahoe, D. A. (1999). Measuring women's work in developing countries. Population and Development Review, 25(3), 543–576.

Doss, C. (2014). If women hold up half the sky, how much of the world's food do they produce? In *Gender in agriculture* (pp. 69-88). Springer, Dordrecht.

Dovi, E. (2006). Tapping women's entrepreneurship in Ghana. Africa Renewal, 20(1), 12-13.

Du, J., Bian, C., & Gan, C. (2017). Bank competition, government intervention and SME debt financing. *China Finance Review International*.

Dzapasi, Y. (2020). Determinants Of Women Entrepreneurship Success in Zimbabwe. A Case Study of Harare Metropolitan Province. *Journal Of Entrepreneurial Innovations*, *1*(1), 37-37

Dzisi, S. (2008): Women entrepreneurs in Small and Medium enterprises in Ghana, Dissertation for the degree Doctor of Philosophy, Victoria, Australia: Swinburne University of Technology

Ekpe, I., Mat, N. B., & Razak, R. C. (2010). The effect of microfinance factors on women entrepreneurs' performance in Nigeria: A conceptual framework. *International Journal of Business and social science*, *1*(2).

Erasmus, L., Reynolds, A., & Fourie, H. (2019). A generic balanced scorecard for small and medium manufacturing enterprises in South Africa. *The Southern African Journal of Entrepreneurship and Small Business Management*, *11*(1), 1-15.

Esnard, T. (2023). Public Policy, Collaborative Governance, and Female Entrepreneurship in the Caribbean: A Critical Assessment. Journal Dialogue Studies, 172.

Eton, M., Ebong, C. D., Fabian, M., & Benard, P. O. (2018). Government interventions in supporting SME growth in Lira district, Northern Uganda.

Fatoki, O. (2014). The causes of the failure of new small and medium enterprises in South Africa. *Mediterranean Journal of Social Sciences*, *5*(20), 922-922.

Favaro, L. (2017). 'Just be confident girls!': Confidence chic as neoliberal governmentality. In *Aesthetic Labor* (pp. 283-299). Palgrave Macmillan, London.

Feng, J., Ahmad, Z., & Zheng, W. (2023). Factors influencing women's entrepreneurial success: A multi-analytical approach. *Frontiers in Psychology*, *13*, 1099760.

Fornell, C. and Lacker, D. (1981), "Evaluating structural equation models with unobservable journal of

marketing research, **1981** - journals.sagepub.com

Frempong, R. B., & Stadelmann, D. (2021). Risk preference and child labor: Econometric evidence. *Review of Development Economics*, *25*(2), 878-894.

Gatukui, P. K., & Katuse, P. (2014). A review of SMEs strategic planning for growth and sustainability in Kenya: Issues and challenges.

Gellynck, X., Cárdenas, J., Pieniak, Z., & Verbeke, W. (2015). Association between innovative entrepreneurial orientation, absorptive capacity, and farm business performance. *Agribusiness*, *31*(1), 91-106.

Ghosly, S. & Vinod, D. (2017), What Constraints Financial Inclusion for Women? Evidence from Indian Microdata, World Development, 92,60-81, http://doi.org.10.1016), worlddev.2016,11.011

Grashuis, J. (2021). Self-employment duration during the COVID-19 pandemic: A competing risk analysis. *Journal of Business Venturing Insights*, *15*, e00241

Gray, D., & Jones, K. F. (2016). Using organizational development and learning methods to develop resilience for sustainable futures with SMEs and micro businesses: The case of the "business alliance". *Journal of Small Business and Enterprise Development*.

Gray, K. R., Cooley, W., & J. Lutabingwa (1997). "Small-Scale Manufacturing in Kenya," Journal of Small Business Management 35(1), 66-72.

Guliman, D. O. (2020). The Role of Entrepreneur's Financial Sophistication on the Nexus of Business Strategy and Sustainability Indicators of Philippine Microenterprises. *Asia-Pacific Social Science Review*, *20*(3).

Gumbo, C. (2015). Knowledge Transfer and Family Business Sustainability in VaZezuru Entrepreneurship model: an Explorative study of Botswana VaZezuru Sub-culture.

Hair, J. F., Hult, G. T. M., Ringle, C. M., and Sarstedt, M. (2016). A Primer on Partial Least Squares Structural Equation Modeling (PLS-SEM). 2nd edition. Thousand Oaks, CA: Sage.

Hallberg, K. (2000). *A market-oriented strategy for small and medium scale enterprises* (Vol. 63). World Bank Publications.

Hampel-Milagrosa, A. (2009). Gender issues in Doing Business: An analysis using case studies of Ghanaian women entrepreneurs. Consultancy report submitted to the Danish International Development Agency (DANIDA).

Hampel-Milagrosa, A. (2011). The role of regulation, tradition and gender in doing business: case study and survey report on a two-year research project in Ghana.

Harrington, Austin (ed.) (2004). Modern Social Theory: An Introduction. Oxford University Press.

Heintz, J. (2005): Employment, Poverty, and Gender in Ghana, Massachussetts: Political Economy Research Institute, University of Massachussets (Working Paper Series Number 92).

Helfaya, A., & Aboud, A. (2023). Editorial for the Special Issue "Corporate Governance, Social Responsibility, Innovation, and Sustainable Business Development Goals". *Sustainability*, *15*(12), 9471.

Henseler, J., Ringle, C.M. and Sarstedt, M. (2015), "A new criterion for assessing discriminant validity in variance-based structural equation modeling", Journal of the Academy of Marketing Science, Vol. 43 No. 1, pp. 115-135.

Heywood, E., & Ivey, B. (2021). Radio as an empowering environment: how does radio broadcasting in Mali represent women's "web of relations"? *Feminist Media Studies*, 1-17.

Hlophe, S. (2021). *Ministry Formation of Emerging Christian Leaders: Equipping Emerging Leaders to Minister Among the Marginalized*. Asbury Theological Seminary.

Hoehn-Velasco, L., Silverio-Murillo, A., & de la Miyar, J. R. B. (2021). The long downturn: The impact of the great lockdown on formal employment. *Journal of Economics and Business*, *115*, 105983.

Honig, B. (1998). What determines success? Examining the Human, Financial, and Social Capital of Jamaican Micro-entrepreneurs. Journal of Business Venturing 13, 371-394.

Hooi, H. C., Ahmad, N. H., Amran, A., & Rahman, S. A. (2016). The functional role of entrepreneurial orientation and entrepreneurial bricolage in ensuring sustainable entrepreneurship. *Management research review*.

Hossain, M. M., Ibrahim, Y., & Uddin, M. M. (2023). Finance, financial literacy and small firm financial growth in Bangladesh: The effectiveness of government support. *Journal of Small Business & Entrepreneurship*, *35*(3), 336-361.

Hsb, S. M., Santosa, H., & Asfriyati, A. (2020). Relationship of Family Income and Family Support with Maternal Reference in Pregnant Women in Pantai Cermin BEmONC, Langkat District, 2019. *Budapest International Research and Critics Institute (BIRCI-Journal): Humanities and Social Sciences*, *3*(1), 486-493.

Hughes, M., Hughes, P., & Morgan, R. E. (2007). Exploitative learning and entrepreneurial orientation alignment in emerging young firms: Implications for market and response performance. *British Journal of Management*, *18*(4), 359-375.

Hugon, P., and C. Farrugia (1989). The Informal Sector: Women and Development Planning in Africa. Analytical and Methodological Studies of the Division of Studies for Development, FEM.3. UNESCO Publication.

Idris, N., & Tan, J. (2017). Review of literature on women entrepreneurs. *Journal of Global Business and Social Entrepreneurship (GBSE)*, *1*(3), 1-11.

Ifekwem, N., & Adedamola, O. (2016). Survival strategies and sustainability of small and medium enterprises in the Oshodi-Isolo Local Government Area of Lagos State. *Acta Universitatis Sapientiae, Economics and Business*, *4*(1), 103-118.

Ifeoma, A. R., Purity, N. O., & Yusuf, A. E. (2018). Effect of entrepreneurship development on poverty alleviation in Nigeria. *Journal of Business and Management*, *20*(2), 80-87.

Ilmiyah, I., Puspitaningtyas, Z., Poernomo, D., & Murdyastuti, A. (2023). A Effect Entrepreneurship Orientation, Government Support on Innovation and Business Performance of SME's Madura Island. *Asian Journal of Management, Entrepreneurship and Social Science*, *3*(03), 455-467.

Inyang, B. J. (2013). Defining the role engagement of small and medium-sized enterprises (SMEs) in corporate social responsibility (CSR). *International business research*, *6*(5), 123.

Iqbal, Z., & Malik, M. (2019). Entrepreneurial orientation and engagement of Pakistani small and medium enterprises in sustainable development practices: Mediating role of knowledge management. *Business Strategy & Development*, *2*(3), 192-203.

Ishara, M. D. D., Yaparathne, Y. M. P. M., & Senavirathne, W. A. R. (2021). The Impact of Accountants'role on Sustainability of Business; Empirical Study on Smes in Sri Lanka

Isidore, E., Che Razak, R., & Mat, N. (2012). Loan access, skill acquisition, bonding and the moderating effect of self-confidence on women entrepreneurs' business performance: A case of Nigeria. *International Journal of Business and Management Studies*, *4*(1), 77-85.

Islam, A., & Abd Wahab, S. (2021). The intervention of strategic innovation practices in between regulations and sustainable business growth: a holistic perspective for Malaysian SMEs. *World Journal of Entrepreneurship, Management and Sustainable Development*.

Islam, A., Muzi, S., & Amin, M. (2019). Unequal laws and the disempowerment of women in the labor market: evidence from firm-level data. *The Journal of Development Studies*, *55*(5), 822-844.

Iwu, C. G., & Opute, A. P. (2019). Eradicating poverty and unemployment: Narratives of survivalist entrepreneurs. *Journal of Reviews on Global Economics*, *8*, 1438-1451.

Jain, B. K. (2020). Microfinance services and women empowerment in Biratnagar metropolitan, Nepal. *Journal of Underrepresented & Minority Progress*, *4*(2), 251-270.

Jara, H. X., & Rattenhuber, P. (2022). *Female labour supply and informal employment in Ecuador* (No. wp-2022-47). World Institute for Development Economic Research (UNU-WIDER).

Javadian, G., & Singh, R. P. (2012). Examining successful Iranian women entrepreneurs: an exploratory study. *Gender in management: An international journal*.

Jena, S. K. (2013). Indigenous Knowledge Innovation (IKI)–An Approach for Sustainable SMEs in Handicraft Sector of KBK Districts of Odisha.

Jones, M. S., & Solomon, J. (2019). Challenges and supports for women conservation leaders. *Conservation Science and Practice*, *1*(6)

Joo, H. Y., & Min, H. (2022). Assessing the impacts of government environmental policies on the small and medium-sized firm's performances in Korea and China. *Benchmarking: An International Journal*, (ahead-of-print).

Joseph, T., Nevo, C., & Nwolisa, C. (2022). Informal Economy and Gender Inequality in Africa. *African Economic and Management Review*, *2*(1), 1-12.

Kabange, M. M., & Simatele, M. (2022). Constraints to formal small business performance in the service sector in Cameroon. *African Journal of Economic and Management Studies*, (ahead-of-print).

Kaka, E. J. (2022). Empowering Women Through Microfinance: Qualitative Evidence. *Global Journal of Accounting and Economy Research*, *3*(1), 53-81

Kalvelage, L., Bollig, M., Grawert, E., Hulke, C., Meyer, M., Mkutu, K., ... & Diez, J. R. (2021). Territorializing Conservation. *Conservation & Society*, *19*(4), 282-293.

Karnreungsiri, I., & Praditsuwan, N. (2017). Motivational and success factors of women entrepreneurs: A case study of small and medium enterprises in manufacturing sector of Thailand. In *3rd RSEP Multidisciplinary International Conferences on Social Issues and Economic Studies* (pp. 17-27).

Kasimba, S., Covic, N., Motswagole, B., Cockeran, M., & Claasen, N. (2022). Street vending of traditional and indigenous food and the potential contribution to household income, food security and dietary diversity: the case of Gaborone, Botswana. *Agroecology and Sustainable Food Systems*, *46*(2), 181-199.

Kasiri, N., Movassaghi, H., & Lamoureux, S. (2020). Sustainability engagement or not? US SMEs approach. *Journal of Small Business Strategy*, *30*(3), 16-32.

Kazmi, M. Z., Sher, F., Musa, M., & Haider, I. (2022). Farmer Knowledge and Practices on Technology Transfer and Farm Mechanization in Rural Areas of Southern Punjab. *International Journal of Agricultural Extension*, *10*(1).

Kim, W., Fang, M., Pang, Q., & Su, M. (2023). SME innovation, supply chain strategy fit and business performance: the moderating role of environmental uncertainty. *Technology Analysis & Strategic Management*, 1-14.

Kline, R. B. (2005). Principles and practice of structural equation modelling. New York, NY: Guilford.

Konwar, R. (2019). Developing Individuality and Self-Confidence: An Agenda for Girl's Education in the Context of Social and Educational Inequality in India. *Available at SSRN 3505183*.

Koumproglou, A., Biginas, K., & Sarantinos, V. (2021). The Importance of Entrepreneurial Orientation in The Covid-19 Era. *Exploring Sustainable Paths*, 143.

Kousar, S., Sabri, P. S. U., Zafar, M., & Akhtar, A. (2017). Technological factors and adoption of green innovation: moderating role of government intervention: a case of SMEs in Pakistan. *Pakistan Journal of Commerce and Social Sciences (PJCSS)*, *11*(3), 833-861.

Kraus, S., Niemand, T., Halberstadt, J., Shaw, E., & Syrjä, P. (2017). Social entrepreneurship orientation: development of a measurement scale. *International Journal of Entrepreneurial Behavior & Research*.

Kundu, S. C., & Rani, S. (2004). Entrepreneurial orientation of aspiring managers: a study. *International Journal of Management and Enterprise Development*, *1*(3), 233-250.

Kusi, A., Yussif, S., & Ismail, A. (2019). Access to Micro Credit by Women Entrepreneurs in Ghana: Sinapi aba Trust-Kumasi in Retrospect. International Journal of Academic Research in Business and Social Sciences, 9(9).

Lamoureux, S. M., Movassaghi, H., & Kasiri, N. (2019). The role of government support in SMEs' adoption of sustainability. *IEEE Engineering Management Review*, *47*(1), 110-114.

Ledgerwood A. (1999). Microfinance handbook: An institutional and financial perspective. Washington DC: World Bank, Sustainable Banking with the Poor Project.

Longenecker, J. G., Moore, C. W., Petty, J. W., Palich, L. E., & McKinney, J. A. (2006). Ethical attitudes in small businesses and large corporations: Theory and empirical findings from a tracking study spanning three decades. *Journal of Small Business Management*, *44*(2), 167-183.

Lwesya, F., & Mwakalobo, A. B. S. (2023). Frontiers in microfinance research for small and medium enterprises (SMEs) and microfinance institutions (MFIs): a bibliometric analysis. *Future Business Journal*, *9*(1), 1-18.

Ma, T., & Guo, J. (2018). Study on information transmission model of enterprise informal organizations based on the hypernetwork. *Chinese journal of physics*, *56*(5), 2424-2438.

Mahmood, A., Naveed, R. T., Ahmad, N., Scholz, M., Khalique, M., & Adnan, M. (2021). Unleashing the barriers to CSR implementation in the sme sector of a developing economy: A thematic analysis approach. *Sustainability*, *13*(22), 12710.

Maitha. J. (1986). Review of credit for women in Kenya. Washington DC: Report to the World Bank Women in Development Division.

Malik, R. A., Batool, H., & Afzal, M. (2023). Determinants Of Women Entrepreneurship Mindset In Achieving Sustainable Development: A Case Study Of Lahore, Pakistan. *Journal of Positive School Psychology*, 1665-1688

Martins, J.M., Anelich, L.E., 2000. Socio-economic features of street food vending, hygiene and microbiological status of street foods in Gauteng, 2000. Technical Cooperation Program (TCP).

Mashapure, R., Nyagadza, B., Chikazhe, L., Mazuruse, G., & Hove, P. (2023). Women entrepreneurship development and sustainable rural livelihoods in Zimbabwe. *Arab Gulf Journal of Scientific Research*.

Mazanai, M., & Fatoki, O. (2011). The effectiveness of business development services providers (BDS) in improving access to debt finance by start-up SMEs in South Africa. *International Journal of Economics and Finance*, *3*(4), 208-216.

Mercy, E. U., Tayo, O. G., Fagbohun, O., Mercy, I. O., & Olawale, Y. O. (2021). Challenges of women in small scale oil palm production. *Academy of Entrepreneurship Journal*, *27*(4), 1-11.

Mininni, G. M. (2022). The Barefoot College 'eco-village'approach to women's entrepreneurship in energy. *Environmental Innovation and Societal Transitions*, *42*, 112-123.

Mira, G. K., & Kennedy, O. (2013). Challenges facing accessibility of credit facilities among women owned enterprises in Nairobi central business district in Kenya. *International Journal of Social Sciences and Entrepreneurship*, *1*(7), 377-396.

Mittal, V., & Raman, T. V. (2021). Financing woes: estimating the impact of MSME financing gap on financial structure practices of firm owners. *South Asian Journal of Business Studies*.

Mlitwa, N., & Kachunda, M. (2021, November). Academic Richness to Guide Sustainability of Small to Medium Enterprises (Smes) Within Business Training Programmes in Emerging Economies-A South African Higher Education Context. In *Proceedings of Iceri2021 Conference* (Vol. 8, P. 9th).

Mokwana, R. M. (2021). *Exploring the sustainability of SMEs in the textile and clothing industry to create employment in South Africa* (Doctoral dissertation, North-West University (South Africa)).

Monyei, F. E., Ukpere, W. I., Agbaeze, E. K., Omonona, S., Kelvin-Iloafu, L. E., & Obi-Anike, H. O. (2021). The Impact of Succession Management on Small and Medium Enterprises' Sustainability in Lagos State, Nigeria. *Sustainability*, *13*(23), 13489.

Morhe, S., Aku, R., & Adomako-Kwakye, C. (2019). Property rights of Ghanaian women in informal conjugal unions. *KNUST LJ*, *8*, 88.

Mozumdar, L., Hagelaar, G., Materia, V. C., Omta, S. W. F., van der Velde, G., & Islam, M. A. (2023). Fuelling entrepreneurial orientation in enhancing business performance: Women entrepreneurs' contribution to family livelihood in a constrained context, Bangladesh. *The European Journal of Development Research*, *35*(3), 623-655

Mozumdar, L., Hagelaar, G., Materia, V. C., Omta, S. W. F., van der Velde, G., & Islam, M. A. (2023). Fuelling entrepreneurial orientation in enhancing business performance: Women entrepreneurs' contribution to family livelihood in a constrained context, Bangladesh. *The European Journal of Development Research*, *35*(3), 623-655.

Msomi, T. S., & Olarewaju, O. M. (2021). Factors affecting small and medium enterprises' financial sustainability in South Africa. *African Journal of Inter/Multidisciplinary Studies*, *3*(1), 103-117.

Muangmee, C., Dacko-Pikiewicz, Z., Meekaewkunchorn, N., Kassakorn, N., & Khalid, B. (2021). Green entrepreneurial orientation and green innovation in small and medium-sized enterprises (SMEs). *Social Sciences*, *10*(4), 136.

Mucheke, F. N. (2015). *Influence of micro-finance institution services on women livelihood: a case of joyful women organization in Trans–Nzoia county, Kenya* (Doctoral dissertation, University of Nairobi).

Munjal, K. (2023). Greater Social Mobility Of Tribal Women In Rural Jharkhand: Entrepreneurship In Tribal Women: A Case Study From Jharkhand. *Vidhyayana-An International Multidisciplinary Peer-Reviewed E-Journal-Issn 2454-8596*, *8*(Si6), 676-692

Mwirigi, C., Gakure, R. W., & Otieno, R. O. (2019). Collateral on strategic access to credit facilities by women owned small and medium enterprises (SMEs). *Advances in Social Sciences Research Journal*, *6*(1).

Neneh, B. N. (2011). *The impact of entrepreneurial characteristics and business practices on the long-term survival of small and medium enterprises (SMEs)* (Doctoral dissertation, University of the Free State).

Newman, A. B., & Alvarez, S. (2022). Questioning boundedly rational frameworks in practice: The case of women entrepreneurs in Kumasi, Ghana. *Journal of Business Venturing*, *37*(4), 106205.

Nukpezah, J. A., & Blankson, C. (2017). Microfinance intervention in poverty reduction: A study of women farmer-entrepreneurs in rural Ghana. Journal of African Business, 18(4), 457-475.

O'Rafferty, S., & O'Connor, F. (2006). The Role of Public Sector Intervention in Product Development Within SMEs: Managing the Sustainability Message. *Tersedia di: www. edcw. org/public/uploads/files/publicat ions/GIN2006_public_sector_intervention. pdf*.

Oakes, P. J., & Turner, J. C. (1980). Social categorization and intergroup behaviour: Do minimal intergroup discrimination make social identity more positive? European Journal of Social Psychology, 10, 295–301.

Obeng, B. A., Robson, P., & Haugh, H. (2014). Strategic entrepreneurship and small firm growth in Ghana, International Small Business Journal, 32(5), 501–524.

Ogidi, E., & Peterson, C. (2021). Entrepreneurial Characteristics and Financial Performance of Small and Medium Enterprises (SMEs) in Plateau State. *Forshen Hub International Journal of Economics and Business Management*, *3*(2).

Ok, C., & Ahn, H. S. (2019). How does entrepreneurial orientation influence the sustainable growth of SMEs? the role of relative performance. *Sustainability*, *11*(19), 5178.

Okeke-Uzodike, O. E., Okeke-Uzodike, U., & Ndinda, C. (2018). Women Entrepreneurship in Kwazulu-Natal: A Critical Review of Government Intervention Policies and Programs. *Journal of International Women's Studies*, *19*(5), 147-164.

Okorie, N. N., Kwa, D. Y., Olusunle, S. O. O., Akinyanmi, A. O., & Momoh, I. M. (2014). Technopreneurship: An urgent need in the material world for sustainability in Nigeria. *European Scientific Journal*, *10*(30).

Okorley, E. L., Zinnah, M. M., Menash, A. O., & Owens, M. (2004). Women in agro-processing in Ghana: A case study of the state of women in small scale fish smoking in the central region of Ghana

Okoye, E. I., Uniamikogbo, E. O., & Sunday, A. A. (2017, July). Accounting skills for sustainable entrepreneurial development: a study of selected small and medium scale enterprises in Edo State, Nigeria. In *The 2017 International Conference on African Entrepreneurship and Innovation for Sustainable Development (AEISD)*.

Olaniran, S. O., & Perumal, J. (2021). Enacting Community Development Principles in Women Empowerment Projects: A Case Study in Ondo State, Nigeria. *Global Social Welfare*, *8*(2), 151-158.

Otieno, D., & Owuor, P. M. G. (2019). Structure of the Small and Medium Informal Dairy Enterprises in Olenguruone and Bahati Sub-Counties. *Structure*, *10*(22).

Otoo, M., Fulton, J., Ibro, G., & Lowenberg-DeBoer, J. (2011). Women entrepreneurship in West Africa: The cowpea street food sector in Niger and Ghana. Journal of Developmental Entrepreneurship, 16(01), 37-63.

Owusu-Kwarteng, L. (2019). 'Educated and educating as a Black woman'–an auto/biographical reflection on my grandmother's influence on my academic and professional outcomes. Gender and Education, 1-17.

Pearson, C., Liu, Y., & Helms, K. (2011). Building sustainability in an Indigenous family-owned SME in northern Australia: Overcoming operational barriers in a housing construction venture. In *Proceedings of the 12th international conference of the Society for Global Business & Economic Development* (pp. 3-16). Society for Global Business & Economic Development (SGBED).

Peprah, J. A. (2012). Access to micro-credit well-being among women entrepreneurs in the Mfantsiman Municipality of Ghana. International Journal of Finance & Banking Studies (2147-4486), 1(1), 1-14.

Permatasari, A., Dhewanto, W., & Dellyana, D. (2023). Creative Social Entrepreneurial Orientation: Developing Hybrid Values to Achieve the Sustainable Performance of Traditional Weaving SMEs. *Journal of Social Entrepreneurship*, 1-15.

Peterman, A. (2012). Widowhood and asset inheritance in Sub-Saharan Africa: Empirical evidence from 15 countries. *Development Policy Review*, *30*(5), 543-571.

Pillai, M. R. (2022). The Effect of Green Entrepreneurial Orientation on Environmental Performance (R&D–Revenue Issues): Mediating Role of Green Supply Chain Management. *Journal of Positive School Psychology*, 11843-11859.

Pincha, C. H. A. M. A. N. (2010). Shifting spaces of women in Tamil Nadu. *Women's Encounter with Disaster*, *204*.

Pu, G., Qamruzzaman, M., Mehta, A. M., Naqvi, F. N., & Karim, S. (2021). Innovative finance, technological adaptation and SMEs sustainability: the mediating role of government support during COVID-19 pandemic. *Sustainability*, *13*(16), 9218.

Purnomo, M., Maulina, E., Damayanti, R., Ramadhan, R., Alamsah, U., Shalihah, A., ... & Komariah, L. (2023). WOMAN ENTREPRENEURIAL ORIENTATION BASED ON SYNTHETIC SCOOPING REVIEW. *Indonesian Journal of Business & Entrepreunership*, *9*(2).

Quagrainie, F. A., Mensah, A. O., & Adom, A. Y. (2018). Christian entrepreneurial activities and micro women entrepreneurship development. *Journal of Enterprising Communities: People and Places in the Global Economy*

Ranabahu, N., & Tanima, F. A. (2021). Empowering vulnerable microfinance women through entrepreneurship: Opportunities, challenges and the way forward. *International Journal of Gender and Entrepreneurship*.

Ranaldo, S., Dicuonzo, G., & Donofrio, F. (2023). GENDER DIVERSITY AND FINANCIAL AND ENVIRONMENTAL PERFORMANCE IN SMES: A SYSTEMATIC LITERATURE.

Richardson, P., R. Howarth, and G. Finnegan (2004). The Challenges of Growing Small Businesses: Insights from Women Entrepreneurs in Africa. SEED Working Paper, 47. International Labor Office, Geneva.

Ringle, C. M., Wende, S., and Becker, J.-M. 2015. "SmartPLS 3." Boenningstedt: SmartPLS GmbH, http://www.smartpls.com.

Rodgers, C. (2010). Sustainable entrepreneurship in SMEs: a case study analysis. *Corporate Social Responsibility and Environmental Management*, *17*(3), 125-132.

Rogerson, C. M. (1997). Globalization or informalization? African urban economies in the 1990s, in Rakodi, C. (ed.), The Urban Challenge in Africa: Growth and Management of its Large Cities. Tokyo: United Nations University Press: 337-70.

Roxas, B. (2021). Environmental sustainability engagement of firms: The roles of social capital, resources, and managerial entrepreneurial orientation of small and medium enterprises in Vietnam. *Business Strategy and the Environment*, *30*(4), 2194-2208.

Roxas, B. (2021). Environmental sustainability engagement of firms: The roles of social capital, resources, and managerial entrepreneurial orientation of small and medium enterprises in Vietnam. *Business Strategy and the Environment*, *30*(4), 2194-2208.

Sabiu, I. T., Abdullah, A. A., & Amin, A. (2017). Impact Of Motivation and Personality Characteristics on Bumiputeras'entrepreneurial Persistence in Malaysia. *Journal Of Developmental Entrepreneurship*, *22*(02), 1750009

Salawu, M. B., Ogunniyi, I. A., Salman, K. K., & Rufai, A. M. (2019). Land Access, Credit Access and Choice of Employment among Youth in Rural Nigeria.

Saleem, Q. (2013). Overcoming constraints to SME development in MENA countries and enhancing access to finance. *IFC Advisory Services in the Middle East and North Africa*.

Sanusi, S. O., & Ibrahim, U. (2023). Rural Women Participation in Nutrition and Agri-Entrepreneurial Development: Empirical Evidence from Yobe State, Nigeria. *Egyptian Journal of Agricultural Research*, *101*(2), 282-291.

Schroeder, H. (2012). The Art and Science of Transformation for Sustainability. *Sustainability: The Journal of Record*, *5*(5), 277-281.

Serafimova, M., & Petrevska, B. (2018). Female entrepreneurship in tourism: A strategic management perspective in Macedonia. *Journal of Applied Economics and Business*, *6*(1), 21-32.

Shahzad, K., Abdullah, M., & Baig, M. N. (2021). Analyzing Patriarchal Preoccupation and Instinctual Delectation in Waste Land: A Gender Perspective. *International Research Journal of Arts and Humanities*, *49*(49), 101.

Sharma, N. K., Govindan, K., Lai, K. K., Chen, W. K., & Kumar, V. (2021). The transition from linear economy to circular economy for sustainability among SMEs: A study on prospects, impediments, and prerequisites. *Business Strategy and the Environment*, *30*(4), 1803-1822.

Shet, S. V., & Pereira, V. (2021). Proposed managerial competencies for Industry 4.0–Implications for social sustainability. *Technological Forecasting and Social Change*, *173*, 121080.

Shipton, P. (1986). Borrowers and lenders in the Gambia: Preliminary report on a study of "informal" financial systems in some Sahelian farming communities. Cambridge MA: Harvard Institute for International Development.

Shivhare, S., ., N., & Shunmugasundaram, V. (2023). Startup Sustainability based on Government, Technology, and Market: Empirical Study Mediation of Performance & Satisfaction. *Indian Journal of Finance and Banking*, *13*(1), 63-77. https://doi.org/10.46281/ijfb.v13i1.1976

Silva, G. M., Gomes, P. J., Carvalho, H., & Geraldes, V. (2021). Sustainable development in small and medium enterprises: The role of entrepreneurial orientation in supply chain management. *Business Strategy and the Environment*, *30*(8), 3804-3820.

Siregar, P. A., Nurhayati, N., Adinda, D., Sitorus, M. A., Catursaptanie, R., & Hutasoit, E. F. (2022). Analysis Of Family Planning Dropouts in Women of Reproductive Age. *Journal Riset Kesehatan*, *11*(1), 53-59.

Smith-Hunter, A. (2006). *Women entrepreneurs across racial lines: Issues of human capital, financial capital and network structures*. Edward Elgar Publishing.

Sofer, M., & Saada, M. T. (2017). Entrepreneurship of women in the rural space in Israel: Catalysts and obstacles to enterprise development. *Sociologia Ruralis*, *57*, 769-790.

Spence, M., Ben Boubaker Gherib, J., & Ondoua Biwolé, V. (2011). Sustainable entrepreneurship: is entrepreneurial will enough? A north–south comparison. *Journal of business ethics*, *99*(3), 335

Stel, A. v., D. J. Storey, A.R. Thurik (2006): The effect of business regulations on nascent and young business entrepreneurship, Rotterdam: Erasmus University Rotterdam (ERIM Report Series, No. ERS-2006-052-ORG).

Stevenson, H. H. (1983). *A perspective on entrepreneurship* (Vol. 13). Boston: Harvard Business School.

Stevenson, H., & Gumpert, D. (1985). The heart of entrepreneurship.

Sulaiman, S. N., Parimoo, D., & Banga, S. M. (2016). Open Innovation as Business Driver: Investigating the Impact of Firm-Level Evidence on Opening Up to External Players. *IUP Journal of Entrepreneurship Development*, *13*(4).

Sulphey, M. M., & Salim, A. (2020). Development of a tool to measure social entrepreneurial orientation. *Journal of Entrepreneurship in Emerging Economies*.

Sunstein, C. R. (2022). On the limited policy relevance of evolutionary explanations. *Behavioural Public Policy*, 1-7.

Susanto, P., Hoque, M. E., Shah, N. U., Candra, A. H., Hashim, N. M. H. N., & Abdullah, N. L. (2023). Entrepreneurial orientation and performance of SMEs: the roles of marketing capabilities and social media usage. *Journal of Entrepreneurship in Emerging Economies*, *15*(2), 379-403.

Tajfel, H. (1981). Human groups and social categories: Studies in social psychology. New York: Cambridge University Press.

Taslim, F., & Kadiyono, A. L. (2023). Entrepreneurial orientation of Muslim Micro, Small and Medium Enterprises (MSMEs) owners in West Sumatra. *INSPIRA: Indonesian Journal of Psychological Research*, *4*(1), 20-28.

Tesfayohannes, M. (2012). African Entrepreneurs Should Plan and Aspire Beyond; The Fence at The Current Complex Global Business Environment. *Sigmund Weis School of Business, Susquehanna University, Selinsgrove, PA, USA*.

Thebe, P., & Ncube, G. (2015). Street entrepreneurship in Zimbabwe: Survivalist or growth oriented? -a case of Bulawayo city Centre. *International Journal of Development and Sustainability*, *4*(2), 126-144.

to environmental collaboration: a stakeholder theory and evidence from multinational companies in an emerging market. *British journal of management*, *34*(1), 487-511.

Tortosa, V., Moliner, M. A., & Sánchez, J. (2009). Internal market orientation and its influence on organizational performance. *European Journal of Marketing*, *43*(11/12), 1435-1456.

Turner, J. C. (1984). Social identification and psychological group formation. In H. Tajfel (Ed.), The social dimension: European developments in social psychology (Vol. 2, pp. 518–538). Cambridge: Cambridge University Press.

Uma, S., & Pal, M. (2021). All work no pay: On valuing women's housework.

variables and measurement error," Journal of marketing research, Vol. 18, pp. 39-50.

Vătămănescu, E. M., Gazzola, P., Dincă, V. M., & Pezzetti, R. (2017). Mapping entrepreneurs' orientation towards sustainability in interaction versus network marketing practices. *Sustainability*, *9*(9), 1580.

Venugopal, K., & Das, S. (2022). Assessment of operational functions affecting on the micro and small enterprises' sustainability. *Parikalpana KIIT Journal of Management*, *18*(1), 126-133.

Vijfvinkel, S., Bouman, N., & Hessels, J. (2011). Environmental sustainability and financial performance of SMEs. *Scientific Analysis of Entrepreneurship and SMEs*, *3*, 47.

Wang, K. Y., Hermens, A., Huang, K. P., & Chelliah, J. (2015). Entrepreneurial orientation and organizational learning on SMEs' innovation. *International Journal of Organizational Innovation*.

Wellalage, N. H., & Thrikawala, S. (2021). Bank credit, microfinance and female ownership: Are women more disadvantaged than men. *Finance Research Letters*, *42*, 101929.

Wentzel, L., Fapohunda, J. A., & Haldenwang, R. (2022). The relationship between the integration of CSR and sustainable business performance: Perceptions of SMEs in the south African construction industry. *Sustainability*, *14*(3), 1049.

Westman, L., Moores, E., & Burch, S. L. (2021). Bridging the governance divide: The role of SMEs in urban sustainability interventions. *Cities*, *108*, 102944.

Wijayawardhana, W. M. P. M., & Siriwardhane, D. R. J. (2022). Determinants of women's wage differential compensation sensitivity and residential sectorial diversity of it: An exploratory study in Sri Lanka. *GSJ*, *10*(4).

Wong, S. K. S. (2014). Impacts of environmental turbulence on entrepreneurial orientation and new product success. *European Journal of Innovation Management*.

Yap, C. S., Keling, W., & Ho, P. L. (2023). Determinants of entrepreneurial performance of rural indigenous women entrepreneurs in Sarawak, Malaysia. *Gender in Management: An International Journal*, *38*(3), 337-356.

Yasun, S. (2018). Does education enable underprivileged women to achieve real equality in property rights? A case study of inheritance rights of women in Turkey. In *Women's Studies International Forum* (Vol. 69, pp. 100-114). Pergamon.

Yatim, N. H., Rusuli, M. S., & Yatim, N. A. (2019). The effect of Government Intervention on the sustainable Competitive Advantage Among SMEs in Malaysia. *International Journal of Modern Trends in Business Research*, *2*(8), 15-22.

ARTICLE 3

3. AN INTELLIGENT QUAD BAND USER EQUIPMENT BLOCKING COMMUNICATION SYSTEM

Michael Agyare, Francis Kwabena Oduro-Gyimah, Solomon Nsor-Anabiah and Isaac Hanson

Department of Telecommunications Engineering, Ghana Communication Technology University, Accra, Ghana

***Abstract*— In this paper we present a quad band selective mobile phone communication blocking system for mobile phone restricted areas. The design works on 2G, 3G, 4G and 5G network systems. Mobile phone jammers function by blocking the entire communication spectrum, as a result in the case of emergencies no mobile can either make or receive calls. Therefore, we present a system where, access to mobile phone communication would be given to privileged users and a signaling control channel jammer to attenuate the control channel of network operators in the restricted area. Mobile phones always connect to the base station (BS) with the strongest cell reception, attenuating the operators control channel will as a result leave our system as the "BS" with the strongest cell reception in the restricted area. It grants access to mobile phones in the restricted area to connect to our system. Thereby having full control of the entire restricted area. This will allow mobile phones in the restricted area to connect to our system and selective blocking of communication would be performed, where privileged users would be given access to communication. The results show that when the system is implemented mobile phone communication can be prioritized to suit privileged users within a mobile phone restricted area.**

Keywords

Mobile Phone Jammer, Privileged User, Intelligent Selective System, Mobile Phone Restricted Areas

INTRODUCTION

Due to the growing popularity of telecommunications, mobile phones are becoming a necessary component of almost every human existence. Mobile phones have evolved into a necessary but specific tool in our daily lives. Users are now able to use other multi-media chat apps, make calls, and send texts. The ability to get in touch with anyone at any time is remarkable. However, there are a number of places where mobile phone activities are restricted. These locations include banks, movie theatres, libraries, mosques, halls of worship, and any other setting where stillness is essential. It ends up noticeably irritating and upsetting when a mobile phone rings or somebody gets a call amid parties (tuning in to a sermon or lecturing, asking at the mosque), official gatherings and social affairs that requires silence. An engaged region where phones are limited is in schools particularly senior secondary schools (motel) and exams corridors of tertiary establishments (preparing universities, Polytechnics and colleges).

With this as an issue, mobile phone jammers are utilized to keep phone clients from making and accepting calls inside that specific limited range. [1]. Therefore, the elementary determination of the mobile jammers is to block communications between a mobile phone and base stations. [2]. This discourages mobile phone utilization in the confined range. Since there are distinctive, frequency bands that the mobile phone system use. The jammers would need to jam mobiles by crossing over those bands successfully. [3], such as GSM, WCDMA,4G and 5G [4].

Unfortunately, the use of mobile phone jammers would probably meddle with or bother public mobile services, and in turn have serious consequences on the users such as [5]

- Jeopardising the quality of the service (QoS).
- May affect the contact to emergency services.
- Bring about inconvenience and loss of business for mobile service provider
- Distressing the total income of mobile service providers.

The following are some benefits of a mobile phone jammer. [6];

- One of the underlying advantages of utilizing mobile phone jammer is that, the device can impede any mobile phone signal from base station. In the event that a jammer is utilized, it can block out the signals from the mobile phone from reaching the base station. Apart from this, it likewise enables save critical information by hindering the signals so employees are not able to send trade information to others in the form of pictures or videos.

- The jamming devices help prevent phone interruption during important meetings.

The use of a mobile phone jammer has some limitations. Once activated no mobile phone can be able to function within the restricted area. For that reason, in the case of emergencies no mobile phone can either make or receive phone calls.

Therefore, there is a need for a system, which can allow certain mobile phones to exclusively make communication within the restricted area. The system should selectively allow mobile phone communication within the restricted area. The system should effectively control communication in the restricted area. All mobile phones in the restricted area should connect to the system without interference from external operators. To ensure this another system is needed to attenuate the signalling control channel of network operators in the restricted area. This will allow mobile phones in the restricted area to fully connect to our system.

BACKGROUND

Over the past, few years' different types of mobile phone jammers have been manufactured for the commercial market. However, the evolution of the generation of communication networks has developed the interest of researchers to come up with different ways of jamming communications in a network for security reasons. [7] [8] [9] [10]. In 2008, a group of students designed an intelligent jamming system, which can block only the controller channels in the Global system for mobile communication (GSM) and digital cellular network (DCS) and operate only if the jammer senses an active mobile in the restricted area. [11]. In 2013, another group designed a jammer, which works at GSM 900MHz and GSM 1800MHz simultaneously and thus jams the four well-known network carriers (MTN, GLO, Etisalat, and Zain) in Nigeria. [12].

A group in 2002 developed a real-time interception system for the GSM protocol. [13]. In the paper, they exhibited three new capture attempt frameworks for security purposes. The first one (detector) powers all idle Mobile phones close by to generate action, which can be utilized to actuate a caution of mobile phones' presence. The second one screens information exchange between mobile phones and BS. The third system syndicates the previous two systems to improve obstructive performance. These interceptors monitor GSM transactions and, if necessary, block nonprivileged calls.

In a paper presented on new GSM/UMTS jamming, a pseudo base station was built to attempt connecting with mobile devices. [14]. While the devices are trying to connect, the system will get a unique identity, such as IMSI and IMEI. The system cannot perform selective blocking of communication of these mobile terminals.

The above works can all block phone calls in a certain way. However, with external operator influence in a restricted area full communication control would not be accomplished. Mobile phones always connect to the BTS with the strongest cell reception. Therefore, with this concept, we can attenuate external operators signalling control channels. As a result, our system is a "BTS" with the strongest cell reception in the restricted area. This will obviously allow mobile phones in the restricted area to connect to our system. Thereby having full control of the entire restricted area. We present scenarios of this case in the next section III.

1 An approach scenario of how the system will connect to mobile phones and perform selective blocking of communication in the restricted area

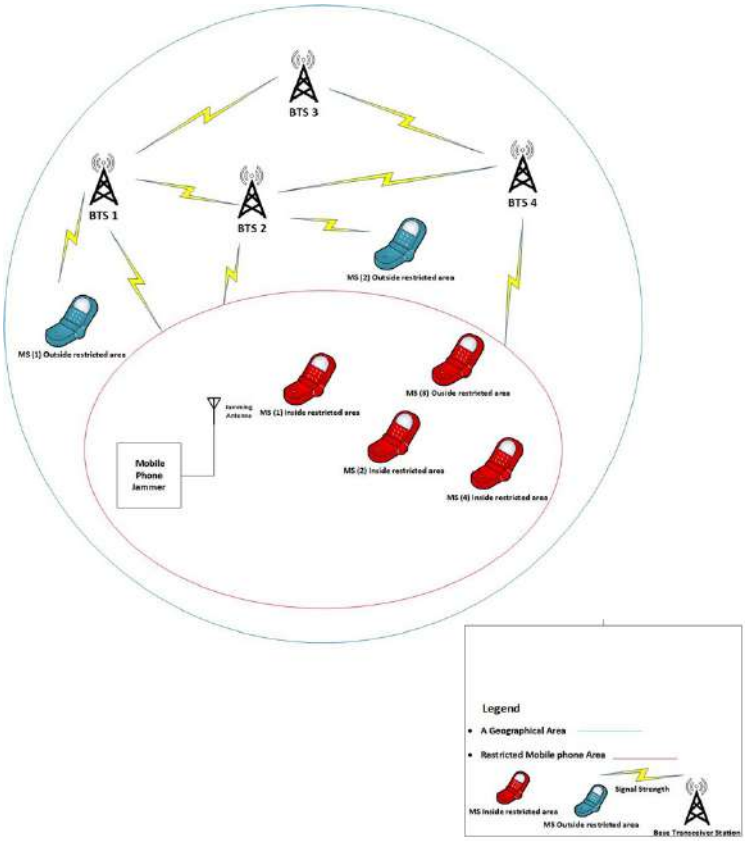


Fig. 1: A mobile phone jammer blocking the signal from the base station to the mobile phone

In this scenario, mobile phones in the restricted are completely cut off from the operators' BTS by the mobile phone jammer. Therefore, in emergency contact situations (fire, police, and ambulance services) communication cannot be established in the restricted area.

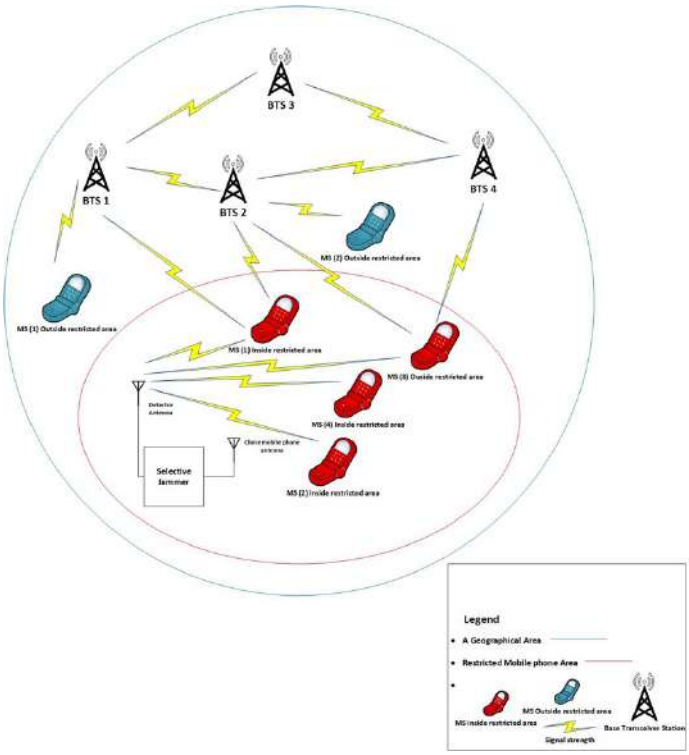


Fig. 2: Selective blocking system activated in the restricted area

Fig. 2. shows the selective mobile phone communication blocking system activated in the restricted. The mobile phones labelled in red are those in the restricted area and those in blue are those outside the restricted area. The restricted area is labelled with a red oval and the entire geographical area is labelled with a blue circle. The BTS's represent the operators' base stations. Once the selective mobile phone communication blocking system is activated, it broadcasts its radio frequency as a base station. As a result, the mobile phones in the restricted area can see the broadcast frequency and may attempt to connect to it depending on the signal strength. Thus, it will compare the signal strength of the available base stations and connect to the strongest.

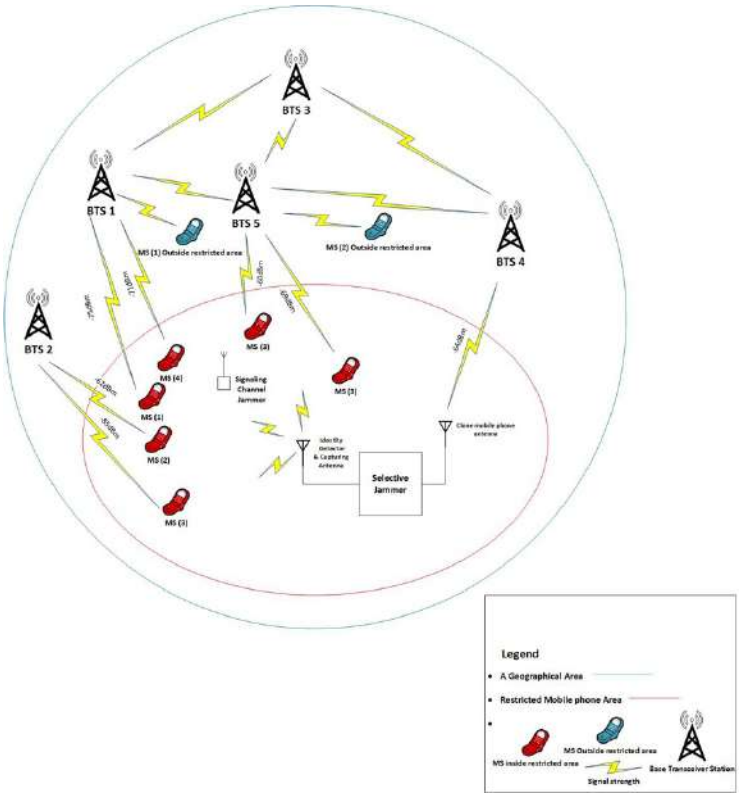


Fig. 3: Selective blocking system with a signalling control channel jammer in the restricted area

Fig. 3. shows the selective mobile phone communication blocking system activated and a signalling channel jammer deactivated with mobile phones having active connections with base stations outside the restricted area. The mobile phones labelled in red are those in the restricted area and those in blue are those outside the restricted area. The restricted area is labelled with a red oval and the entire geographical area is labelled with a blue circle. The BTSs represent the operators' base stations. In the scenario where mobile phones in the restricted choose to connect to base stations out of the restricted area according to cell selection criterion. The purpose of implementing the system in the mobile phone restricted will not be achieved. Therefore, a need arises to force all mobile phones that enter the restricted area to connect to the proposed system. This can be achieved by placing a signalling channel jammer in the restricted area to disrupt the signalling control channel of base stations outside the restricted area (the operators' BTS). Because of this disruption, the mobile phones in the restricted will not be able to connect to the operators' network. Therefore, the only available system to connect with will be the proposed system.

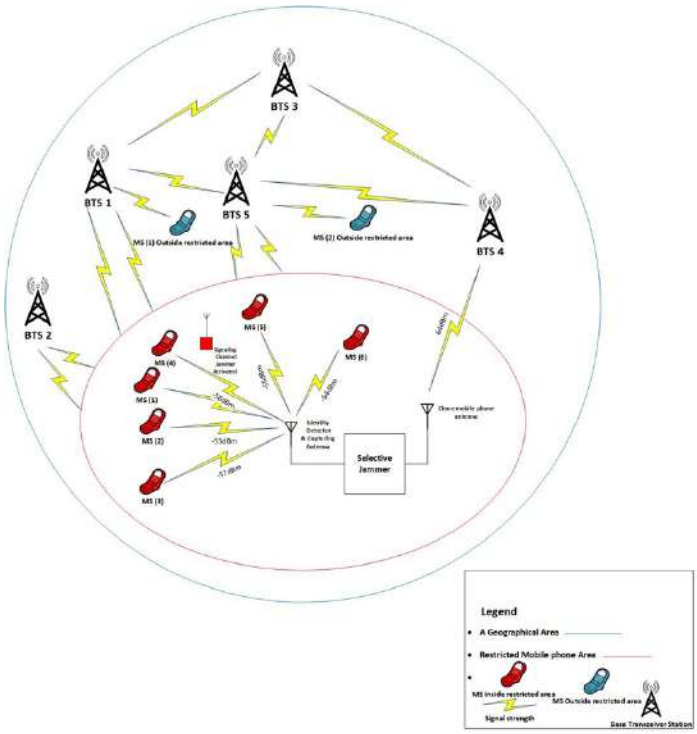


Fig. 4. Selective blocking system with mobile phones connected to it in the restricted area

Fig. 4. Shows the selective mobile phone communication blocking system activated with a signalling channel jammer activated and mobile phones in the restricted area connected to the mobile phone selective blocking system. The mobile phones labelled in red are those in the restricted area and those in blue are those outside the restricted area. The restricted area is labelled with a red oval and the entire geographical area is labelled with a blue circle. The BTS's represent the operators' base stations.

In this scenario, mobile phones do not have an option to connect to the operator's network but are forced to connect to the proposed system due to the introduction of the signalling channel jammer.

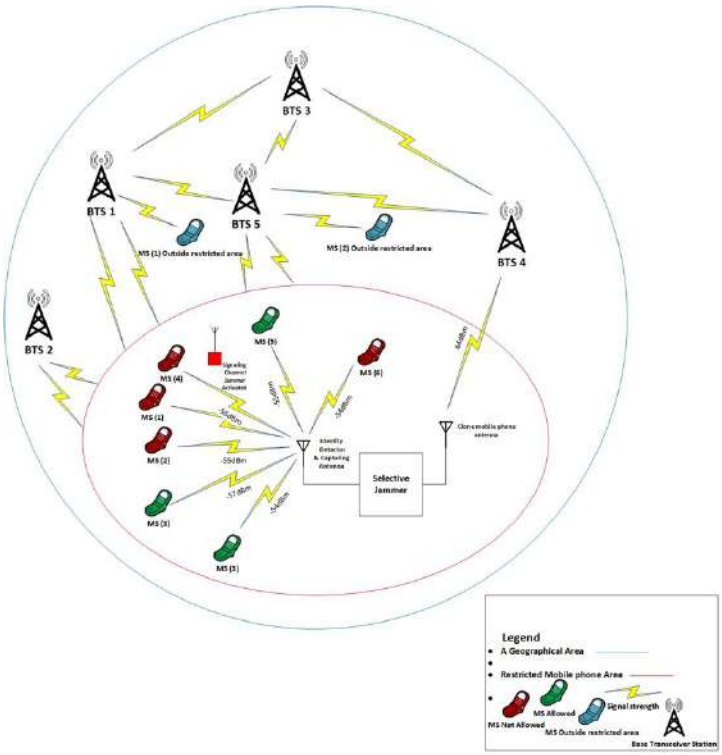


Fig. 5. Selective blocking system performing selective blocking in the restricted area

Fig. 5. Shows a scenario where mobile phones connected to the proposed system (selective jammer) are selectively blocked. The mobile phones labelled in red are those connected to the proposed system but have been denied a communication service, the green labels are the ones who have been granted communication service and the blue are those outside the restricted area. The restricted area is labelled with a red oval and the entire geographical area is labelled with a blue circle. The BTS's represent the operators' base stations. With the proposed system connected to a mobile phone, when the mobile phone wants to perform a communication service, the proposed system would check its database of eligible mobile phones allowed in the restricted area. If a mobile phone is found eligible then that mobile phone would be allowed else would be blocked. All allowed mobile phones would be connected to the operators' network by the proposed system. The proposed system is like a filter that determines who can establish communication with the operators' network.

EXPERIMENTAL DETAIL & METHODS

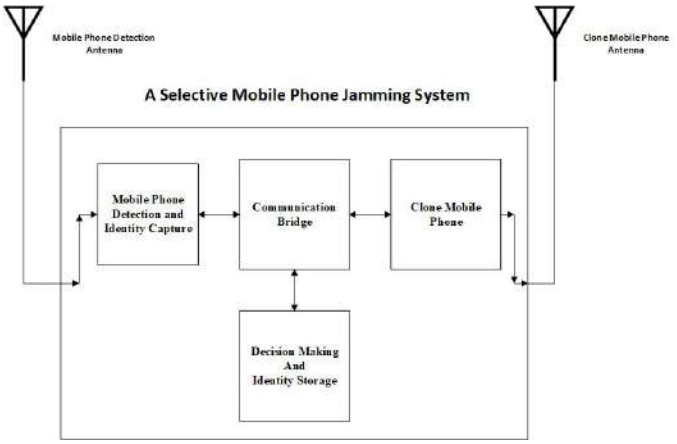


Fig. 6: System Model

The system model looks at connecting mobile phones in the restricted area to the true operator's network. The system acts as a filter, which determines which mobile phone can enjoy communication in the restricted area. Within the identity and decision-making unit is a register containing the eligibility of mobile phone identities, that can enjoy communication in the restricted area. If a mobile phone that is connected to the system wants to enjoy communication, the system will check its identity storage to find out if that mobile phone is permitted to enjoy the requested service or not. If permitted then the mobile phone will be allowed, if not then it will be rejected. When a mobile phone requests for the service and is permitted, the system would connect the mobile phone to the operator's network.

The mobile phone detection and identity capture unit is responsible for capturing a user's IMSI number and connecting users to the system. If a mobile phone user is granted access, the user's IMSI number will be imprinted on the clone mobile phone. Then connected to the operator's network. When communication is established between the clone mobile phone and the operator's network, then the communication bridge forwards the communication from the clone mobile phone and the operator network to the user in the restricted area. This forwarding by the communication bridge is done through the mobile phone detection and identity capture unit. This form of communication can be established for both GSM, UMTS, 4G, and 5G networks.

System Modelling in MATLAB Simulink

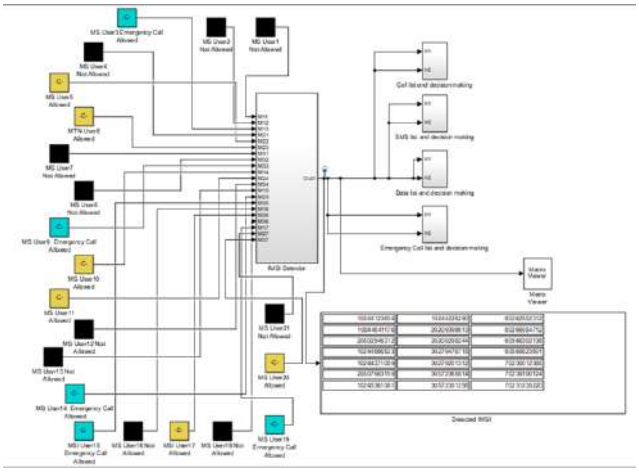
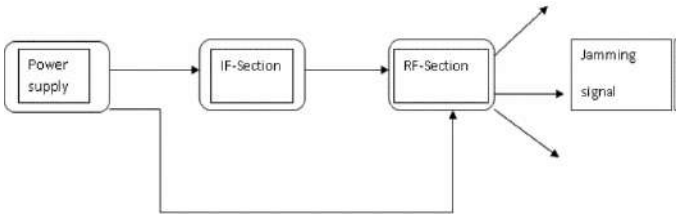


Fig. 7: System design in Simulink

In fig. 7 is the system design in the Matlab Simulink environment. There are twenty-one nodes representing mobile stations. The black-labeled nodes represent mobile stations, that are not privileged to perform communications, and the yellow-labeled nodes are privileged mobile stations permitted to perform communication. The light blue nodes represent privileged mobile stations permitted to only perform emergency calls. The decision-making registers for calls, sms, data connection, and emergency calls can be programmed to block all nodes labeled in black and allow light blue nodes to only perform emergency calls. It can also selectively allow the yellow-labeled nodes to perform communications based on the decision-making registry for calls, sms, data, and emergency calls. The decision-making registers are found at the output of the IMSI detector. The IMSI detector functions to detect available mobile stations. The output display of this design is a matrix viewer. The matrix viewer displays the output decision-making for each detected mobile station. However, the matrix viewer can display the decision for allowing MS for only one MS at a time. Meaning it cannot display multiple “allowed” MS per view.

Design structure of the signaling control jammer



The power supply unit offers the necessary power to control the IF and RF area. The intermediate Frequency (IF) unit is the segment where the signal is produced to the Radio Frequency section (RF). IF unit is responsible for frequency tuning by producing a triangular wave, which is mixed with a noise signal to sweep the Voltage Controlled Oscillator (VCO). The IF unit comprises of four main parts which are:

a) Triangular Wave Generator: To set the exact frequency band in the VCO in the RF unit. b) Noise Generator: To produce output noise.

c) Mixer: To mix the triangular wave signal with the noise signal.

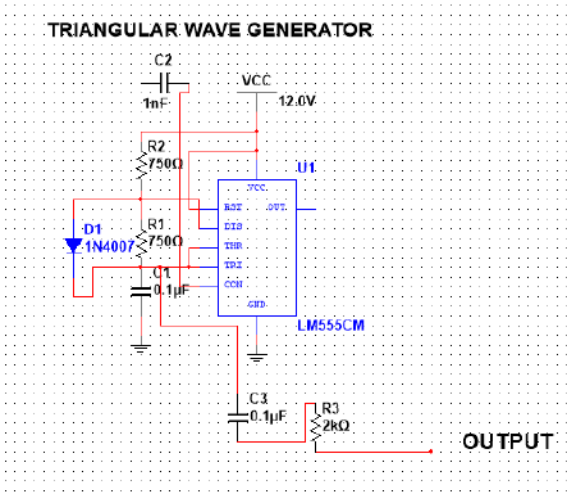


Fig. 8: Triangular wave generator circuit

A triangular wave generator is used to adjust the frequency band in the Voltage Controlled Oscillator (VCO). This will sweep the desired frequency range to cover the downlink frequency, which is 935 to 960 MHz, 806 MHz to 821 MHz, 1805 to 1880 MHz, and 2110 MHz to 2170 MHz. Where these are, the frequency ranges that are needed to block the transmission for GSM/UMTS/4G/5G band frequencies. The 555 timer IC was utilized and works in a steady mode to produce the broad signal to the VCO.

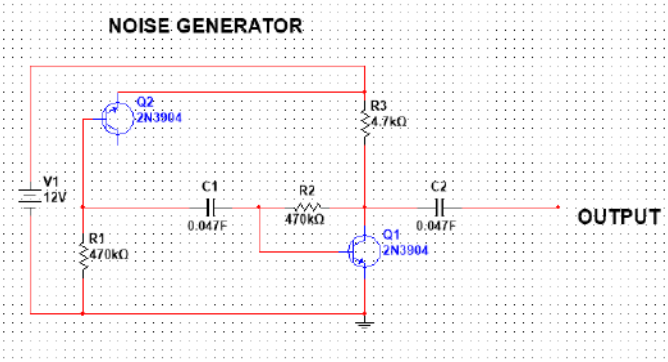


Fig. 9: Noise generator

In this paper, the jamming system needs a specific kind of noise to cover a portion band of the spectrum, so the most applicable type of noise in this case is white noise. When all is said in done can be characterized as a Random development of charges or charge transporters in an electronic device creating current and voltage that fluctuate arbitrarily with time. Without noise, the yield of the VCO is only an un-adjusted sweeping RF carrier. Due to this, it is compulsory to mix the triangular wave signal and noise.

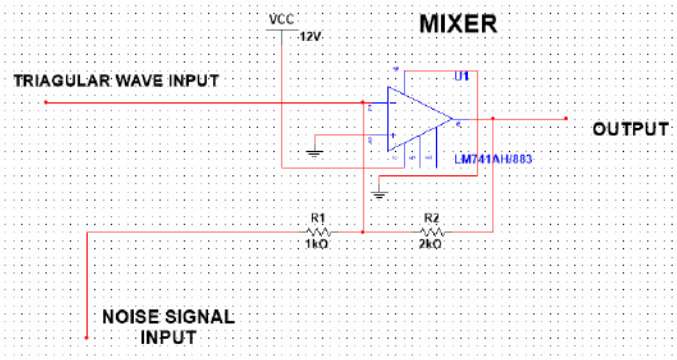


Fig. 10: Mixer circuit

The mixer is an amplifier, which functions as a summer. The triangular wave signal and noise will be added together in the mixer before inflowing into the VCO.

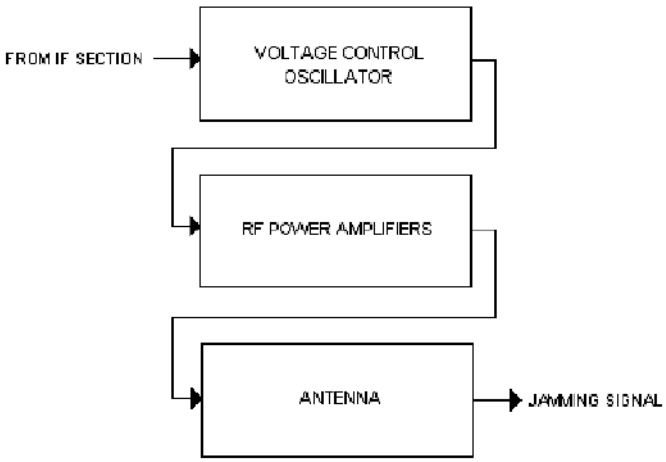


Fig. 11: Block diagram of RF section

To effectively jam a specific area we have to think about an essential parameter, the signal-to-noise ratio, denoted as the SNR. Each device working on radio communication principles can only endure noise in a signal up to a specific level. This is termed as SNR management capability of the device. Most cellular devices have an SNR dealing with a capacity of around 12dB. A very good device may have an estimation of 9dB, in spite of the fact that it is exceptionally improbable. To guarantee the jamming of these devices, we have to lessen the SNR of the carrier signal to below the 9dB threshold.

For this, we consider the direst outcome imaginable from a jammers perspective. This would mean the most extreme transmitted power S max from the tower, alongside the least estimation of the SNR management capability of a mobile device. Precisely,

J = -24dBm

since SNR min = S/J

where J is the power of the jamming signal.

So we need to have a jamming signal strength of -24dBm at the mobile device‘s reception to effectively jam it. Be that as it may, our emanated signal will experience some attenuation when conveyed from the antenna of the jammer to the antenna of the mobile phone. This path loss can be considered utilizing the straightforward free space path loss estimation:

$L_P = 32.45 + 20\log_{10}(fD)$-------- Equation (1)

At this juncture, f is the frequency in MHz, and D is the distance traveled in kilometers. By means of the GSM downlink center frequency (947.5MHz) and a jamming radius of 20m, we get the value of path loss to be 58dBm. This ideal path loss is for free space only, and the path losses in air will be significantly more prominent. This implies that the jamming range will be not as much as the 20m used to ascertain this value. Along these lines, incorporating the power lost in path loss, we need to transmit a signal with the strength of:

$J_T = 58 - 24 = 34dBm$ ----------Equation (2)

SIMULATION AND RESULTS

simulation result for the selective blocking system

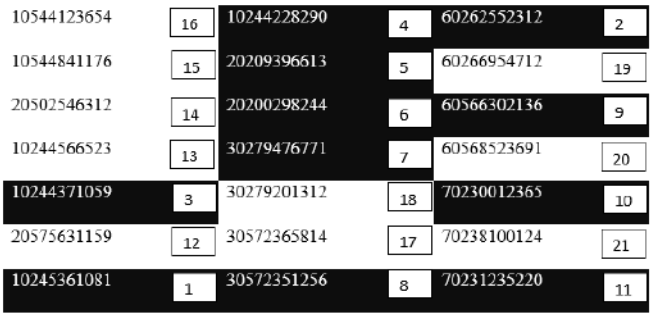


Fig. 12: A 7x3 view of detected IMSI numbers with eleven eligible IMSI numbers

Fig. 12 shows the stored mobile phone numbers (IMSI numbers) in the decision-making and identity storage unit found in Fig. 6. The black highlighted IMSI numbers in Fig. 12 are considered privileged users. The special numbers tagged on the individual IMSI numbers are linked to the matrix viewer to indicate the position of that IMSI number or mobile phone on the matrix viewer. The entire structure of Fig. 12 is in a matrix form. There are two main colors in the matrix viewer which signifies if a mobile phone is allowed or not allowed. That is the color white indicates when a mobile phone is allowed and orange when a mobile phone is not allowed. The Z-axis in Fig. 8 represents color coding between -1 and 1. The number, 1 on the z-axis represents “true” or “allowed” which stands for the color white. The number, 0 also in the z-axis represents “false” or “not allowed” which corresponds to the color orange.

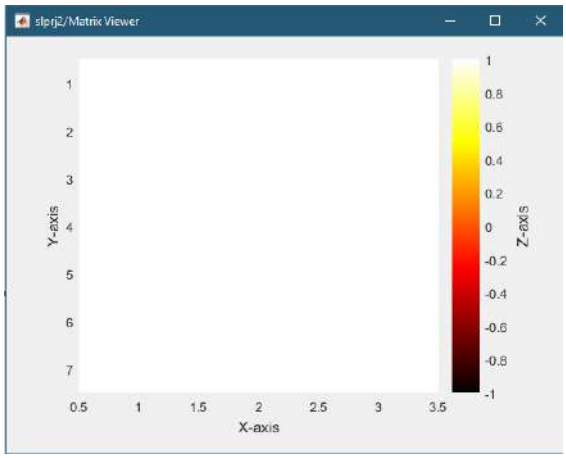


Fig. 8: Matrix viewer of all mobile phones allowed

Fig. 8 shows a complete white matrix graph. In this scenario, all mobile phones have been allowed to operate within the restricted area.

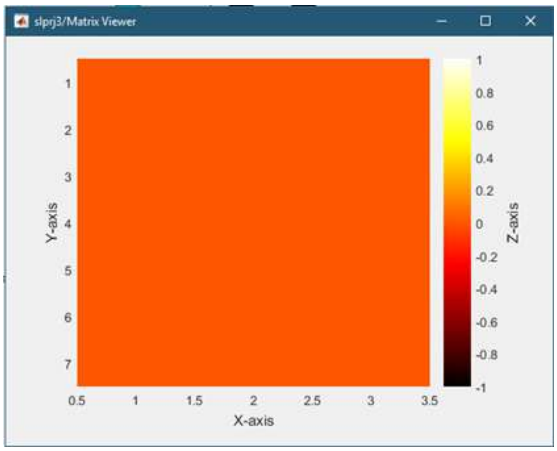


Fig. 9: Matrix viewer of all mobile phones blocked

Fig. 9 shows a complete orange matrix graph. In this scenario, all mobile phones have been blocked operation within the restricted area. Therefore no communication in that region.

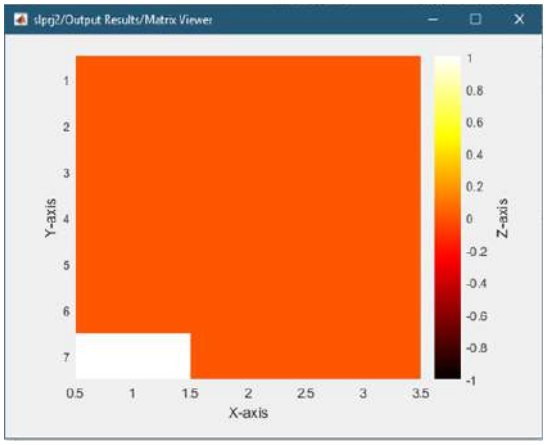


Fig. 10: Matrix viewer of IMSI number tag 1 allowed

Fig. 10 shows a portion of the entire graph in white. That is the graph shows the intersection of row number 7 on the y-axis against the column numbers 0.5 and 1.5 on the x-axis. This indicates that the IMSI number tagged number 1 in Fig. 12 is allowed for communication service.

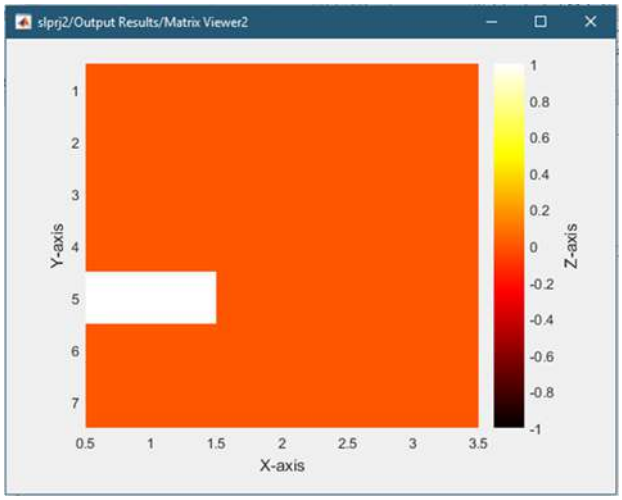


Fig. 11: Matrix viewer of IMSI number tag 3 allowed

Fig. 11 shows a portion of the entire graph in white. That is the graph shows the intersection of row number 5 on the y-axis against the column numbers 0.5 and 1.5 on the x-axis. This indicates that the IMSI number tagged number 3 in Fig. 12 is allowed for communication service.

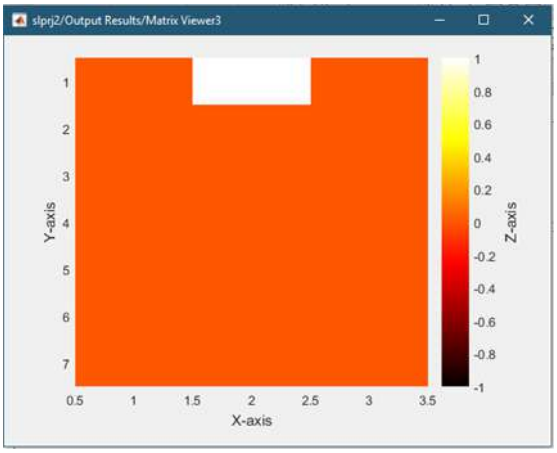


Fig. 12: Matrix viewer of IMSI number tag 4 allowed

Fig. 12 shows a portion of the entire graph in white. That is the graph shows the intersection of row number 1 on the y-axis against column numbers 1.5 and 2.5 on the x-axis. This indicates that the IMSI number tagged number 4 in Fig. 12 is allowed for communication service.

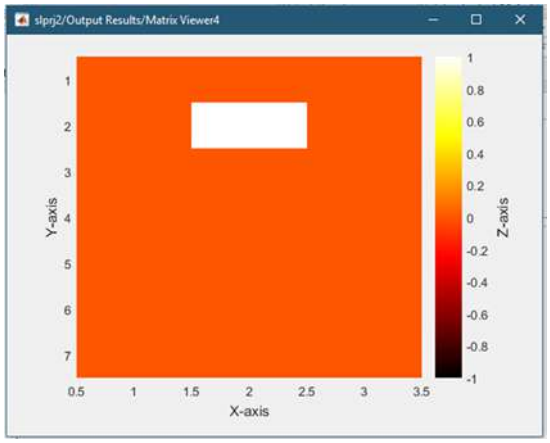


Fig. 13: Matrix viewer of IMSI number tag 5 allowed

Fig. 13 shows a portion of the entire graph in white. That is the graph shows the intersection of row number 2 on the y-axis against column numbers 1.5 and 2.5 on the x-axis. This indicates that the IMSI number tagged number 5 in Fig. 12 is allowed for communication service.

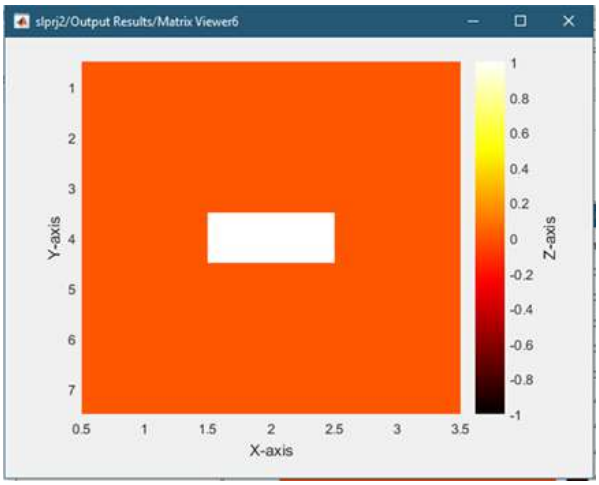


Fig. 14: Matrix viewer of IMSI number tag 7 allowed

Fig. 14 shows a portion of the entire graph in white. That is the graph shows the intersection of row number 4 on the y-axis against column numbers 1.5 and 2.5 on the x-axis. This indicates that the IMSI number tagged number 7 in Fig. 12 is allowed for communication service.

2 Simulation results for signaling control channel jammer

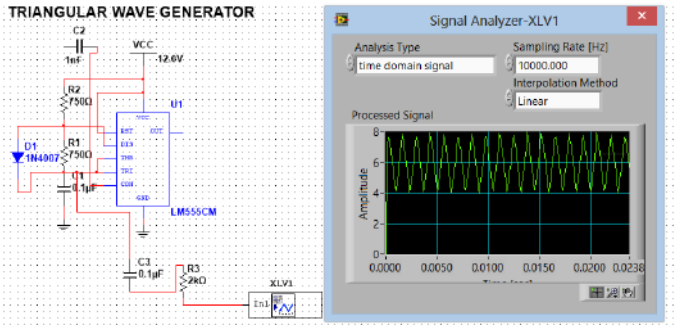


Fig. 15: Triangular wave generator simulation

Fig. 15 shows the results of the triangular wave generator producing a triangular wave, which will tune VCOs in the RF section to the following range of downlink frequencies; 935-960MHz and 1805-1880.

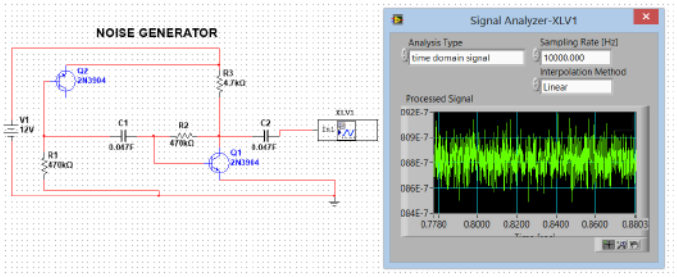


Fig. 16: Noise generator simulation

Fig. 16 shows the results of the noise generator which generates the noise that will be mixed with the triangular wave at the mixer stage. Noise is the actual element that is going to disturb the frequency spectrum between the mobile phone and the base station.

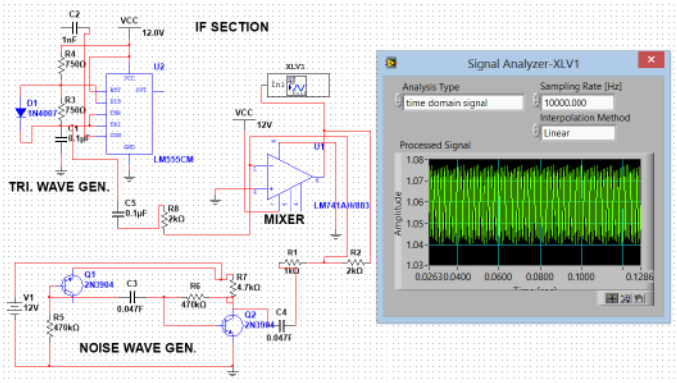


Fig. 17: IF section simulation

At the IF stage, the triangular wave is mixed with the noise wave before entering the VCOs. Fig. 17 shows the results of the mixer.

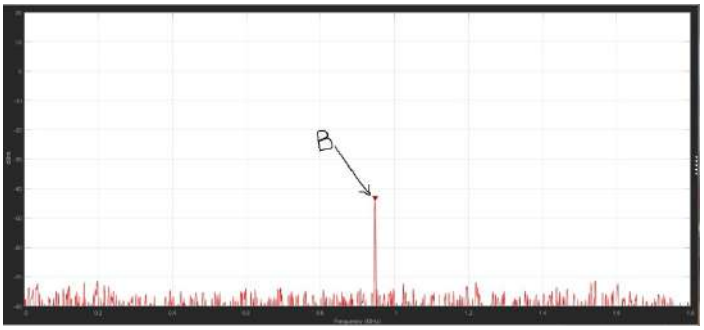


Fig. 18: When the signaling control channel jammer is deactivated for 900MHZ band frequency control channel

Fig. 18 shows the spectrum results when the control channel jammer does not distort the frequency spectrum of the GSM 900 signaling control channel. The peak labeled B represents the signal power of the control channel in the frequency spectrum when the jammer is disabled. B= -41dbm.

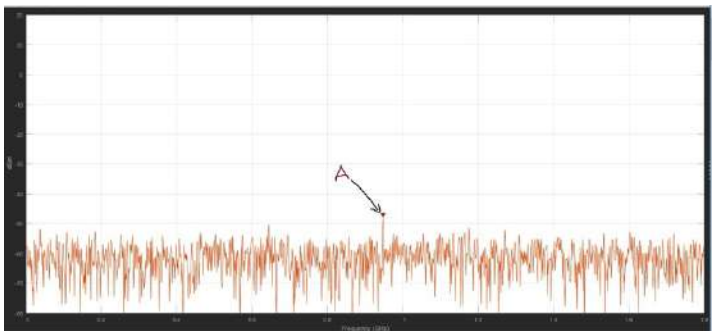


Fig. 19: When the signaling control channel jammer is activated for 900MHZ band frequency

Fig. 19 shows the spectrum results when the control channel jammer distorts the frequency spectrum of the GSM 900 signaling control channel. The peak labeled A represents the signal power of the control channel in the frequency spectrum when the jammer is enabled. A= -48.8dbm.

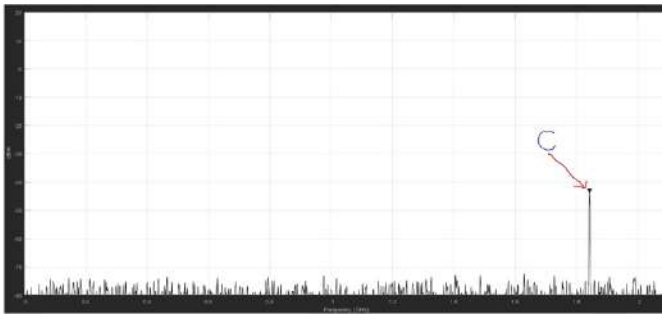


Fig. 20: When the signaling control channel jammer is deactivated for 5G 1800MHZ band frequency

Fig. 20 shows the spectrum results when the control channel jammer does not distort the frequency spectrum of the 5G signaling control channel. The peak labeled C represents the signal power of the control channel in the frequency spectrum when the jammer is disabled. C= -40.98dbm.

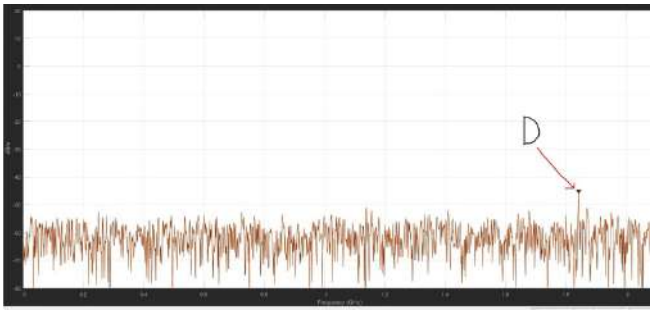


Fig. 21: When the signaling control channel jammer is activated for 5G 1800MHZ band frequency

Fig. 21 shows the spectrum results when the control channel jammer distorts the frequency spectrum of the 5G signaling control channel. The peak labeled D represents the signal power of the control channel in the frequency spectrum when the jammer is enabled. D= -49.20dbm.

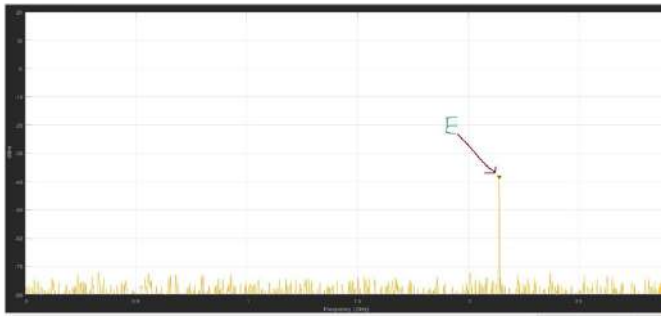


Fig. 22: When the signaling control channel jammer is deactivated for 3G 2100MHZ band frequency

Fig. 22 shows the spectrum results when the control channel jammer does not distort the frequency spectrum of the 3G signaling control channel. The peak labeled E represents the signal power of the control channel in the frequency spectrum when the jammer is disabled. E= -39.88dbm.

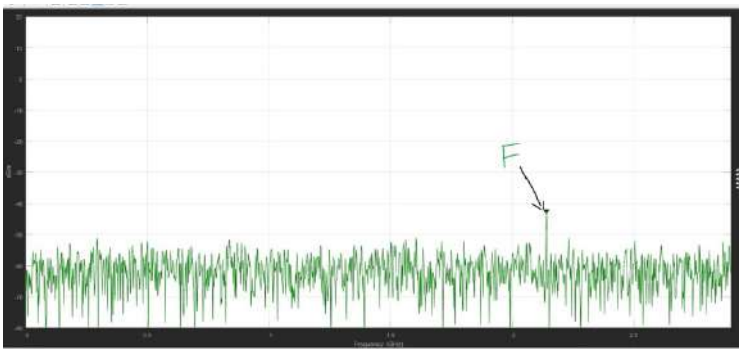


Fig. 23: When the signaling control channel jammer is activated for 3G 2100MHZ band frequency

Fig. 23 shows the spectrum results when the control channel jammer distorts the frequency spectrum of the 3G signaling control channel. The peak labeled F represents the signal power of the control channel in the frequency spectrum when the jammer is enabled. F= -42.70dbm.

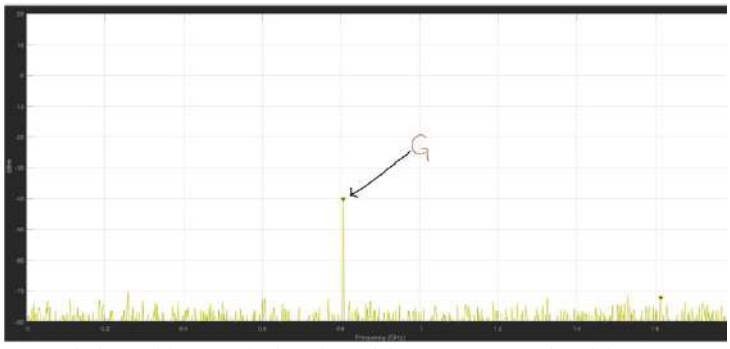


Fig. 24: When the signaling control channel jammer is deactivated for 4G 800MHZ band frequency

Fig. 24 shows the spectrum results when the control channel jammer does not distort the frequency spectrum of the 4G signaling control channel. The peak labeled G represents the signal power of the control channel in the frequency spectrum when the jammer is disabled. G= -40.21dbm.

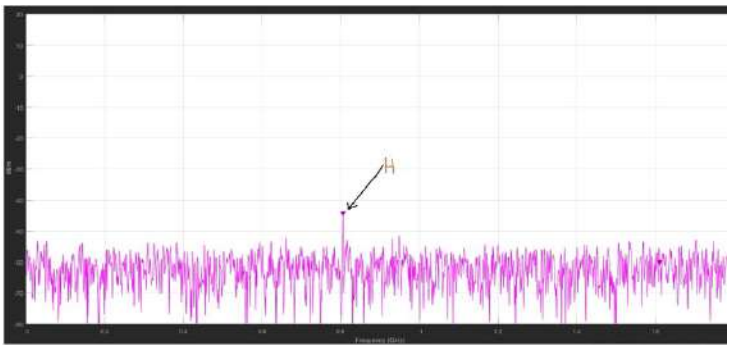


Fig. 25: When the signaling control channel jammer is activated for 4G 800MHZ band frequency

Fig. 25 shows the spectrum results when the control channel jammer distorts the frequency spectrum of the 4G signaling control channel. The peak labeled H represents the signal power of the control channel in the frequency spectrum when the jammer is enabled. H= -44.16dbm.

CONCLUSION

The results of this work show that when the system is implemented mobile phone communication services can be prioritized to suit privileged users within the mobile phone-restricted area. The above spectrum results also demonstrate that all mobile phones in the restricted area would effectively connect to our system without external network operators' interference in the restricted area.

References

[1] B. Eduard-Marian, S. Halunga, O. Fratu, and M. Popescu, "Intelligent Blocking System for Mobile Communications Initiated by Unauthorized Users," in *International Conference on Electronics, Computers and Artificial Intelligence (ECAI)*, 2023.

[2] A. Kabir, "Design and Construction of Mobile Phone Jammers using Extrinsic Noise," Osun State University, Osogbo, Nigeria, 2014.

[3] M. Stahlbery, "Radio Jamming Attacks Against two Papular Mobile Networks," in *HUT TML*, 2000.

[4] V. A. S. Mahato, "Cellular Signals jamming System in 2G and 3G," *IJAREEIE journal,* April 2014.

[5] Australian Communications and Media Authority, "Review of the Mobile Phone Jammer Prohibition," Australia, 2010.

[6] M. Barzig, "Advantages of Using a Mobile Phone Jammer," Airticles Factory, 26 December 2015. [Online]. Available: http://www.articlesfactory.com/articles/other/advantages-of-using-a-mobile-phone-jammer.html. [Accessed 4 August 2017].

[7] D. Vogel, D. Rausche and D. Gläsel, "Susceptibility of LTE to Downlink Jamming," in *International Conference on Military Communications and Information Systems (ICMCIS)*, 2019.

[8] Y. Arjoune and S. Faruque, "Smart Jamming Attacks in 5G New Radio: A Review," in *IEEE Annual Computing and Communication Workshop and Conference (CCWC)*, 2020.

[9] A. F. Abdelhamied Farh and K. Hamid Bilal, "Design and Implementation of a Jamming System for Smart Phone Using Cognitive Radio Network," in *2023 24th International Arab Conference on Information Technology (ACIT)*, 2023.

[10] C. Dorn, A. Depold, T. Kurin, F. Lurz and A. Hagelauer, "Low-Power Smart Selective LTE Jammer for Search and Rescue Applications using Software-Defined Radio," in *IEEE Annual Conference on Wireless and Microwave Technology (WAMICON)*, 2023.

[11] A. Karim Al sbeeh, A. Naim, A. Hussan and A. Samier, "MOBILE PHONE INTELLIGENT JAMMING SYSTEM," Hashemite University, 2008.

[12] U. Uno, P. Okoye and N. V. Charles, "ON THE PHYSICS OF GSM JAMMER AND ITS APPLICATION IN LECTURE THEATERS," *Science Journal of Physics,* 18 January 2013.

[13] F. J. González Castaño, J. Vales Alonso, J. M. Pousada Carballo, F. Isasi de Vicente and M. J. Fernández Iglesias, "Real-Time Interception Systems for the GSM Protocol," *IEEE TRANSACTIONS ON VEHICULAR TECHNOLOGY,* vol. 51, no. 5, pp. 904-914, 2002.

[14] S. Yubo, Z. Kan, Y. Bingxin and C. Xi, "A GSM/UMTS Selective Jamming System," *2010 International Conference on Multimedia Information Networking and Security,* 2010.

ARTICLE 4

4. Identifying Factors Associated with Student Performance in Engineering Mathematics: A Multilevel Modelling Approach

Wahab A. Iddrisu

Department of Mathematics and Statistics, Ghana Communication Technology University, Accra, Ghana.

Correspondence should be addressed to Wahab A. Iddrisu; widdrisu@gctu.edu.gh

Abstract

This study employs Multilevel Modeling to explore factors influencing student performance in Engineering Mathematics at the university level, in order to pinpoint specific areas for improvement. Data were gathered from both institutional records and a survey of 307 students within the Engineering Faculty of Ghana Communication Technology University. A comprehensive analysis was conducted, considering the nested structure of students within classes. A diverse set of variables including program of study, sex, WASSCE (West Africa Senior Secondary Certificate Examination) scores in Elective Mathematics, and teacher experience were examined to understand their associations with student performance in Engineering Mathematics. The findings highlight the differential impact of various factors on Engineering Mathematics scores. Notably, programme of study (p-value = 0.001), sex (p-value = 0.004), and WASSCE Elective Mathematics scores (p-value = 0.018) demonstrated significant associations, underlining their relevance in predicting student performance in Engineering Mathematics. Unexpectedly, teacher experience (p-value = 0.040) also exhibited a minor yet statistically significant correlation with student performance in Engineering Mathematics. These results emphasize the importance of considering both academic prerequisites and contextual factors in understanding and predicting student performance. The study contributes significantly to the field of Mathematics Education by elucidating the multifaceted nature of factors influencing student achievement. The implications extend to tailored support strategies for students based on academic backgrounds and underscore the significance of teacher experience in shaping student performance. This study further offers insights into the complexities of factors influencing student success in Engineering Mathematics, providing a foundation for future studies to delve deeper into the interplay between academic prerequisites, contextual factors, and student performance in Mathematics education at the university level.

1. Introduction

Engineering Mathematics stands as a cornerstone in engineering education, serving as the foundational framework upon which subsequent engineering disciplines rely [1]. However, the determinants of student success in this critical subject have long fascinated educators and researchers alike. Understanding the multifaceted factors influencing student performance in Engineering Mathematics is pivotal not only for academic institutions but also for the broader scope of educational strategies and student support mechanisms [2, 3].

In the realm of educational research, Multilevel Modeling (MLM) has emerged as an invaluable analytical tool, particularly in studying complex hierarchical data [4, 5]. Its utility extends to investigating educational contexts, where various factors at multiple levels such as individual, classroom, and institution contribute to academic outcomes [5]. This approach enables researchers to discern nuanced relationships between these factors, offering a comprehensive understanding of the intricate interplay shaping student achievement [6, 7].

A pivotal facet in elucidating the determinants of success in Engineering Mathematics lies in identifying the student characteristics most correlated with high performance in this discipline [8–10]. Prior studies have often explored the influence of cognitive abilities, prior mathematical proficiency, study habits, and motivation on academic outcomes [9, 10]. The intricate relationship between these characteristics and their impact on Engineering Mathematics performance warrants a comprehensive investigation.

Additionally, the role of Elective Mathematics prerequisites in shaping student performance in Engineering Mathematics is an area ripe for exploration [10]. While these prerequisites are intended to fortify students' mathematical foundations, their actual impact on subsequent performance in specialized engineering mathematics courses remains a subject of debate [10]. Understanding the link between performance in Elective Mathematics and success in Engineering Mathematics can provide insights into refining curriculum structures and prerequisites for aspiring engineers.

The application of Multilevel Modeling in investigating the multifaceted nature of student performance in Engineering Mathematics stands as a novel approach with significant relevance. By embracing the complexity inherent in educational contexts, MLM allows for a nuanced analysis that acknowledges the interconnectedness and the interdependencies of various factors impacting student outcomes [11]. Its application in this domain is not only innovative but also promises a more comprehensive understanding of the intricate web of influences at play [12].

However, despite the growing body of research exploring factors influencing academic performance in Mathematics [13–15], a notable research gap persists in comprehensively integrating Multilevel Modeling to investigate the determinants of success specifically in Engineering Mathematics at the university level. This study aims to bridge this gap by employing MLM to examine the multifaceted nature of factors influencing student performance in Engineering Mathematics courses. By doing so, it seeks to shed light on the nuanced interplay between individual attributes, classroom dynamics, and institutional factors shaping academic achievement in this critical discipline.

Understanding the practical implications of this innovative approach is crucial. Unraveling the intricate web of factors influencing student performance in Engineering Mathematics holds significant implications for educational policies, curriculum design, and targeted interventions aimed at supporting struggling students [16–18]. However, the complexity inherent in MLM analysis, including data aggregation challenges, model specification issues, and interpretation complexities, presents potential hurdles that need careful consideration and methodological rigor [19–21].

This study embarks on a comprehensive exploration of the factors associated with student performance in Engineering Mathematics at the university level, leveraging Multilevel Modeling as a powerful analytical tool. By addressing the gaps in the existing literature and embracing the complexities of educational contexts [22], this study endeavors to offer valuable insights into fostering academic success in this pivotal discipline while acknowledging the challenges inherent in this innovative approach.

2. Materials and Methods

2.1 Research Design

This study utilizes a nested design [23] to investigate the factors impacting student performance in Engineering Mathematics at the university level. Acknowledging the hierarchical arrangement where Students are nested within Classes, this design enables a comprehensive exploration of how diverse factors function across different levels within the educational framework.

2.2 Participants

A survey was developed and administered to a randomly selected group of students within the Engineering Faculty of the Ghana Communication Technology University (GCTU) from July 2023 to October 2023. Initially, a sample size of 312 was established considering a 95% confidence level, an estimated standard deviation of 0.45, and a margin of error of 5%. To meet this sample size, 320 questionnaires were distributed among eligible students who volunteered to participate in the survey. Ultimately, 307 questionnaires were completed and returned, achieving an impressive response rate of 95.94%.

2.3 Data Collection and Ethical Considerations

Student-level data encompassing demographics, prior academic performance, socio-economic background, and other relevant variables were gathered from both student records and the survey. Class-level data such as the teaching experience of the Engineering Mathematics Lecturer were extracted from institutional records and program documentation.

Anonymity is maintained in reporting results, and the study adheres to ethical guidelines for research involving human participants.

2.4 Statistical Analysis

This study proposes a multilevel modeling approach [23] to investigate the factors associated with student performance in Engineering Mathematics at the university level. The Multilevel Model employed can be represented as shown in Equations (1) and (2):

Level 1 (Individual Student Level):

$$Y_{ij} = \beta_{0j} + \beta_{1j}\left(X_{1ij}\right) + \beta_{2j}\left(X_{2ij}\right) + \ldots + r_{ij} \tag{1}$$

Where:

Y_{ij} represents the Engineering Mathematics performance for student i in class j.

$X_{1ij}, X_{2ij}, \cdots$ denote individual-level predictors.

β_{0j} represents the intercept at the class level.

$\beta_{1j}, \beta_{2j}, \cdots$ are the coefficients representing the effects of predictors at the class level.

r_{ij} is the residual representing unexplained variance at the student level.

Level 2 (Class Level):

$$\beta_{0j} = \gamma_{00} + \gamma_{01}\left(Z_{1j}\right) + \gamma_{02}\left(Z_{2j}\right) + \ldots + u_{0j} \tag{2}$$

Where:

$Z_{1j}, Z_{2j}, \cdots$ denote class-level predictors.

γ_{00} represents the grand mean intercept.

$\gamma_{01}, \gamma_{02}, \cdots$ are the coefficients representing the effects of predictors at the class level.

u_{0j} is the residual representing unexplained variance at the class level.

The intra-class correlation coefficient, which will allow for further evaluation of the level of non-independence in the outcome at Level 1 is computed using Equation 3.

$$ICC = \frac{\sigma_B^2}{\sigma_B^2 + \sigma_W^2} \tag{3}$$

Where σ_W^2 and σ_B^2 are the within-group and between-group variances respectively.

The Multilevel Model was estimated using IBM SPSS Statistics [24], employing maximum likelihood estimation to obtain parameter estimates and variance components.

Model fit indices, such as the Likelihood Ratio Test [25], Akaike Information Criterion (AIC) [26], and Akaike's Information Corrected Criterion (AICC) [27], were used to assess the goodness-of-fit. Results were interpreted to identify significant predictors of Engineering Mathematics performance at both individual and class levels, considering their respective effects and contributions to student outcomes.

2.5 Model Building

The model building involved a series of steps [28]. Initially, a null or unconditional model was developed, a one-way analysis of variance random effects model devoid of Level 1 or Level 2 predictors. This initial step aimed to determine if variance exists between classes concerning student performance in Engineering Mathematics. This assessment answered the query, "Does a (Level 2) class impact the (Level 1) baseline of student performance in Engineering Mathematics, reflecting the average score?" This phase encompassed computing the intraclass correlation coefficient (ICC) derived from the deviance statistic (-2LL) and the design effect.

Subsequently, a random coefficient model was introduced to examine significant associations between Level 1 predictors and Engineering Mathematics performance. This step also evaluated differences among classes regarding each predictor's impact. Finally, a third model integrated both Level 1 and Level 2 variables to assess their collective relevance in forecasting student performance in Engineering Mathematics. This comprehensive model included predictors at both Level 1 and Level 2, accounting for random effects in both the Level 1 intercept and slopes. Group-centering was applied to Level 1 predictors, while grand-mean centering was utilized for Level 2 predictors in the partially and fully conditional models.

At the student level (Level 1), predictors considered for Engineering Mathematics performance encompassed students' age, gender, program of study, parental education, aggregate score in the West Africa Senior Secondary Certificate of Examination (WASSCE), WASSCE scores in Core Mathematics, and WASSCE scores in Elective Mathematics. At the class level (Level 2), the teaching experience of the Engineering Mathematics Lecturer was posited as a predictor of Engineering Mathematics performance.

3. Results and Discussion

3.1 Descriptive Statistics

The findings in Table 1 depict a predominantly male student population with varying levels of parental education and diverse academic performances in both Core and Elective Mathematics. The distribution across engineering programs and Engineering Mathematics classes appears relatively balanced within the sample (Table 1).

Table 1: Descriptive statistics for the categorical variables

Socio-demographic variables		Frequency	Percent
Sex of student	Male	279	90.9
	Female	28	9.1
Parental education	Both parents uneducated	99	32.2
	At least one parent educated	208	67.8
WASSCE core mathematics score	A1 - Excellent	46	15.0
	B2 - Very good	55	17.9
	B3 – Good	73	23.8
	C4 – Credit	53	17.3
	C5 – Credit	50	16.3
	C6 – Credit	30	9.8
WASSCE elective mathematics score	A1 - Excellent	2	.7
	B2 - Very good	83	27.0
	B3 – Good	40	13.0
	C4 – Credit	95	30.9
	C5 – Credit	16	5.2
	C6 – Credit	71	23.1
Programme of study	Computer Engineering	108	35.2
	Telecommunication Engineering	100	32.6
	Electrical and Electronic Engineering	99	32.2
Class	Engineering Mathematics I	58	18.9
	Engineering Mathematics II	64	20.8
	Engineering Mathematics III	61	19.9

	Engineering Mathematics IV	63	20.5
	Engineering Mathematics V	61	19.9
All respondents		307	100.0

As presented in Table 2, the average age of students stands at approximately 22.58 years, ranging between 19 and 26 years, exhibiting moderate variability around this mean age. In terms of academic performance, the average score in the WASSCE lies at 20.98, showcasing considerable diversity among students, with scores ranging from 12 to 30. Additionally, the lecturers teaching Engineering Mathematics possess an average experience of roughly 8.82 years, varying between 5 and 14 years, indicating some variability in their tenure. Notably, students' scores in Engineering Mathematics have an average of 59.09, showcasing a wider range from 26 to 92 and substantial variability in performance within the cohort.

These findings underscore the diversity within the student population and highlight the variance in academic scores and teacher experience in the context of Engineering Mathematics. The statistics reflect a broad range of ages among students, suggesting a moderate spread across the sample. Moreover, the WASSCE scores exhibit significant diversity, indicating varied levels of academic proficiency. Both lecturer experience and student performance in Engineering Mathematics demonstrate notable variability, suggesting differences in teaching backgrounds and academic capabilities within the sampled university cohort.

Table 2: Descriptive statistics for the continuous variables

Socio-demographic variables	N	Minimum	Maximum	Mean	Std. Deviation
Age of student	307	19	26	22.58	2.395
WASCCE aggregate score	307	12	30	20.98	5.523
Teacher experience	307	5	14	8.82	3.658
Score in Engineering Mathematics	307	26	92	59.09	11.918

Table 3 exhibits correlations between the continuous predictor variables (students' age, WASSCE aggregate score, and teacher experience) and the response variable (Score in Engineering Mathematics) in the context of university-level Engineering Mathematics studies. The correlations indicate negligible associations between students' age and their performance in Engineering Mathematics, as well as the WASSCE aggregate score and their performance in this subject. These correlations are both weak and statistically insignificant, suggesting that variations in students' age or WASSCE scores don't linearly relate to their performance in Engineering Mathematics.

Conversely, the analysis reveals a statistically significant but weak negative correlation between teacher experience and students' performance in Engineering Mathematics. This implies that higher levels of teacher experience are associated with slightly lower student performance in this subject. Despite the

statistical significance, the strength of this relationship remains minor, indicating that other factors beyond teacher experience likely exert more substantial influences on student performance in Engineering Mathematics at the university level. Overall, these findings underscore the nuanced nature of predictors influencing student performance in Engineering Mathematics, highlighting the need for further exploration of multifaceted factors beyond the scope of age, academic background, and teacher experience.

Table 3: Correlations between the response variable and the continuous predictor variables

	(1)	(2)	(3)	(4)
Age of student (1)	1			
WASCCE aggregate score (2)	-.068	1		
Teacher experience (3)	-.001	-.014	1	
Score in Engineering Mathematics (4)	-.057	-.058	-.156**	1

**. Correlation is significant at the 0.01 level (2-tailed).

3.2 Parameter Estimates of the Fitted Multilevel Models

Table 4 presents a comprehensive overview of parameter estimates from three fitted multilevel models investigating factors impacting student performance in Engineering Mathematics at the university level. The intercept values, representing the estimated average scores in Engineering Mathematics, progressively increase across models, indicating adjustments in the average score estimation based on included variables. Program of study demonstrates negative coefficients in both Model 2 and Model 3, suggesting that certain enrolled programs might correlate with lower scores in Engineering Mathematics. On the other hand, being male (reference category) exhibits positive coefficients in both models, indicating higher scores compared to females. While age, parental education, and WASSCE scores in Core Mathematics show minor associations, WASSCE Elective Mathematics scores consistently exhibit a significant negative correlation with Engineering Mathematics scores across models. Moreover, teacher experience emerges as a significant predictor only in Model 3, where greater experience correlates with slightly lower student scores.

Regarding measures of variation, the within-group variance decreases as more variables are considered in the models, indicating reduced variability in student scores within groups. Conversely, the between-group variance remains relatively stable across models, implying consistent differences in average scores between classes. The Intraclass Correlation Coefficient (ICC) rises from Model 1 to Model 3, signifying an increasing proportion of total variance in scores attributable to between-class differences. Additionally, the model fit indicators (AIC, AICC) decrease across models, indicating an improved fit as more predictors are added.

The findings highlight the differential impact of various factors on student performance in Engineering Mathematics. Factors such as program of study, sex, WASSCE Elective Mathematics scores, and teacher experience demonstrate noteworthy associations with student scores. The variations in model fit and measures of variation suggest the importance of considering multiple factors in understanding and predicting student performance in this academic domain.

Table 4: Parameter estimates of the fitted multilevel models

Variables	Model 1, Coefficient (p-value)	Model 2, Coefficient (p-value)	Model 3, Coefficient (p-value)
Intercept	59.060 (<0.001)	81.020 (<0.001)	85.756 (<0.001)
Programme of study		-2.782 (0.001)	-2.823 (0.001)
Age of student		-0.346 (0.179)	-0.332 (0.196)
Sex of student		6.777 (0.003)	6.563 (0.004)
Parental education		0.369 (0.778)	0.519 (0.692)
WASCCE aggregate score		-0.020 (0.859)	-0.028 (0.800)
WASSCE core mathematics score		0.714 (0.559)	0.6540 (0.592)
WASSCE elective mathematics score		-3.002 (0.019)	-3.0030 (0.018)
Teacher experience			-0.527 (0.040)
Measures of variation			
Within-group variance	87.077	72.14	62.192
Between-group variance	5.462	5.277	5.514
Intraclass Correlation Coefficient (ICC)	0.059	0.068	0.081
Model fit indicators			
-2 Log Likelihood	2387.325	2326.222	2321.572
Akaike's Information Criterion (AIC)	2393.325	2346.222	2343.572

Hurvich and Tsai's Criterion (AICC)	2393.404	2346.966	2344.467

4. Discussion

This study investigating factors influencing student performance in Engineering Mathematics at the university level revealed significant insights into academic achievement determinants. Firstly, it highlighted the varying impact of different factors on student performance in Engineering Mathematics. Notably, variables such as program of study, sex, WASSCE Elective Mathematics scores, and teacher experience exhibited noteworthy associations with student scores. Particularly, the relevance of WASSCE Elective Mathematics scores emerged as a significant predictor, indicating its role as a prerequisite influencing performance in Engineering Mathematics.

These findings largely align with the study's initial hypotheses, particularly concerning the association between academic background factors and student performance [29–31]. However, unexpected findings, such as the association between teacher experience and slightly lower scores, diverged from expectations [32]. The data analysis revealed intriguing patterns—while academic background factors played a role, contextual factors like program of study and teacher experience significantly influenced student performance in Engineering Mathematics.

The implications of these findings within the broader academic domain of Mathematics education are substantial. They shed light on the multifaceted nature of factors influencing student performance. The study fills gaps in existing literature by emphasizing the relevance of both academic prerequisites, like WASSCE Elective Mathematics [10], and contextual factors, such as teacher experience [32]. This nuanced understanding contributes to more comprehensive models for predicting and supporting student achievement in Engineering Mathematics.

Unexpected findings, particularly the association between teacher experience and slightly lower scores, prompt theories regarding the complexities of teaching methodologies or variations in classroom dynamics that might influence student performance [32]. The limitations of the study, such as potential unmeasured variables or constraints in data collection, might have influenced the robustness of the results. However, the methodological rigor of the multilevel modeling and the substantial sample size enhance the study's reliability.

The findings have implications for educational practice and policy [33]. They underscore the importance of tailored support strategies for students based on academic backgrounds and the significance of teacher experience in influencing student performance. Future research could explore these relationships more deeply, considering potential alternative explanations or interpretations to further enrich our understanding of factors impacting student achievement in Mathematics.

5. Conclusion

The investigation into factors influencing student performance in Engineering Mathematics at the university level yielded significant insights into the complex interplay of determinants affecting academic achievement. The study highlighted the differential impact of various factors, notably program of study, sex, WASSCE Elective Mathematics scores, and teacher experience, on student performance. Particularly, the relevance of WASSCE Elective Mathematics as a prerequisite emerged as a significant predictor, underscoring its influence on Engineering Mathematics scores.

The study's outcomes significantly contribute to the field of Mathematics education by emphasizing the multifaceted nature of factors affecting academic performance. By bridging gaps in the literature, the research underscores the importance of considering both academic prerequisites and contextual factors in predicting and supporting student success in Mathematics.

Unexpected findings, like the association between teacher experience and student scores, prompt theories regarding potential teaching methodologies or classroom dynamics influencing student outcomes. However, limitations such as unmeasured variables might have impacted the results, although the methodological rigor and substantial sample size enhance the study's reliability.

Data Availability

The survey data pertinent to the findings of this current study can be provided upon request.

Conflicts of Interest

The author declares that there is no conflict of interest regarding the publication of this paper.

References

[1] Karney, B., Gollish, S., & Mather, A. (2019). A Decision-Making Framework for Engineering Mathematics Education. *Proceedings of the Canadian Engineering Education Association (CEEA)*. https://doi.org/10.24908/pceea.vi0.13468.

[2] Bilbao, J., Bravo, E., García, O., Rebollar, C., Varela, C., Uukkivi, A., Labanova, O., Latõnina, M., Safiulina, E., Cellmer, A., Cymerman, J., Kierkosz, I., Brown, K., Kelly, G., Lopes, A., Soares, F., Feniser, C., Bocanet, V., & Rusu, F. (2020). Exploring and Developing a Shared Understanding of the Issues Surrounding Engineering Mathematics. *WSEAS Transactions on Information Science and Applications*. https://doi.org/10.37394/23209.2020.17.4.

[3] Rogovchenko, Y., & Rogovchenko, S. (2022). Promoting Engineering Students' Learning with Mathematical Modelling Projects. SEFI 50th Annual Conference of the European Society for Engineering Education. "Towards a New Future in Engineering Education, New Scenarios that European Alliances of Tech Universities Open Up". *Barcelona: Universitat Politècnica de Catalunya*. https://doi.org/10.5821/conference-9788412322262.1451.

[4] Flunger, B., Trautwein, U., Nagengast, B., Lüdtke, O., Niggli, A., & Schnyder, I. (2019). Using Multilevel Mixture Models in Educational Research: An Illustration with Homework Research. *The Journal of Experimental Education*, 89, 209 - 236. https://doi.org/10.1080/00220973.2019.1652137.

[5] Zulvia, P., Kurnia, A., & Soleh, A. (2017). Multilevel Modeling and Panel Data Analysis in Educational Research (Case Study: National Examination Data Senior High School in West Java). *AIP Conference Proceedings*, 1827, 020004. https://doi.org/10.1063/1.4979420.

[6] Liouaeddine, M., & Bijou, M. (2021). Multilevel Modeling an Innovative Tool for Analyzing Clustered Data: Application to Education and Its Projection on Environmental Management. *E3S Web of Conferences*. https://doi.org/10.1051/e3sconf/202131901008.

[7] Kulawardana, D., & Sooriyarachchi, M. (2017). Multilevel Modelling of General Certificate of Education Ordinary Level Performance of Schools in Conflict-Affected Areas in Sri Lanka. *EPH - International Journal of Educational Research*. https://doi.org/10.53555/ephijer.v1i1.1.

[8] Lent, R., Miller, M., Smith, P., Watford, B., Lim, R., & Hui, K. (2016). Social Cognitive Predictors of Academic Persistence and Performance in Engineering: Applicability across Gender and Race/Ethnicity. *Journal of Vocational Behavior*, 94, 79-88. https://doi.org/10.1016/J.JVB.2016.02.012.

[9] Deshler, J., Fuller, E., & Darrah, M. (2019). Affective States of University Developmental Mathematics Students and their Impact on Self-Efficacy, Belonging, Career Identity, Success and Persistence. *International Journal of Research in Undergraduate Mathematics Education*, 5, 337 - 358. https://doi.org/10.1007/s40753-019-00096-3.

[10] Derr, K., Hübl, R., & Ahmed, M. (2018). Prior Knowledge in Mathematics and Study Success in Engineering: Informational Value of Learner Data Collected From a Web-Based Pre-Course. *European Journal of Engineering Education*, 43, 911 - 926. https://doi.org/10.1080/03043797.2018.1462765.

[11] Gordon, M., & Bergeron, L. (2015). The Use of Multilevel Modeling and the Level Two Residual File to Explore the Relationship Between Middle Years Programme Student Performance and Diploma

Programme Student Performance. *Social science research*, 50, 147-63. https://doi.org/10.1016/j.ssresearch.2014.11.004.

[12] Badullahewage, P., & Attygalle, D. (2021). Modelling a Multilevel Data Structure Using a Composite Index. *American Journal of Applied Mathematics and Statistics*, 9, 75-82. https://doi.org/10.12691/AJAMS-9-3-1.

[13] Pitsia, V., Biggart, A., & Karakolidis, A. (2017). The Role of Students' Self-Beliefs, Motivation and Attitudes in Predicting Mathematics Achievement: A Multilevel Analysis of the Programme for International Student Assessment Data. *Learning and Individual Differences*, 55, 163-173. https://doi.org/10.1016/J.LINDIF.2017.03.014.

[14] Wijaya, T., Yu, B., Xu, F., Yuan, Z., & Mailizar, M. (2023). Analysis of Factors Affecting Academic Performance of Mathematics Education Doctoral Students: A Structural Equation Modeling Approach. *International Journal of Environmental Research and Public Health*, 20. https://doi.org/10.3390/ijerph20054518.

[15] Buzzai, C., Filippello, P., Puglisi, B., Mafodda, A., & Sorrenti, L. (2020). The Relationship between Mathematical Achievement, Mathematical Anxiety, Perfectionism and Metacognitive Abilities in Italian Students. *Mediterranean Journal of Clinical Psychology*, 8. https://doi.org/10.6092/2282-1619/MJCP-2595.

[16] Belecina, R., & Ocampo, J. (2016). Mathematical Curiosity, Epistemological Beliefs, and Mathematics Performance of Freshman Preservice Teachers. *MIMBAR PENDIDIKAN: Jurnal Indonesia untuk Kajian Pendidikan*, 1, 123-136. https://doi.org/10.17509/MIMBARDIK.V1I1.1758.

[17] Tanius, E., Koomashri, A., Arasu, P., Idrakisyah, M., Siregar, S., Kasim, C., Vinnarasi, A., Uluganathan, P., & Jalil, S. (2018). The Relationship between Influence Factors (Perception, Knowledge, Interest) and Mathematics Performance of Primary Students in a National School in Malaysia. *IJIRMPS*, 6. https://doi.org/10.17605/OSF.IO/WX8VZ.

[18] Fatawu, A., Kwakye, D., Atepor, S., Owuba-Asiedu, L., Segbefia, C., Asemani, E., Katu, D., & Nchor, E. (2022). Exploring Factors that Hinder Senior High School Students' Academic Performance in Mathematics. *Journal of Education, Society and Behavioural Science*. https://doi.org/10.9734/jesbs/2022/v35i121190.

[19] McNeish, D., & Stapleton, L. (2016). The Effect of Small Sample Size on Two-Level Model Estimates: A Review and Illustration. *Educational Psychology Review*, 28, 295-314. https://doi.org/10.1007/S10648-014-9287-X.

[20] Stapleton, L., McNeish, D., & Yang, J. (2016). Multilevel and Single-Level Models for Measured and Latent Variables When Data Are Clustered. *Educational Psychologist*, 51, 317 - 330. https://doi.org/10.1080/00461520.2016.1207178.

[21] Luo, W., Li, H., Baek, E., Chen, S., Lam, K., & Semma, B. (2021). Reporting Practice in Multilevel Modeling: A Revisit After 10 Years. *Review of Educational Research*, 91, 311 - 355. https://doi.org/10.3102/0034654321991229.

[22] Jacobson, M., Kapur, M., & Reimann, P. (2016). Conceptualizing Debates in Learning and Educational Research: Toward a Complex Systems Conceptual Framework of Learning. *Educational Psychologist*, 51, 210 - 218. https://doi.org/10.1080/00461520.2016.1166963.

[23] Suh, Y., Cho, S., & Bottge, B. (2018). A Multilevel Longitudinal Nested Logit Model for Measuring Changes in Correct Response and Error Types. *Applied Psychological Measurement*, 42, 73 - 88. https://doi.org/10.1177/0146621617703182.

[24] Caplova, Z., & Švábová, P. (2020). IBM SPSS statistics. *Statistics and Probability in Forensic Anthropology*, 343-352. https://doi.org/10.1016/b978-0-12-815764-0.00027-7.

[25] Vuong, Q. H. (1989). Likelihood Ratio Tests for Model Selection and Non-Nested Hypotheses. *Econometrica: Journal of the Econometric Society*, 307-333.

[26] Akaike, H. (2011). Akaike's Information Criterion. *International Encyclopedia of Statistical Science*, 25-25.

[27] Hurvich, C. M., & Tsai, C. L. (1995). Model Selection for Extended Quasi-Likelihood Models in Small Samples. *Biometrics*, 1077-1084.

[28] Lopes, J., & Oliveira, C. (2020). Teacher and School Determinants of Teacher Job Satisfaction: A Multilevel Analysis. *School Effectiveness and School Improvement*, 31(4), 641-659.

[29] Yuniar, R. (2021). The Impact of Students' Perception on their Academic Background on Their Learning Motivation. *Journal of English Language Teaching and Learning*, 2, 34-40. https://doi.org/10.18860/JETLE.V2I2.11921.

[30] Deo, S., Chaudhary, K., & Sharma, B. (2020). Student Background: An Invaluable Player for Academic Success. *2020 IEEE Asia-Pacific Conference on Computer Science and Data Engineering (CSDE)*, 1-6. https://doi.org/10.1109/CSDE50874.2020.9411526.

[31] Kishore, J., Anand, T., Nazli, T., & Mandal, R. K. (2019). Academic Performances and Associated Factors amongst School Adolescents: A Cross Sectional Study. *International Journal of Healthcare Education & Medical Informatics (ISSN: 2455-9199)*, 6(2), 10-16. https://doi.org/10.24321/2455.9199.201907.

[32] Gerritsen, S., Plug, E., & Webbink, D. (2017). Teacher Quality and Student Achievement: Evidence from a Sample of Dutch Twins. *Journal of Applied Econometrics*, 32, 643-660. https://doi.org/10.1002/JAE.2539.

[33] Perry, L., & Ketterlin-Geller, L. (2018). Policies and Practices in Support of Mathematics Learning in Global Contexts. *Global Education Review*, 5, 1-4.

ARTICLE 5

5. Prioritization of factors that influence student participation in Massive Open Online Courses; a Best-Worst Approach

Abstract: The study sought to rank seventeen (17) factors (sub-factors/sub-criteria) that influence MOOC usage by students. MOOCs are massive open online courses. The 17 sub-factors were placed in four (4) groups (main factors/criteria) namely learner attributes, course characteristics, social factors, and technological factors. The 17 sub-factors are academic skills and abilities, prior experience, time, motivation, attitude, economic, computer self-efficacy, feedback, course quality, course difficulty, accessibility, social presence, social support, interactivity, internet access, internet quality, and platform quality. The ranking was done using the Best Worst Method (BWM), a multi-criteria decision-making technique. A BWM questionnaire was developed based on the main and sub-factors. Ten domain experts were identified and chosen for the completion of the questionnaire. The domain experts were mostly from academia. They have in-depth knowledge of student experiences with MOOCs and other Open Educational Resources (OERs). The responses from the questionnaire were analyzed with the BWM Solver. The 4 main factors or criteria were ranked first, followed by the ranking of the 19 sub-factors or sub-criteria. Internet access was found to have the highest influence on student participation in MOOCs while course difficulty was found to have the least influence. The results are presented and discussed.

Keywords: Best Worst Method, MCDM, xMOOC, cMOOC, MOOC usage factors, multi-criteria decision making

1.0 Introduction

MOOCs are Massive Open Online Courses (Jordan, 2015). MOOCs are open to anyone who is interested in enrolling from any part of the world, and has internet connectivity. There are two main types of MOOCs; the xMOOC and the cMOOC (Rodriguez, 2012). The xMOOC is more popular than the cMOOC, although the earliest MOOCs were considered cMOOCs (Baturay, 2015). The xMOOC or extended MOOC uses the traditional pedagogical model of teaching, thus it is typically teacher-centered (Baturay, 2015). It typically consists of video lectures delivered asynchronously, downloadable text files, online chat platforms, quizzes/tests, and other online teaching and learning resources. The video lectures are delivered by lecturers from the university that provides the course (Baturay, 2015). The cMOOC uses the connectivist pedagogical model. The connectivist model is based on a network of connections between learners who interact via online discussion platforms on the MOOC site as well as social media platforms such as Twitter and Facebook. The connectivist model is student-centered; the instructor simply serves as a moderator (Moe, 2015).

MOOCs have traditionally been free; however, several MOOC providers are monetizing the courses (Shah, 2016). The "open" nature of MOOCs presupposes a free resource, thus students who enroll on a regular MOOC would expect to not pay to get access to content but would expect to pay for a certificate upon completion. MOOCs have traditionally been a free resource; thus, MOOC participation and completion rates have been widely expected to be high. On the contrary, MOOC participation and completion rates have been widely criticized (Porter, 2015). MOOCs have had dreadful completion rates from the onset (Newton, 2020). Completion rates among the big MOOC provider brands such as Harvard, MIT, and Stanford are very low; around 20% (Newton, 2020).

Newton (2020) wrote extensively on the disheartening news about MOOCs in an online article. Newton (2020) stated that MOOCs were initially seen as the phenomenon that would upend everything in higher education, but unfortunately, MOOCs have been a disappointment. This disappointment is mainly because of the low completion rates that have been recorded. Many people believe that if there was a way to get the MOOC completion rates up, their pathway will change (Newton, 2020). The article suggests that MOOC participants who are determined to complete will do so; motivated students will eventually complete the course.

MOOC completion rate has been a controversial topic (Fianu et al., 2020). Most writers have defined MOOC completion as performing all the tasks necessary to earn a student a certificate. Some MOOC researchers have argued that MOOC completion rates should not be treated as "raw" percentages because people enroll on MOOCs for different reasons (Fianu et al., 2020). Some people may enroll on MOOCs just to browse the course to study the structure and content; others may enroll to satisfy their curiosity, while others may enroll to connect with people from different parts of the world (Zheng et al., 2015). Despite the controversies surrounding MOOC completion rates, it is imperative that research is conducted on the factors that influence MOOC participation, and subsequent completion. MOOCs are relevant in the domain of Open Educational Resources (OERs); thus, the extensive use of their resources by participants will contribute significantly to bridge the knowledge gap across the globe.

This paper seeks to use the best worst method (BWM), a multi-criteria decision-making (MCDM) technique to rank a set of factors that influence MOOC usage or participation by university students in Ghana. While MCDM techniques have been applied in several e-learning studies, very few of these studies used BWM. There is scanty literature on the use of BWM to rank MOOC usage factors.

2.0 Literature Review

The literature review sought to identify factors that affect MOOC participation or use from the MOOC literature. The factors that were identified are discussed in the subsequent sections. The factors have been grouped into four (4) main factors and seventeen (17) sub-factors. The main factors or criteria are as follows: learner attributes, course characteristics, social factors, and technological factors.

2.1 Learner Attributes

These are individual characteristics of students/learners who want to enroll on MOOCs and use the MOOC resources. The sub-factors comprise the following:

2.1.1 Academic skills and abilities

Aldowah et al. (2020) conducted a study on factors affecting student dropout rate in MOOCs using the Decision-Making Trial and Evaluation Laboratory (DEMATEL) method, a multiple-criteria decision-making method. Their study showed that student academic skills and abilities directly influenced MOOC dropout rates. Alemayehu & Chen (2021) conducted a review of MOOC-related publications in selected SSCI indexed journals from 2014 to 2020. The findings of their study showed that student academic skills and abilities directly influenced student engagement with MOOCs. Semenova & Rudakova (2016) conducted a study on MOOC uptake barriers using administrative data from the Coursera platform. Their research report showed that academic skills and abilities had a significant influence on MOOC usage.

2.1.2 Prior experience

Prior experience refers to previous experience with MOOCs and other online learning platforms. Studies conducted by Aldowah et al. (2020), Alemayehu & Chen (2021), and Semenova & Rudakova (2016) showed that prior experience influenced MOOC usage. Prior experience was found to be a predictor of MOOC retention and achievement in a study conducted by Greene et al. (2015)

2.1.3 Time

Time refers to the amount of time available to the student to use MOOCs. Studies conducted by Aldowah et al. (2020) and Greene et al. (2015) showed that time had a significant influence on MOOC participation. Vu et al. (2015) also found time to directly influence MOOC participation. Vu et al. (2015) used a social learning framework in their study.

2.1.4 Attitude

Attitude is a settled way of thinking or feeling about the use of MOOCs. Attitude has a direct influence on MOOC participation (Alemayehu & Chen, 2021).

2.1.5 Motivation

Motivation refers to internal and external drives for the student to use MOOCs. Motivation has a direct influence on MOOC participation (Alemayehu & Chen, 2021; Aldowah et al., 2020).

2.1.6 Economic

The economic factor refers to monetary issues related to the use of MOOCs. The economic factor has a direct influence on MOOC participation (Alemayehu & Chen, 2021).

2.1.7 Computer self-efficacy

Computer self-efficacy refers to the ability of a student to use a personal computer, smartphone, or tablet. A study conducted by Gomez-Zermeno & Aleman de La Garza (2016) on MOOC dropout and retention rates shows that computer self-efficacy influences MOOC participation. A similar study conducted by Fianu et al. (2018) showed that computer self-efficacy has a direct significant influence on MOOC usage intention.

2.2 Course Characteristics

These are specific attributes of the MOOC course. The sub-factors comprise the following:

2.2.1 Feedback

Feedback refers to the feedback a student receives on progress made, as well as responses to questions they ask. Feedback has a direct influence on MOOC participation (Alemayehu & Chen, 2021; Aldowah et al., 2020).

2.2.2 Course quality

Course quality refers to the quality of course design which includes instructional quality, structure, and content. The quality of the MOOC course has a direct influence on MOOC participation (Alemayehu & Chen, 2021). Instructional quality has a direct significant influence on MOOC usage (Fianu et al., 2018).

2.2.3 Course difficulty

Course difficulty refers to the ease with which a student is able to understand the course content and make progress. Course difficulty has a direct influence on MOOC participation (Aldowah et al., 2020).

2.2.4 Accessibility

Accessibility refers to the ease at which students are able to access the MOOC site either via app or web. Nanda et al. (2021) used topic modelling and qualitative analysis in a MOOC study. The feedback from the learners showed that accessibility to the MOOC sites greatly influenced participation.

2.3 Social Factors

These are factors that pertain to instructors, fellow students, friends, and family. The sub-factors comprise the following:

2.3.1 Social presence

Social presence refers to the feeling of social acceptance during a MOOC course. Social presence influences MOOC usage (Aldowah et al., 2020). Social presence facilitates MOOC usage intentions (Eriksson et al., 2017).

2.3.2 Social support

Social support refers to support from friends, family, teachers, and instructors regarding the use of MOOCs. Social support facilitates MOOC usage and participation continuance (Aldowah et al., 2020; Eriksson et al., 2017)

2.3.3 Interaction

Interaction is social exchange between the student and instructors, as well as other students. Interactivity on the MOOC sites enhances student usage of MOOCs. Interactivity has a positive influence on MOOC usage (Aldowah et al., 2020).

2.4 Technological Factors

Refers to technology-related factors that influence MOOC usage. The sub-factors comprise the following:

2.4.1 Internet access

Refers to access to basic internet services. A mixed methods study conducted by Fianu et al. (2020) in selected Ghanaian universities showed that internet access has a positive direct influence on MOOC usage.

2.4.2 Internet quality

Refers to the quality of the internet service. The quality of the internet service has a positive direct influence on MOOC usage (Fianu et al., 2020).

2.4.3 Platform quality

Refers to the overall quality of the MOOC platform (web or app) hosting the course. Platform quality has a direct influence on MOOC usage. Good quality platforms facilitate MOOC usage and vice versa (Nanda et al., 2021).

3.0 Best Worst Method, a Multi-Criteria Decision-Making Technique

A system may consist of a collection of factors that influence the performance of the system. In such a system, it becomes necessary to rank these factors based on their influence on the system performance by developing a model (Yazdani-Chamzini et al., 2013). Multi-Criteria Decision-Making (MCDM) techniques are useful in modelling these factors (Seuring, 2013). MCDM techniques have been applied in various areas such as engineering, science, business operations, consumer behaviour, and technology (Mardani et al., 2015). MCDM techniques use weight evaluation in the ranking of factors (Malek & Desai, 2019). There are several weight evaluation techniques such as Weighted Sum Method (WSM), Simple Multi-Attribute Rating Technique (SMART), Weighted Aggregated Sum-Product Assessment (WASPS), Multi-Objective Optimisation Ratio Analysis (MOORA), Fuzzy-Analytic Hierarchy Process (Fuzzy-AHP), Simple Additive Weighting (SAW), and Weighted Product Method (WPM) (Malek & Desai, 2019).

The extant literature has touted the use of Fuzzy-AHP in solving MCDM problems; however, Fuzzy-AHP produces a large number of pair-wise comparisons. The large number of comparisons causes

inconsistencies in the pair-wise comparisons (Herrmann et al., 2014). To tackle the issue of complexity in the Fuzzy-AHP technique, Jafar Rezaei developed a novel approach called the Best Worst Method (BWM) in 2015 (Malek & Desai, 2019). The BWM produces less pair-wise comparisons and performs better than Fuzzy-AHP because of the following advantages; consistency, minimum violation, total deviation and conformity (Rezaei, 2015). Mi et al. (2019) conducted an extensive survey on published articles using BWM and validated its advantages as proposed by Jafar Rezaei.

BWM has been applied in several areas, for instance transportation (Duan et al., 2019; Khakdaman et al., 2020), supply chain (Gupta et al., 2020; Seuring, 2013), technology (Van De Kaa et al., 2014), construction (Yazdani-Chamzini et al., 2013), manufacturing (Herrmann et al., 2014; Malek & Desai, 2019), research and development (R&D) (Salimi & Rezaei, 2018), airline operations (Rezaei et al., 2018), and consumer decision making (Rezaei, 2015).

The 5-step procedure of BWM proposed by Rezaei (2015) is shown below (steps 2 to 4 are executed by domain experts/respondents) (Gupta et al., 2020):

Step 1: Obtain an essential list of criteria

Step 2: Select best (B) and worst (W) for main and sub-criteria

Step 3: Using a scale of 1 to 9, each respondent produces pairwise comparison between best criterion B over all the other criteria. This will result in vector $A_B = (a_{B1}, a_{B2}, ..., a_{Bn})$

Step 4: Using a scale of 1 to 9, each respondent produces pairwise comparison of all the other criteria with worst criterion (W). This will result in vector $A_W = (a_{W1}, a_{W2}, ..., a_{Wn})$

Step 5: Obtain the optimized weights for all criteria $(w_1^*, w_2^*, ..., w_n^*)$

That is, we obtain the weights of criteria so that the maximum absolute differences for all *j* can be minimized for $\{| w_B - a_{Bj} w_j |, | w_j - a_{jW} w_W |\}$. The following minimax model will be obtained:

min max $\{| w_B - a_{Bj} w_j |, | w_j - a_{jW} w_W |\}$

Such that $\sum_j w_j = 1,$

$w_j \geq 0,$ for all (1)

Model (1) is transformed to a linear model as follows:

$\min \xi^L,$

Such that

$| w_B - a_{Bj} w_j | \leq \xi^{L^*},$ for all $j,$
$| w_j - a_{jW} w_W | \leq \xi^{L^*},$ for all $j,$
$\sum_j w_j = 1,$
$w_j \geq 0,$ for all. (2)

Model (2) can be solved to obtain optimal weights $(w_1^*, w_2^*, ..., w_n^*)$ and optimal value ξ^{L^*}.

We desire that the consistency of attribute comparisons (ξ^{L^*}) be close to zero (0) (Rezaei, 2016).

The global weights of each criterion are the product of the local weights of both main and sub-criteria. After the global weights are calculated, the overall score of each alternative is calculated with the additive value function.

$$V_i = \sum_{j=1}^{n} w_j u_{ij} \qquad (3)$$

i is the index of any alternative

u_{ij} is the normalized score of alternative i with respect to criterion j. u_{ij} can be derived from expressions (4) and (5). Expression (4) is used for positive criteria, while expression (5) is used for negative criteria.

$$u_{ij} = \frac{x_{ij}}{\sum_i x_{ij}} \quad \text{for all } j \qquad (4)$$

$$u_{ij} = \frac{\frac{1}{x_{ij}}}{\sum_i \frac{1}{x_{ij}}} \quad \text{for all } j \qquad (5)$$

where x_{ij} is the real score of alternative i with respect to criterion j.

4.0 Methodology

The methodology used for the study is shown in Figure I. It consists of six stages. The first stage is a comprehensive literature review to identify MOOC usage factors (barriers and enablers). The review focused on studies that involved the investigation of factors or variables that influenced MOOC usage intentions, MOOC usage, and MOOC usage continuance. Some of the studies investigated dropout rates and the causes of dropout, while other studies investigated retention.

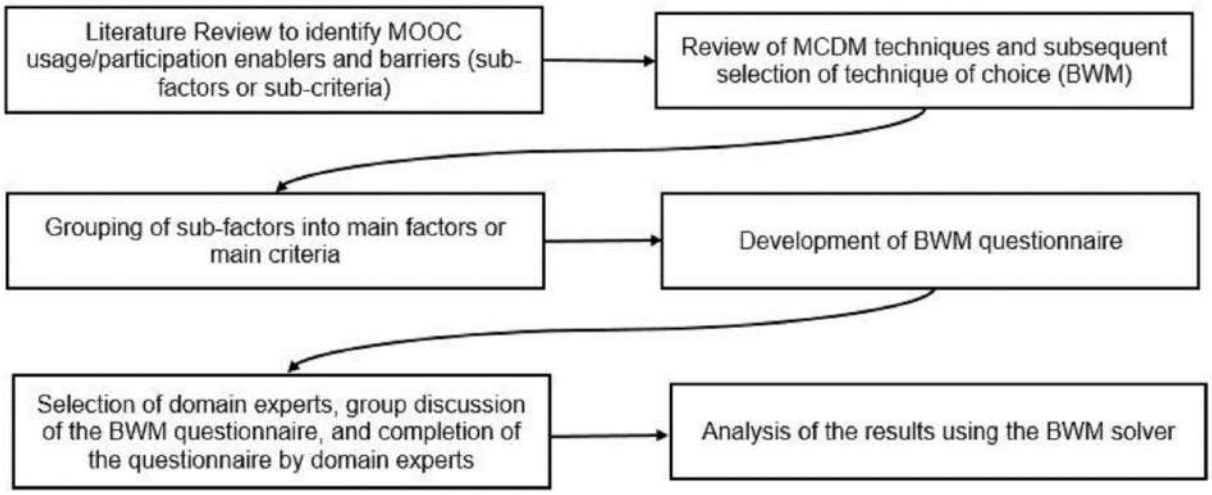


Figure I: The Research Methodology

The second stage involved a review of the literature on MCDM techniques to identify the most appropriate technique. BWM was chosen because of its advantages, as stated earlier. Additionally, BWM does not require a large sample size.

The third stage involved the grouping of sub-factors into main factors or main criteria. There were 4 main factors/criteria namely learner attributes, course characteristics, social factors, and technological factors. The grouping is necessary because the BWM technique requires main criteria and sub-criteria for the calculation of weights.

The fourth stage was BWM questionnaire development. The questionnaire was developed based on Rezaei (2015). The first part of the questionnaire consisted of the selection of the best (most important) and worst (least important) main criteria. This was followed by the ranking of the best main criterion against the other criteria, and then the ranking of the worst main criterion against the other criteria. A 9-point scale was used anchored between “equally important” and “absolutely more important”. The procedure was repeated for all the sets of sub-criteria in each of the 4 groups. Table I shows the grouping of the sub-criteria under each main criterion.

During the fifth stage, ten domain experts were identified and chosen for the completion of the questionnaire. The domain experts were mostly from academia. They have in-depth knowledge of student experiences with MOOCs and other Open Educational Resources (OERs). Table II shows the profile of the experts. Ten experts were chosen because BWM does not require a large sample size. Other MCDM studies have used similar number of experts/respondents/cases; for instance

Table I: Grouping of sub-factors

Main Factor	Sub-factor	Reference
Learner attributes	Academic skills and abilities	(Aldowah et al., 2020), (Alemayehu & Chen, 2021), Semenova and Rudakova (2016)
	Prior experience	(Aldowah et al., 2020), (Alemayehu & Chen, 2021), (Greene et al. 2015), Semenova and Rudakova (2016)
	Time	(Aldowah et al., 2020), (Greene et al. 2015), (Vu et al. 2015)
	Motivation	(Aldowah et al., 2020), (Alemayehu & Chen, 2021)
	Attitude	(Alemayehu & Chen, 2021)
	Economic	(Alemayehu & Chen, 2021)
	Computer self-efficacy	Gomez-Zermeno and Aleman de La Garza (2016)
Course Characteristics	Feedback	(Aldowah et al., 2020), (Alemayehu & Chen, 2021)
	Course Quality	(Alemayehu & Chen, 2021)
	Course difficulty	(Aldowah et al., 2020)
	Accessibility	(Nanda et al., 2021)
Social factors	Social presence	(Aldowah et al., 2020), (Eriksson et al. 2017)
	Social support	(Aldowah et al., 2020), (Eriksson et al. 2017)
	Interaction	(Aldowah et al., 2020) (Nanda et al., 2021), (Alemayehu & Chen, 2021)
Technological factors	Internet access	(Fianu et al., 2020).
	Internet quality	(Fianu et al., 2020).
	Platform quality	(Nanda et al., 2021)

Malek & Desai (2019) [5 experts], Gupta et al. (2020) [8 experts], and Khakdaman et al. (2020) [6 choice tasks]. An online focus group meeting was held with the experts to discuss the questionnaire. The questionnaire was fine-tuned based on the feedback from the experts. The amended questionnaire was set up in Google forms; subsequently, the link was sent to the experts for completion. The experts completed the questionnaire accordingly. The questionnaire responses were exported to MS Excel and subsequently analyzed. The researcher modified the original BWM Solver created by Jafar Rezaei (Rezaei, 2015) to suit the context of the study. The BWM Solver is an MS Excel file that has built-in functions that automatically calculates the respective weights (local and global) of each criterion based on the responses from the questionnaire. The Solver allows the researcher to populate the template with all the criteria, select the best criteria, select the worst criteria, and input respondent rankings (as per the 1-9 scale). The Solver calculates weights for one respondent at a time. Ten (10) Solver files were created for each respondent. Figure II and Figure III are screenshots of the populated BWM Solver for one of the respondents.

Criteria Number =	Criterion 1	Criterion 2	Criterion 3	Criterion 4
Names of Criteria	Learner attributes	Course Characteristics	Social factors	Technological factors
Select the Best	Learner attributes			
Select the Worst	Social factors			

Best to Others	Learner attributes	Course Characteristics	Social factors	Technological
Learner attributes	1	8	8	6

Others to the Worst	Social factors
Learner attributes	9
Course	8
Social factors	1
Technological	8

Weights	Learner attributes	Course Characteristics	Social factors	Technological
	0.673267327	0.118811881	0.04950495	0.158415842

Ksi*	0.277227723

Figure II: Responses on the ranking of the 4 main criteria by a respondent using the BWM Solver

Criteria Number =	Criterion 1	Criterion 2	Criterion 3	Criterion 4	Criterion 5	Criterion 6	Criterion 7
Names of Criteria	Academic	experience	Time	Attitude	Motivation	Economic	Computer S E
Select the Best	Attitude						
Select the Worst	Prior						

Best to Others	Academic	Prior	Time	Attitude	Motivation	Economic	Computer
Attitude	7	7	6	1	7	6	8

Others to the	Prior
Academic	8
Prior experience	1
Time	9
Attitude	9
Motivation	8
Economic	8
Computer S E	8

Weights	Academic	Prior	Time	Attitude	Motivation	Economic	Computer
	0.0962618	0.0359378	0.1123055	0.4626985	0.0962618	0.1123055	0.0842291

Ksi*	0.2111343

Figure III: Responses on the ranking of the 7 sub-criteria under Learning Attributes by a respondent (using the BWM Solver)

Table II: Profile of Experts

Expert	Gender	Position	Area of Expertise	Years of Experience
Expert 1	Male	Lecturer	Information Systems	7
Expert 2	Male	IT Support Staff	Systems Analyst	12
Expert 3	Male	Lecturer	Leadership studies	5
Expert 4	Female	Lecturer	Instructional technology/Learning science	20
Expert 5	Male	Professor	IT	30
Expert 6	Female	Educator / mentor	Physics	>10
Expert 7	Male	Senior Assistant Librarian	Library Science	31
Expert 8	Male	Lecturer	Management and economics	7
Expert 9	Male	Assistant Lecturer	Information science	8
Expert 10	Male	Assistant Lecturer	E-learning	9

5.0 Results of Data Analysis

The initial task was the calculation of the respective weights of the main factors/criteria, viz. learner attributes, course characteristics, social factors, and technological factors. Table III shows the results of the calculations. Table III shows that regarding the main factors, "learner attributes" has the highest average weight (0.369610821) for the 10 experts, while "social factors" has the lowest average weight (0.150296518). "Technological factors" has the second highest average weight (0.266924358) while "course characteristics" has the third highest average weight (0.213168303). This result means that the group of experts are of the opinion that the "attributes of the learner" is the most important factor in the usage of MOOCs, while the social factor is the least important. The BWM consistency ratio shows the level of reliability of the output; the output of BWM is always consistent (Rezaei, 2015). The closer the consistency ratio is to zero, the better (Rezaei, 2015). Table III shows that the output of Expert 3 is the most reliable while that of Expert 2 is the least reliable. The average consistency ratio is 0.31, which is not highly reliable, but consistent.

Table IV shows the final ranking of the sub-factors. The ranking is based on the value of the global weight; the sub-factor with the highest global weight has a rank of 1, while the sub-factor with the lowest global weight has a rank of 17. The table shows that internet access is the most important sub-factor (with a rank of 1 and global weight 0.148009) while course difficulty is the least important sub-factor (with a rank of 17 and global weight 0.025652). The top three most important sub-factors are internet access, attitude, and course quality, while the three least important factors are social support, prior experience, and course difficulty.

Table III: Weights and Consistency Ratios for Main Factors

Expert	Learner attributes	Course Characteristics	Social factors	Technological factors	Consistency Ratio
Expert 1	0.673267327	0.118811881	0.04950495	0.158415842	0.211134285
Expert 2	0.149606299	0.070866142	0.62992126	0.149606299	0.417322835
Expert 3	0.204545455	0.204545455	0.113636364	0.477272727	0.136363636
Expert 4	0.138436482	0.594462541	0.193811075	0.073289902	0.374592834
Expert 5	0.165738162	0.614206128	0.142061281	0.077994429	0.380222841
Expert 6	0.673076923	0.057692308	0.134615385	0.134615385	0.269230769
Expert 7	0.116071429	0.116071429	0.049107143	0.71875	0.325892857
Expert 8	0.126213592	0.126213592	0.097087379	0.650485437	0.359223301
Expert 9	0.724576271	0.11440678	0.046610169	0.11440678	0.305084746
Expert 10	0.724576271	0.11440678	0.046610169	0.11440678	0.36
Average	**0.369610821**	**0.213168303**	**0.150296518**	**0.266924358**	**0.31390681**

Table IV: Final ranking of sub-factors

Main Factor	Major weight	Sub-factor	Local weight	Global weight	Rank
Learner attributes	0.369610821	Academic skills and abilities	0.089016591	0.034876	**14**
		Prior experience	0.110581253	0.026441	**16**
		Time	0.132477827	0.039993	**12**
		Motivation	0.15037759	0.061604	**8**
		Attitude	0.240955758	0.099098	**2**
		Economic	0.105381206	0.037907	**13**
		Computer self-efficacy	0.171209776	0.069693	**5**
Course Characteristics	0.213168303	Feedback	0.165764136	0.047782	**10**
		Course Quality	0.389222948	0.07795	**3**
		Course difficulty	0.102277885	0.025652	**17**
		Accessibility	0.342735031	0.061784	**7**
Social factors	0.150296518	Social presence	0.264070621	0.068919	**6**
		Social support	0.243553519	0.034689	**15**
		Interaction	0.492375859	0.046688	**11**
Technological factors	0.266924358	Internet access	0.46428877	0.148009	**1**
		Internet quality	0.253509124	0.048826	**9**
		Platform quality	0.282202106	0.070089	**4**

6.0 Discussion of the Results

As stated in the previous sections, "learner attributes" is the most important main factor, while the top three most important sub-factors are internet access, attitude, and course quality. Çelikbilek & Adıgüzel Tüylü (2019) conducted a similar study using fuzzy DEMATEL and ANP. Their study had three (3) main factors and nineteen (19) sub-factors. The main factors were technology, education, and e-learning. Technology was found to be the most important main factor. This paper found "technological factors" to be the second most important main factor. There is some consistency between this paper and the study conducted by Çelikbilek & Adıgüzel Tüylü (2019) because technology emerges as an important factor in e-

learning uptake. This paper found internet access to be the most important sub-factor; internet access is a technological factor. Çelikbilek & Adıgüzel Tüylü (2019) state that in the current technological era where most of the prestigious universities have online content delivered through videos, papers, online tests, and online courses, technological factors have become indispensable in the e-learning ecosystem. Another study conducted by Naveed et al. (2021) had four (4) main factors: technological, individual/user, pedagogical, and social. The 4 main factors were further classified into thirteen (13) sub-factors. Naveed et al. (2021) used a fuzzy AHP technique to prioritize the m-learning (mobile learning) adoption factors. The technological factor was found to be the most important factor, followed by the individual/user factor. The results of the study conducted by Naveed et al. (2021) are consistent with this paper because this paper found learner attributes and technological factors to be the two most important factors. "Technological facilitating conditions" was found to be the most important sub-factor/sub-criterion, while individual self-efficacy was found to the second most important criterion. Naveed et al. (2021) stated that technological factors are critical to m-learning, thus m-learning providers must put in resources to update their infrastructure and provide the latest technology when implementing m-learning solutions. Hsieh (2016) used MCDM to rank three (3) main criteria regarding MOOC adoption; higher education student's desires, online-learning technological functions, and online- education scholar's considerations. The results of their study showed that online-learning technological functions had the highest weight among the 3 main factors.

Fianu et al. (2020) recommended the use of MOOCs in blended learning formats in tertiary institutes. In their mixed methods study to identify MOOC uptake factors, functional internet access and teacher motivation (among other factors) were identified as significant influencers of MOOC uptake. This paper found internet access to be the most important sub-factor, while student attitude is the second most important sub-factor. While blending face-to-face lectures with MOOCs may not be a typical blended learning strategy, Fianu et al. (2020) argued that MOOCs can complement information students get from face-to-face lectures. Regarding attitude, they reiterated the point that teacher motivation can change students' attitude towards MOOC uptake. University management must invest in infrastructure that will facilitate the provision of quality internet access to students to promote e-learning. Regulators of internet service providers (ISPs) should be effective and ensure that ISPs meet set Quality of Service (QoS) targets. Appropriate sanctions should be applied if ISPs fail to provide quality service. ISPs must also endeavor to extend their services to new areas that need internet services. As teacher motivation is an important factor in MOOC uptake, teachers/lecturers should do their best to encourage students to use MOOCs as a source of educational content to complement the traditional sources of educational content.

Course quality and platform quality were the third and fourth most important sub-factors respectively. This result implies that MOOC providers must ensure that the courses are well designed with pedagogically sound content. The MOOC platforms should also be reliable (no downtime), easy to navigate, have fast-loading websites, quality graphics, and fast downloads. Computer self-efficacy is the fifth most important sub-factor. The importance of computer self-efficacy shows that universities must support students with training regarding computer literacy. Universities can setup computer literacy courses at the entry level to improve computer self-efficacy of students.

While all the factors considered in the study are important, university management and lecturers may want to focus their efforts and resources on the most important factors, while taking the other factors into consideration.

7.0 Conclusion

The results of the study are consistent with similar studies that used MCDM techniques to prioritize e-learning uptake factors, including MOOCs. The five most important factors are internet access, attitude, course quality, platform quality, and computer self-efficacy. University management must invest in infrastructure that will facilitate the provision of quality internet access to students to promote e-learning. Regulators of internet service providers (ISPs) should be effective and ensure that ISPs meet set Quality of Service (QoS) targets. Appropriate sanctions should be applied if ISPs fail to provide quality service. ISPs must also endeavor to extend their services to new areas that need internet services. Teachers/lecturers should do their best to encourage students to use MOOCs as a source of educational content to complement the traditional sources of educational content. MOOC providers must ensure that the courses are well designed with pedagogically sound content. The MOOC platforms should also be reliable (no downtime), easy to navigate, have fast-loading websites, quality graphics, and fast downloads. Universities should have computer literacy courses at the entry level to improve computer self-efficacy of students. University management and lecturers may want to focus their efforts and resources on the most important factors, while taking the other factors into consideration.

8.0 Directions for future research

The study can be expanded with additional sub-factors. Additionally, other MCDM techniques such as fuzzy AHP can be employed to prioritize the MOOC uptake factors.

9.0 Limitations of the study

The study was limited to 17 sub-factors. There could be more factors regarding MOOC uptake.

References

Aldowah, H., Al-Samarraie, H., Alzahrani, A. I., & Alalwan, N. (2020). Factors affecting student dropout in MOOCs: a cause and effect decision-making model. Journal of Computing in Higher Education, 32(2), 429–454. https://doi.org/10.1007/s12528-019-09241-y

Alemayehu, L., & Chen, H. L. (2021). Learner and instructor-related challenges for learners' engagement in MOOCs: a review of 2014–2020 publications in selected SSCI indexed journals. Interactive Learning Environments, 0(0), 1–23. https://doi.org/10.1080/10494820.2021.1920430

Baturay, M. H. (2015). An overview of the world of MOOCs. Procedia - Social and Behavioral Sciences, 174, 427–433. https://doi.org/10.1016/j.sbspro.2015.01.685

Çelikbilek, Y., & Adıgüzel Tüylü, A. N. (2019). Prioritizing the components of e-learning systems by using fuzzy DEMATEL and ANP. Interactive Learning Environments, 0(0), 1–22. https://doi.org/10.1080/10494820.2019.1655065

Duan, L., Tavasszy, L. A., & Rezaei, J. (2019). Freight service network design with heterogeneous preferences for transport time and reliability. Transportation Research Part E: Logistics and Transportation Review, 124, 1–12. https://doi.org/10.1016/j.tre.2019.02.008

Eriksson, T., Adawi, T., & Stöhr, C. (2017). '" Time is the bottleneck "': a qualitative study exploring why learners drop out of MOOCs. Journal of Computing in Higher Education, 29(1), 133–146. https://doi.org/10.1007/s12528-016-9127-8

Fianu, E., Blewett, C., & Ampong, G. O. (2020). Toward the development of a model of student usage of MOOCs. Education+ Training, 62(5), 521–541.

Fianu, E., Blewett, C., Ampong, G. O. A., & Ofori, K. S. (2018). Factors affecting MOOC usage by students in selected Ghanaian universities. Education Sciences, 8(2), 1–15. https://doi.org/10.3390/educsci8020070

Gomez-Zermeno, M. G., & Aleman de La Garza, L. (2016). Research analysis on MOOC course dropout and retention rates. Turkish Online Journal of Distance Education, 17(2), 3–14.

Greene, J. A., Oswald, C. A., & Pomerantz, J. (2015). Predictors of Retention and Achievement in a Massive Open Online Course. American Educational Research Journal, 52(5), 925–955. https://doi.org/10.3102/0002831215584621

Gupta, H., Kusi-Sarpong, S., & Rezaei, J. (2020). Barriers and overcoming strategies to supply chain sustainability innovation. Resources, Conservation and Recycling, 161. https://doi.org/10.1016/j.resconrec.2020.104819

Herrmann, C., Schmidt, C., Kurle, D., Blume, S., & Thiede, S. (2014). Sustainability in manufacturing and factories of the future. International Journal of Precision Engineering and Manufacturing - Green Technology, 1(4), 283–292. https://doi.org/10.1007/s40684-014-0034-z

Hsieh, M. Y. (2016). Online learning era: Exploring the most decisive determinants of MOOCs in Taiwanese higher education. Eurasia Journal of Mathematics, Science and Technology Education, 12(5), 1163–1188. https://doi.org/10.12973/eurasia.2016.1504a

Jordan, K. (2015). Massive open online course completion rates revisited: Assessment, length and attrition. International Review of Research in Open and Distance Learning, 16(3), 341–358. https://doi.org/10.19173/irrodl.v16i3.2112

Khakdaman, M., Rezaei, J., & Tavasszy, L. A. (2020). Shippers' willingness to delegate modal control in freight transportation. Transportation Research Part E: Logistics and Transportation Review, 141. https://doi.org/10.1016/j.tre.2020.102027

Malek, J., & Desai, T. N. (2019). Prioritization of sustainable manufacturing barriers using Best Worst Method. Journal of Cleaner Production, 226, 589–600. https://doi.org/10.1016/j.jclepro.2019.04.056

Mardani, A., Jusoh, A., & Zavadskas, E. K. (2015). Fuzzy multiple criteria decision-making techniques and applications - Two decades review from 1994 to 2014. Expert Systems with Applications, 42(8), 4126–4148. https://doi.org/10.1016/j.eswa.2015.01.003

Mi, X., Tang, M., Liao, H., Shen, W., & Lev, B. (2019). The state-of-the-art survey on integrations and applications of the best worst method in decision making: Why, what, what for and what's next? Omega (United Kingdom), 87, 205–225. https://doi.org/10.1016/j.omega.2019.01.009

Moe, R. (2015). The brief & expansive history (and future) of the MOOC : Why two divergent models share the same name. Current Issues in Emerging ELearning, 2(1).

Nanda, G., Douglas, K. A., Waller, D. R., Merzdorf, H. E., & Goldwasser, D. (2021). Analyzing Large Collections of Open-Ended Feedback from MOOC Learners Using LDA Topic Modeling and Qualitative Analysis. IEEE Transactions on Learning Technologies, 14(8), 1–12. https://doi.org/10.1109/TLT.2021.3064798

Naveed, Q. N., Aseere, A. M., Muhammad, A., Islam, S., Qureshi, M. R. N., Siddique, A., Hussain, M. R., & Shahwar, S. (2021). Evaluating and ranking mobile learning factors using a multi-criterion decision-making (Mcdm) approach. Intelligent Automation and Soft Computing, 29(1), 111–129. https://doi.org/10.32604/iasc.2021.015009

Newton, D. (2020, June 21). The "Depressing" And "Disheartening" News About MOOCs. Forbes.Com. https://www.forbes.com/sites/dereknewton/2020/06/21/the-depressing-and-disheartening-news-about-moocs/?sh=14962a5876ed

Porter, S. (2015). To MOOC or Not to MOOC. How Can Online Learning Help to Build the Future of Higher Education? (R. Rikowski (ed.)). Elsevier.

Rezaei, J. (2015). Best-worst multi-criteria decision-making method. Omega (United Kingdom), 53, 49–57. https://doi.org/10.1016/j.omega.2014.11.009

Rezaei, J. (2016). Best-worst multi-criteria decision-making method: Some properties and a linear model. Omega (United Kingdom), 64, 126–130. https://doi.org/10.1016/j.omega.2015.12.001

Rezaei, J., Kothadiya, O., Tavasszy, L., & Kroesen, M. (2018). Quality assessment of airline baggage handling systems using SERVQUAL and BWM. Tourism Management, 66, 85–93. https://doi.org/10.1016/j.tourman.2017.11.009

Rodriguez, O. (2012). MOOCs and the AI - Stanford like Courses : Two Successful and Distinct Course Formats for Massive Open Online Courses. European Journal of Open, Distance and E-Learning, 1–12.

Salimi, N., & Rezaei, J. (2018). Evaluating firms' R&D performance using best worst method. Evaluation and Program Planning, 66, 147–155. https://doi.org/10.1016/j.evalprogplan.2017.10.002

Semenova, T. V., & Rudakova, L. M. (2016). Barriers to Taking Massive Open Online Courses (MOOCs). Russian Education and Society, 58(3), 228–245. https://doi.org/10.1080/10609393.2016.1242992

Seuring, S. (2013). A review of modeling approaches for sustainable supply chain management. Decision Support Systems, 54(4), 1513–1520. https://doi.org/10.1016/j.dss.2012.05.053

Shah, D. (2016). Monetization over Massiveness: A Review of MOOC Stats and Trends in 2016. Class Central. https://www.class-central.com/report/moocs-stats-and-trends-2016/

Van De Kaa, G., Rezaei, J., Kamp, L., & De Winter, A. (2014). Photovoltaic technology selection: A fuzzy MCDM approach. In Renewable and Sustainable Energy Reviews (Vol. 32, pp. 662–670). Elsevier Ltd. https://doi.org/10.1016/j.rser.2014.01.044

Vu, D., Pattison, P., & Robins, G. (2015). Relational event models for social learning in MOOCs. Social Networks, 43, 121–135. https://doi.org/10.1016/j.socnet.2015.05.001

Yazdani-Chamzini, A., Razani, M., Yakhchali, S. H., Zavadskas, E. K., & Turskis, Z. (2013). Developing a fuzzy model based on subtractive clustering for road header performance prediction. Automation in Construction, 35, 111–120. https://doi.org/10.1016/j.autcon.2013.04.001

Zheng, S., Rosson, M. B., Shih, P. C., & Carroll, J. M. (2015). Understanding Student Motivation , Behaviors , and Perceptions in MOOCs. Motivation and Dynamics of the Open Classroom, 1882–1895.