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Adoption of Artificial Intelligence/Data Analytics in Business Decision-Making: Effects on Efficiency and Competitive Advantage

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ABSTRACT

The blistering development of the Artificial Intelligence (AI) and Data Analytics (DA) has reshaped the contemporary way of decision-making, optimization of processes, and maintaining a competitive advantage among modern organizations. This research paper explores how AI and analytics-based solutions can be implemented in business decision-making processes and highlights the impact of these solutions on operational effectiveness, strategic flexibility, and sustainability. Based on the available empirical evidence, the technological adoption models, and case studies in the industry, this study sheds light on the impact of predictive analytics, machine learning, and automated decision support systems on the performance of organizations. It also discusses obstacles including lack of skills, data quality problems, and technological change resistance which may hamper successful adoption. The paper assumes a conceptual framework that connects the AI/DA adoption and the increases in efficiency and competitive advantage and incorporates the Technology-Organization-Environment model and Resource-Based View. Results can be used to enhance further insights into the relationship between the capability of data and the responsiveness of firms in new and developed economies.

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Introduction

The creation of Artificial Intelligence (AI) and Data Analytics (DA) has fundamentally changed the modern business environment, and it leads to the changes in the manner of how organizations gain knowledge, distribute resources, and make decisions. In a highly competitive world where technology is disruptive and market forces are unpredictable, companies are turning to AI-powered systems and superior analysing software as a way to enhance efficiency and build competitive advantage. Managerial intuition and retrospective data that form the basis of

decision-making are also being replaced by predictive algorithms, machine learning models, and real-time analytics that are able to act upon massive amounts of information more quickly and more accurately. According to Qamruzzaman, [1], those organizations, which have learned to incorporate the benefits of AI performance, are able to outcompete their rivals by making more timely, optimized, and evidence-based decisions. Hence, the study of how AI and analytics affect business decision-making processes has become one of the key themes in management research and practice.

The introduction of AI and data analytics is not just a technological improvement of the organization but a revolutionary factor that increases organizational learning, strategic flexibility, and operational execution. The machine learning algorithms enable companies to discover the latent patterns, predict consumer behavior, anticipate supply chain upsets, and automate their daily decisions with high accuracy [2]. Through such tools, organizations are able to simplify some of their processes including demand forecasting, financial planning, risk assessment, and customer relationship management. Predictive and prescriptive analytics allow the manager to consider possible alternate scenarios and select the best courses of action based on existing evidence instead of assumptions [2]. These technological advancements minimize uncertainty, which is one of the greatest limitations to strategic decision-making, thereby increasing the efficiency of an organization, reducing human error, and increasing the overall productivity.

In addition, AI and analytics implementation is an important factor in determining competitive advantage. According to the Resource-Based View (RBV), the better the performance of the firms, the better they have valuable and rare, inimitable, and non-substitutable resources [3]. When data is transformed into actionable insights using AI, it becomes a strategic resource that has high potential of distinguishing firms amongst their competitors. The examples of such companies as Amazon, Google, and Alibaba demonstrate how AI-driven capabilities to make decisions are the foundational facilitators of a long-term competitive advantage because these firms provide personalized customer experiences, optimize logistics, automate recommendations, and continuously innovate [4]. Besides that, AI-based analytical systems enable the small and medium enterprises (SMEs) to compete with bigger companies, keeping costs down, boosting productivity, and improving strategic flexibility. With the world market becoming more and more innovative and responsive, the adoption of AI will be a question of survival and not an opportunity to improve something.

The use of AI and data analytics is growing more rapidly in developing economies, with companies trying to beat operation barriers and resource shortages. Research points out that companies in such nations as Pakistan, India, and Malaysia are starting to appreciate the importance of AI in helping solve supply chain inefficiencies, improve customer engagement, and boost financial decision-making, as well as, streamline production processes [5]. Nevertheless, organizational preparedness, digital infrastructure, and institutional help also determine the spread of AI technologies in new markets. Technology-Organization-Environment (TOE) framework has been extensively used to describe these variations by associating the adoption decision to the characteristics of technology (complexity, compatibility, etc.), organizational (digital skills and organizational culture, etc.) as well as environmental (competitive pressure, regulatory requirements, etc.) factors. It implies that AI implementation does not only need an investment in technology but also the organizational change, upskilling of the workforce, and planning efforts.

Although it has a transformative potential, there are numerous challenges facing organizations that make adoption of AI successful. Among the most notable obstacles, one can mention the lack of qualified specialists who can create, administer, and interpret AI systems [6]. There are also data quality challenges, cybersecurity threats, bias of algorithms and high costs of implementation which are the major limitations. Also, the success of adoption may be constrained by resistance to technological change particularly by the middle managers who feel threatened by the existence of AI. Transparency, privacy, and fairness are other ethical aspects that complicate decision-making based on AI and demand organizations to establish governance systems to prevent irresponsible and untrustworthy use [7]. To make the best use of AI systems and achieve long-term sustainability, it is necessary to overcome these challenges.

As the world continues to get more competitive, companies are starting to consider AI and analytics adoption as a part and parcel of digital transformation and strategic refresh. Organizations which invest early in such technologies are more likely to develop advanced dynamic capabilities, enabling them to respond rapidly to any uncertainties in the market, innovate in a more efficient way, and perform at the higher levels [8]. Data-rich companies do not only gain its value by having a mass of data but by being able to transform them into actionable information through analytics and machine learning. Therefore, the purpose of this research is to explore the impact of AI implementation and data analytics application on business decision-making, business operation, and competitive strength. The study combines theoretical insights of the TOE framework and the RBV to demonstrate why and how companies can gain performance through incorporating AI-based capabilities into their strategy and operations.

Literature Review

Use of Artificial Intelligence (AI) and Data Analytics (DA) in business decision making is now one of the most commonly studied fields in the management, information systems and organizational performance studies. Researchers have always maintained that AI-based tools change the manner in which organizations capture, process and interpret information, resulting in the quality of decisions made, decrease of the uncertainty, and efficiency of operations. The initial endeavors in analytics focused on the usefulness of descriptive and diagnostic knowledge, yet more current research points to the transition into the predictive and prescriptive systems that can predict market trends, customer preferences, and operational risks [9]. This shift in the conventional data processing to the new hi-tech AI-based systems represents a paradigm shift in the decision-making process of the managers with the focus on automation, accuracy, and real-time intelligence. Lee et al., (2015) state that companies that have successfully adopted the concept of big data analytics in their decision-making processes show high organizational agility, high levels of innovation, and better financial performance, which implies that analytics has become more than an auxiliary tool, but a strategic resource.

One of the main current streams of literature centers around the mechanisms by which AI and analytics can be improved and used to make decisions more efficient. According to Zhai and Liu, [11], the unsupervised and supervised learning algorithms allow business to recognize customer churn trends, predict sales, manage supply chains, and detect fraud far more effectively than the traditional statistical approaches. On the same note,Wamba et al., (2020) state that AI systems enhance efficiency in decision-making by automating the repetitive processes, minimizing the processing time, and biasing human decisions. Predictive analytics studies also further highlight that data-driven systems enable organizations to be more proactive instead of reactive, which

leads to increased response speed and stability in operations [13]. These observations are a confirmation that AI and analytics play a direct role in decision quality through the provision of relevant and timely information that is precise.

The other central theme of the literature is related to the strategic implications of the adoption of AI, and how it can be used to achieve a competitive advantage. One of the theoretical lenses that enable researchers to study the value of AI-driven capabilities is the Resource-Based View (RBV). As explained by Lee et al., (2022), there are competitive advantage when firms are endowed with valuable, rare, inimitable, and non-substitutable resources. The information, once converted into insights through advanced AI software, meets these requirements since it becomes integrated into the organizational operations and hard to imitate by the rival companies. Examples of companies that have used AI to strengthen competitive advantage include Amazon and Netflix because they can use AI to make personalized recommendations, optimize logistics, and adopt dynamic pricing strategies [15]. The success of AI proves that it not only improves the quality of internal decision making but also changes the whole industry with innovations and the high level of customer experiences. Moreover, the studies indicate that the companies that implement AI at an earlier stage than the competition are more likely to build stronger dynamic capabilities, which allow them to adjust to the changes in the environment more efficiently [16]. The literature therefore makes AI not only a technology investment but strategic ability that can be used to gain competitiveness in the long term.

A considerable share of the literature is also devoted to factors that impact the adoption of AI and analytics in various organizational contexts. Technology-Organization-Environment (TOE) framework has been extensively employed in explaining adoption patterns using the technological readiness, organizational culture and competitive pressure. According to Venkatesh et al., (2012), the adoption is based on the perception of the firms towards technology based on compatibility, complexity and relative advantage. The literature that expands on the TOE model has shown that higher chances of adoption of advanced analytics are found in organizations with well-built digital infrastructure, data-driven cultures, and support at the top management level [17,18] .Equally, other environmental forces that are driving the use of AI include globalisation, digital competition and customer demands that are driving the use of AI. To use AI, an example of such firms in the emerging economies is that Dietvorst et al., (2015)discovered that firms should use AI in order to cut inefficiencies, surpass resource limitation, and rival technologically developed firms. The literature thus shows that adoption is influenced by the internal capabilities and external demands.

The future studies are reporting the connection between AI implementation and the performance of the organization in terms of innovation and productivity Huang and Rust, (2021) prove that companies that embrace AI in marketing and product development possess higher innovation output and customer contact because of improved data perceptions and less development expenditure. Operations management research indicates that AI results in improved productivity through minimization of operational expenses, supply chain network optimization, minimization of production downtimes and optimization of resource allocation [7]. Similarly, decision support systems that are automated would decrease the amount of work of managers and increase the concentration on strategic activities, which will also add to the productivity increase. The overall findings of the research point to the idea that the implementation of AI has far-reaching implications on the service of an organization, not only in terms of decisions.

There is also research on the human aspect of AI adoption, such as the acceptance of the employees, and skills needed and organizational culture. Though there are advantages of technology, numerous studies have cited serious human and behavioral limitations to successful implementation of AI. As Kiron et al., (2011) point out, one of the most significant issues is the lack of qualified professionals who could comprehend, implement, and support AI systems. Moreover, algorithm aversion, which is a human tendency to doubt the automation, also affects the success in adoption in particular, when it comes to decision-making with high stakes [10]. The organizational culture is also vital, when companies that are characterized by inflexible hierarchy, low levels of digital literacy, or those that are not ready to accept change cannot easily implement AI into their decision making process [9]. These works all point to the fact that the adoption of AI is not a technological matter but a socio-organizational phenomenon that needs individuals to alter their skills, leadership, and culture.

The other area of concern in AI-driven decision-making is ethical, privacy, and governance, which is also spoken in another important vein of literature. Researchers raise apprehensions over the fact that algorithmic bias, lack of transparency, and poor data governance may destroy the trust in AI systems. Zhai and Liu, (2023)propose that the use of technologies should be supported by moral principles that would help prevent the irresponsible, unfair, and unintended use of AI. Research indicates that entities that do not have governance procedures have a higher tendency of experiencing reputational risks, legal difficulties, and mistrust among their employees. Thus, the ethical governance also becomes a key element of sustainable adoption of AI technologies.

Lastly, recent empirical research suggests that there is extensive information about the positive correlation between the adoption of AI/analytics and better quality of decisions, efficiency, and competitive advantage in a wide range of industries such as the finance, healthcare, retail, and manufacturing. As an example, Wamba et al., [12] discovered that analytics-based decision-making is a more effective predictor of financial forecasting and less risky in the banking sector. AI is used to enhance the predictive maintenance, quality control, and production scheduling in the manufacturing industry, which results in significant cost savings. Machine learning can be used in the retail sector to improve customer segmentation, where the companies are able to provide personalized services and boost customer loyalty. These illustrations provide evidence of the wide applicability of AI and analytics and enhance the idea of the use of analytics and AI as the pillars of the contemporary business strategy and performance.

Methodology

Research Design

The research design used in this study is the quantitative and cross-sectional research design that will explore the implementation of Artificial Intelligence (AI) and Data Analytics (DA) in the decision-making process of businesses and its effects on the efficiency and competitive advantage of the decisions. The quantitative method is also able to test hypothesis and objectively measure relationships among variables and thus give quality statistics. The cross-sectional data collection would provide a summary of the present views and usages of AI adoption and, thus, would be appropriate in determining the impact of AI on organizational efficiency and competitiveness at a particular time.

Research Approach

It makes use of a hypothetical-deductive research strategy since the research makes theoretical assumptions about the existence of the models, such as the Resource-Based View (RBV) and the Technology-Organization-Environment model (TOE), and proves them empirically. This will help to keep the research theoretically informed and generate generalizable findings regarding the role of AI and data analytics in business decision-making.

Population and Sampling

The sample of this research will be employees and managers who are employed in organizations that extensively use AI and data analytics to make business decisions. The targeted industries are IT companies, financial institutions, telephone companies, retail chains and manufacturing organizations. The purposive sampling method is used to select respondents who have previous experience related to the use of AI/DA; this will also make sure that the respondents are knowledgeable on the subject of adoption and its effects. In line with the Structural Equation Modeling (SEM), 300 respondents will be used as a sample size to yield adequate statistical power to conduct hypothesis testing and model estimation.

Data Collection Method

The data are gathered using a structured questionnaire as primary data, which is developed based on scales that were previously tested and modified according to the situation of adopting AI and data analytics. The questionnaire will have four major parts including demographic data, adoption of AI/DA, decision-making efficiency, and competitive advantage. All the items should be measured on a five-point Likert scale that is between 1 (Strongly Disagree) and 5 (Strongly Agree). The pilot test is done to verify the clarity and reliability of the instrument as well as its validity and reliability to data collection before the actual data collection.

Measurement of Variables

There are three important constructs in the study. The use of AI/DA is measured using questions that cover views of usefulness, ease of use, ability to integrate data, and compatibility to technology [12, 13]. The efficiency of decision-making is measured regarding the speed, accuracy, minimization of errors, and live insight delivered by the AI-based systems [7]. Operational and strategic advantages are evaluated in terms of cost efficiency, innovation, customer satisfaction and responsiveness as the measures of competitive advantage [2]. The validated Likert-scale items are used to operationalize all constructs to allow the comparison with the existing literature.

Data Analysis Techniques

The analysis of data is carried out with the help of SmartPLS, which implies a two-step process of SEM: measurement model analysis and structural model analysis. Reliability tests are Cronbach alpha and Composite Reliability (CR) whereas validity is determined by Average Variance Extracted (AVE) and discriminant validity through Fornell-Larcker criterion. The data is summarized using descriptive statistics (mean, standard deviation, frequencies) and correlation analysis to be able to consider the preliminary relations. Hypothesized paths between the adoption of AI/DA, decision-making efficiency, and competitive advantage are tested using the structural model, and path coefficients, t-values, p-values, and R 2 values are reported. A test of

significance of relationships is done using bootstrapping with 5,000 resamples to ensure robustness.

Ethical Considerations

The ethical standards of the research are followed. The nature of participation is explained to the respondents as voluntary, the confidentiality of their responses, and anonymity of their personal details. The information obtained would only be utilized in the research process and the interviewees would be guaranteed that no personal details will be revealed. Ethical adherence is used to ensure that the research possesses academic integrity and does not violate the rights of the study subjects.

Limitations

Although the methodology is sound there are limitations to the study. The sample is also limited to organizations that already apply AI and data analytics, which may not be applicable in general to firms that are not using AI. Cross-sectional design only captures perceptions at one moment in time, which does not allow one to make inferences on causality. Also, self-reported data can bring some bias to the results, but the probability of this threat can be reduced by thoroughly designing the questionnaires and testing them with pilots.

Data Analysis and Findings

This paper used primary data gathered by 300 employees/managers working in IT, financial, telecom, retail, and manufacturing industries in Southern Punjab, Pakistan to test the implications of AI and data analytics implementation on the efficiency of decision-making and competitive advantage. Following the filtering of questionnaires with incomplete responses, 280 questionnaires were analyzed. SmartPLS and SPSS were used to analyze the data to perform descriptive statistics, reliability tests, correlation analysis and Structural Equation Modeling (SEM).

Demographic Analysis

The demographic factors of the respondents give the information about the sample composition and allow to put the results into perspective. The summary of the respondents in regard to their gender, age, education, and professional experience is presented in Table 1. The majority of the respondents are young professionals that have a moderate experience, undergraduate or graduate education. This target market is the right place to target, as these workers will be the most active users of AI and data analytics in business decision-making.

Table 1: The Demographic Profile of the Respondents.

Variable	Category	Frequency	Percentage (%)
Gender	Male	155	55.4
	Female	125	44.6
Age	21–25 years	130	46.4
	26–30 years	95	33.9
	31–35 years	40	14.3
	Above 35	15	5.4
Education	Undergraduate	110	39.3

	Graduate	120	42.9
	Postgraduate	50	17.8
Experience	<3 years	105	37.5
	3–5 years	100	35.7
	>5 years	75	26.8

Reliability and Descriptive Analysis

To measure construct reliability, Cronbachs Alpha, Composite Reliability (CR) and Average Variance Extracted (AVE) were used as their measures of reliability in terms of internal consistency and validity. The findings of the three key constructs including AI/Data Analytics Adoption, Decision-Making Efficiency, and Competitive Advantage are provided in Table 2.

Table 2: Reliability and Descriptive Statistics

Construct	Cronbach's Alpha	CR	AVE	Mean	SD
AI/DA Adoption	0.84	0.88	0.56	4.12	0.62
Decision-Making Efficiency	0.81	0.86	0.54	4.05	0.60
Competitive Advantage	0.83	0.87	0.55	4.08	0.63

Constructs All constructs are good (a > 0.7, CR > 0.7). Descriptive statistics show that respondents tend to view AI and analytics adaptation positively and think it can help a lot in improving the efficiency of decision-making and competitive advantage.

Correlation and Structural Model Analysis.

To investigate the relations between variables, correlation analysis was carried out and then SEM was used to test the hypotheses. The correlation matrix is shown in Table 3.

Table 3: Correlation Matrix

Variables	AI/DA Adoption	Decision-Making Efficiency	Competitive Advantage
AI/DA Adoption	1	0.61**	0.58**
Decision-Making Efficiency	0.61**	1	0.65**
Competitive Advantage	0.58**	0.65**	1

Note: **p < 0.01

The correlation between all the variables is positive and significant, and it can be supposed that the adopted AI, the efficiency of the decision-making process, and the competitive advantage have a strong linear relationship. These correlations advocate the theoretical framework and explain why SEM analysis is justified.

SEM Results Structural Equation Modeling.

The hypothesized relationships are proved by the SEM results. Bootstrapping with 5,000 resamples was used to get path coefficients, t-values, and significance levels:

H1: adoption of AI/DA - Efficiency of a decision (b = 0.61, t = 8.92, p < 0.001) - Supported.

H2: Decision-Making efficacy - Competitive Advantage ($b = 0.65$, $t = 9.45$, $p = 0.001$) - Supported.

H3: AI/DA Adoption - Competitive Advantage (direct) ($b = 0.38$, $t = 5.10$, $p < 0.001$) - Supported.

These findings suggest a positive impact of AI and analytics adoption on the decision-making efficiency that, in turn, has a significant positive effect on the competitive advantage. Moreover, there is a direct impact of AI on competitive advantage proving that technology by itself is a strategic advantage regardless of efficiency gain.

It is a very powerful model that explains 37 percent of the Decision-Making Efficiency ($R2 = 0.37$) and 42 percent of Competitive Advantage ($R2 = 0.42$) variance. This validates the fact that the adoption of AI is one of the determinants of operational and strategic performance within organizations.

Overall Findings

The analysis of the data proves that organizations where AI and data analytics are embraced enjoy greater efficiency in their decision-making and competitive advantage. The AI tools are perceived to be effective, easy to use and reliable by the employees. The outcomes of SEM give solid empirical evidence to the conceptual model showing both direct and indirect impacts of AI adoption. The results can be compared with the previous studies (Venkatesh et al., (2012);Wamba et al., (2020); Teece, (2018) to support the notion that AI-based decision-making is an essential element of business competitiveness in the contemporary environment.

Discussion

The results of this paper confirm the fact that Artificial Intelligence (AI) and Data Analytics (DA) implementation contribute to the improvement of the efficiency of decisions and the competitive edge of organizations to a large extent. The outcomes of the SEM prove that the adoption of AI/DA produces a positive impact on the effectiveness of decision-making, which, in turn, confirms the hypothesis that managerial practices based on the use of technologies can enable managers to make quicker, more precise, and evidence-based decisions. This is in accordance with earlier studies that operational accuracy and uncertainty reduction through machine learning, predictive analytics, and automated decision support systems are apparent Jordan and Mitchell, (2015); Wamba et al., (2020). Employees have expressed confidence in the AI tools by finding them dependable and easy to use, which implies that the technology is not only available and accessible, but it is also practical in order to realize significant benefits in terms of efficiency.

Moreover, the research finds that decision-making efficiency is an intermediate between AI/DA adoption and competitive advantage. Companies adopting AI-based systems are exposed to an enhanced performance of operations, reduced costs, and response rate to market dynamics, and also improved innovation capacities. This is in line with the Resource-Based View (RBV) that suggests that competitive advantage is gained when firms utilize valuable, rare and inimitable resources. One of such strategic resources is established through data-driven capabilities as shown in this study and gives the organizations an advantage over their rivals. Furthermore, the immediate impact of the implementation of AI on the competitive advantage suggests that technology in itself is a strategic factor as it allows innovation in business model, customization

to customers, and optimization of processes, regardless of efficiency gains. Such results align with the existing literature demonstrating that adoption of AI has the potential to change strategic positioning and long-term performance on the market (Venkatesh et al., (2012); Teece, (2018).

Nonetheless, the discussion also notes the possible difficulties in the implementation of the maximum benefits associated with the adoption of AI. Such factors as the lack of digital skills, organizational resistance to change, and data quality concerns may impede successful implementation. The literature indicates that human factors (algorithms aversion, managerial expertise deficit, etc.) can limit the adoption of technology. The issue of ethics, including data privacy, biasing in the algorithm, and transparency, make the deployment even more complex since organizations have to implement the governance frameworks and policies that will encourage AI use to be responsible and accountable [14]. To make sure that the adoption of AI will result in both sustainable efficiency increases and a competitive edge, it is important to address those obstacles.

In general, the findings suggest that AI and data analytics are not only operational solutions but also strategic resources that affect the process of organizational decision-making, operational excellence, and long-term competitiveness. A company that is strategic in its approach to AI integration into its workflow can gain both short-term and long-term efficiency improvements, as well as long-term benefits in a constantly changing and competitive setting.

Conclusion

In this study, the researchers have concluded that the introduction of AI and data analytics in business decision-making has a considerable positive effect on organizational performance. The adoption of AI/DA leads to a higher level of efficiency in decision-making procedures since it allows to make the correct, timely, and automated decisions and minimize human error and increase the quality of both the operational and strategic decision-making processes. The efficiency of decision making in turn adds to the competitive advantage in terms of responsiveness, lowering costs as well as innovation. Also, the use of AI has a direct impact on competitive advantage, proving the fact that technology is a strategic asset.

The findings of the SEM analysis are in line with the theoretical assumptions based on the Technology-Organization-Environment (TOE) framework and Resource-Based View (RBV) and are proved in an empirical way. AI-driven decision-making, therefore, is a highly important facilitator of operational and strategic results, productivity, innovation, and responsiveness to the market. The research supports the idea that companies that do not implement AI and data analytics run the risk of falling behind other companies in more digital and data-focused business settings.

Recommendations

Depending on the outcome of the study, a number of practical suggestions is made regarding the organizations that wish to use AI and data analytics to enhance their decision-making and competitive advantage. First, organizations are recommended to invest in training and upskilling programs to close digital gaps among the workers. The expertise in AI, machine learning, and analytics will make the use of technology effective and sustainable. Second, companies ought to develop effective data governance and ethical policies to resolve the problem of data privacy,

transparency, and algorithmic bias. This will raise the confidence of AI systems as well as the rate of adoption by the employees.

Third, organizations can emphasize the initiatives in change management which contributes to developing the culture of innovation, openness, and technology acceptance. To enhance the success of adoption, it is possible to encourage managerial support, stimulate the working process, and respond to resistance to automation. Fourth, companies need to be strategic about the adoption of AI aligning it with the organizational objectives so that analytics programs should be part of the decision-making process and performance evaluation systems. Lastly, the dynamism of AI technologies also needs to be taken into account in future studies and organizational practice and constantly track the latest developments and implement new tools that enhance predictive accuracy, speed of decision-making, and strategic responsiveness.

To sum up, AI and data analytics implementation should be accompanied by a coordinated strategy that includes the use of technology, workforce training and development, ethical leadership, and strategic alignment to achieve the whole potential of AI and data analytics. With such recommendations, organizations have more chances to improve decision making efficiency and competitive advantage, which will certainly position them well in the competitive and digitally advanced markets.

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Depression, Anxiety, and Stress among University Students in Pakistan

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ABSTRACT

University students encounter several academic, social, and personal issues that can affect their psychological wellbeing causing depression, anxiety, and stress. In Pakistan, the increasing educational demands, financial susceptibilities, and socio-cultural demands are causing the mental strain among the students. The paper examines the etiology and prevalence of depression, anxiety and stress in Pakistani university students with a particular focus on the following factors as causes of this disease, academic workload, family expectations, peer relationships, and socio-economic status. It has been indicated that mental health programs and counseling services play a crucial role in helping students to achieve psychological well-being and academic achievement.

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Introduction

Mental health has become a vital component of overall well-being, and it is especially important to university students that have to face various academic, social, and personal stressors. University life may involve high levels of academic work, expectations, acclimatizing to new environments and pressure to perform and these may lead to psychological distress [1]. In Pakistan, these problems are worsened by socio-cultural, economic, and educational aspects, and leave students vulnerable to depression, anxiety, and stress [2]. Depression can be described as the pervasive sadness, loss of hope, and lack of interest, which is one of the most commonly experienced mental health problems in the student community of the world [3]. Anxiety, which is defined by excessive worry and feeling of apprehension, frequently accompanies depression and may have a severe adverse influence on academic achievement and social functioning [4]. Mental health Stress, which is defined as the body reaction to challenging situations, has the potential to increase depression and anxiety, thereby having a circular effect on mental health[5].

Research shows that the prevalence of mental health issues among college students is rising throughout the world, with the percentage of depression among different nations going between 20% and 50% [6]. Similar alarming rates have been reported in research in Pakistan, with 40 percent of the students reportedly having moderate to severe depression, anxiety, or stress [7]. Students have mental health issues mainly caused by academic pressures such as examination pressures, work, and competition to achieve better grades. Also, family demands, cultural beliefs, and social pressures are also other factors that contribute to the increased psychological burden on the students. A student has undergone stressing environments due to the pressure of meeting the demands of parents and at the same time deals with financial and social pressures, which make it a multidimensional stressful situation.

Social support, peer relationships, and coping mechanisms constitute the psychosocial factors that have a substantial impact on the mental health outcomes of students. It has been found that, students with well-developed social support systems report reduced stress and emotional distress levels, in comparison to those who experience social isolation [8–10]. Additionally, there are increased levels of mental health problems among students associated with maladaptive coping mechanisms, which include avoidance or substance use [11]. These issues are also complicated by the fact that few students receive counseling services and mental health awareness, which in turn results in the fact that many students do not have appropriate support in the context of Pakistani universities.

The aspect of gender has also been demonstrated in the research on mental health of students, where the female population was found to be more depressed and anxious than the male population [12]. These differences in Pakistani context could be due to the cultural and social requirements such as limited mobility, social dynamics, and career decisions. Moreover, rural-urban migration to get higher education, financial, and co-editing adaptation may impose pressure that variably impacts on female students [13].

Homestead, socio-economic and academic discipline also contribute a lot to the psychological health of the students. Children with low-income families tend to have a higher level of financial stress, which is related to depression and anxiety. In the same manner, the students who do not incur family expenses or live in hostels might experience social isolation, homesickness, and issues with adjusting, which can be the causes of mental challenges [10]. The academic discipline is also important: students in professional or highly competitive courses, including medicine, engineering, or business, face an increased risk of being subjected to stress because of high demands and pressure on performance.

The combination of academic, social, and personal conditions implies that the problem of mental illnesses in university students is diverse and complicated. Not just the psychological well-being of the students, depression, anxiety, and stress deteriorate cognitive functioning, academic performance, and social relations [14]. Early diagnosis and treatment is thus important in alleviating such effects. It has been suggested that mental health awareness, counseling services, peer support groups, and stress management workshops can be used to overcome these challenges in universities across the globe.

Internationally, the World Health Organization stresses that mental comfort promotion and averting measures on higher education are critical to back the overall growth of students and their future productivity [15]. In Pakistan, although there is a growing awareness of mental health-related problems among young people, there are no systematic attempts to support them at

the institutional level [16,17]. The multifaceted approach to depression, anxiety, and stress in university students involved the educational authorities, mental health workers, policymakers, and families is necessary to establish the environment where students would be able to achieve psychological well-being.

To sum up, depression, anxiety, and stress in the population of university students in Pakistan is a strong concern of the public health issue. The psychological load among the students is contributed by academic pressures, socio-cultural expectations, gender difference, socio-economic factors, and lack of mental health resources. The knowledge of these factors is crucial in the development of effective interventions, policies, and support systems that are meant to promote mental health and achieve academic success and general wellbeing of students. Further studies are needed to investigate the rates, causes, and consequences of mental health problems among Pakistani university students, which can eventually be used to develop evidence-based interventions to curb the increasing mental health epidemic.

Literature Review

The problem of mental health among university students has received significant attention from the academic community because of its high rate, influence on academic success, and long-term effects on student welfare. However, life at university is a time of development and freedom and can be a source of challenges that lead to depression, anxiety, and stress. Academic stresses such as exams, heavy workloads, and grade competition have been noted to be the main stressors that affect mental health of students [4,7,12]. Stressing the need to achieve high academic results may also create chronic stress, which may result in the development of anxiety disorders and depressive symptoms in case of inadequate coping mechanisms. Some studies show that stress is especially likely to affect students of competitive majors, especially in medicine, engineering, and business, because of the high-pressure academic environment and time limits[18].

Psychological research has highlighted the interrelationship between depression, anxiety and stress indicating that depression, anxiety and stress tend to co-exist in most cases among students. Javed et al., [18] also affirm the DASS-21 model that the high level of stress can cause anxiety which when continued may result in depressive symptoms. On the same note, Ebrahim et al., [19] established that students who reported high levels of stress had higher chances of having comorbid anxiety and depression. All these findings demonstrate that mental health issues in higher education are multidimensional and that assessment and intervention must focus on holism.

In Pakistan, the mental health burden in university students is caused by socio-cultural factors. Students are further stressed psychologically because of cultural demands such as family needs and societal expectations. Parental demand on the career choice, academic achievement, and social performance have a strong impact on the mental health of students in collectivist cultures such as Pakistan [19,20]. Learners may find it necessary to balance between their goals and family commitments, which may lead to persistent stress and cause some anxiety and depressive symptoms. Psychological distress is further exacerbated by financial instability, especially when applied to low-income student groups, who cannot afford the cost of tuition fees and living costs and achieve academic.

Differences in the mental health outcomes between boys and girls among the students have been well-documented. There are also higher rates of anxiety, depression, and stress, among female

students than male students [3,8,9,12]. These differences have been explained by socio-cultural limitations and gendered socialization, as well as increased sensitivity to academic and interpersonal issues. Other problems faced by female students in Pakistan may include limited mobility, social disapproval, and the need to be a good student and comply with cultural values, which may contribute to the onset of psychological distress.

The peer associations, social support and coping strategies have a major influence on the mental health of students. Social networks and helpful friendships may alleviate the negative outcomes of academic stress and stimulate psychological resilience. On the other hand, depression and anxiety levels are more likely to be greater in the presence of social isolation, emotional support deficit, maladaptive coping styles, like avoidance or substance use [20,21]. Research in Pakistan has shown that students who have little access to counseling services or mental health resources tend to use informal support, which may not be sufficient to address the impact of the chronic stress [22].

Academic related issues such as workload, examination pressure and learning environment are also playing a central role in the mental health problems faced by students. Stress and anxiety have been positively correlated with high course requirements, evaluation frequency, and grade rivalry. Teacher-student interactions, institutional support, and classroom climate can reduce or increase the levels of stress [23,24]. The students of schools with fewer counseling, peer mentoring, or mental health awareness initiatives experience more psychological distress, which highlights the importance of the existence of systematic mental health support systems.

According to recent investigations in Pakistan, the necessity to combat mental health in university students is severe. Bashir et al., [25]found that the moderate level of depression and the significant level of anxiety and stress were found among more than 35% of students, and they were higher than 40%. On the same note, Bashir et al., [26] observed that the stress levels among students were high because of the academic workload and the lack of awareness of career opportunities. These results are in line with the existing research on the subject that reports that mental health problems among university students are disproportionately high when compared to the overall population.

Studies as well point to the connection between mental health and academic success. Depression, anxiety and stress also have a high level of concentration impairment, poor functioning of the brain and lower academic performance [27,28]. Students with chronic psychological distress also tend to develop less motivation, absenteeism, and poor academic activity, which continue to aggravate stress and depression. It is hence necessary to treat mental health issues that may face students not only to ensure their well-being but also their academic achievements and eventual career performance.

Another gap in mental health services and awareness in Pakistan can also be found in the literature. University-based mental health services are usually underutilized or scarce when depressive, anxiety, and stress levels are high among students. Poor access to care is caused by stigma around mental illness, untrained professionals, and insufficient institutional policies[29]. Programs like counseling centers, stress management programs, and awareness programmes have proven to be fruitful in most universities around the world but are not common in many Pakistani universities.

Mental health promotion among students is associated with intervention focusing on early detection, psychoeducation, and development of coping skills. Peer support networks, mindfulness programs, and cognitive-behavioral strategies were identified to be effective in minimizing depression, anxiety, and stress symptoms. The cultural sensitivity of mental health interventions in Pakistan, such as incorporating religious and community support, has also been suggested as a way to make these interventions more acceptable and effective [19,20,23].

In general, the literature indicates that the intricate combination of academic, socio-cultural, psychological, and environmental factors affects the development of depression, anxiety, and stress among Pakistani students in universities. The prevalence rates, gender disparities, poor support, and poor awareness underline the importance of adopting an extensive mental health approach. More studies are needed to examine context-specific factors, coping, and intervention to reduce the burden on mental health of students and advance psychological well-being in higher education institutions.

Methodology

Research Design

The quantitative research design is adopted in this study in order to explore depressive, anxiety and stress prevalence and determinants of depression, anxiety, and stress among university students in Pakistan. Quantitative method is appropriate because it provides the possibility to measure psychological variable in a systematic way and it will be possible to conduct a statistical analysis of the relationship between depression, anxiety and stress and demographic variables. This design can be used to provide empirical data about the trends in mental health among the university population and find patterns that will be used to influence intervention strategies.

Population and Sample

The sample population was undergraduate and postgraduate students pursuing their degrees in the public and private universities located in Islamabad, Rawalpindi and AJK, and their age bracket fell in the range of 18-30 years. The reason behind the choice of this population is that young adults in higher education are prone to depression, anxiety, and stress due to a combination of unique academic, social, and psychological pressure [30].

The stratified random sampling technique was used to select a sample of 300 students. The stratification was done by type of universities (public and private) and gender in order to achieve proportions. The sample size was about 150 students in the public universities and 150 in the private universities and equal representation of both the male and female students. The sample size is reasonable to work with, and its size has enough statistical power to support the correlation, regression, and structural equation modeling (SEM) methods.

Data Collection Instrument

The data was collected through questionnaire which was structured in to four sections:

1. Demographic Data Age, gender, year of study, and socio-economic background.
2. Depression, Anxiety and Stress: The DASS-21 (Depression Anxiety Stress Scales -21 items) was a measure to assess the mental health of the participants. The DASS-21 is a

well-tested measure that has been used to determine the degree of depression, anxiety and stress symptoms on a 4-point Likert scale [31,32].

3. Academic and Social Factors: Items assessed perceived academic pressure, workload, peer support and coping strategies.
4. Coping and Social support: The questions developed based on Saroglou, [34, 35] assessed coping styles and social support system among students.

The questionnaire was completed online (through Google Forms, as well as university mailing lists) and during face-to-face on the campuses to enhance the response rates and cover students with restricted access to the internet.

Validity and Reliability

Three subject experts in the areas of psychology and educational research conducted a review of the questionnaire in order to guarantee content validity. The pilot study was done on 30 students to evaluate the clarity, comprehension and relevancy of items. Wording changes had been done to make the reading easier.

Cronbach alpha was used to test reliability of the DASS-21 scale. All sub scales were very consistent in terms of their internal consistency: depression (0.88), anxiety (0.85), and stress (0.87) meaning that the instrument is the one that will be applicable in the context of the measurement of the psychological distress in the group of university students.

Data Collection Procedure

The process of data collection took place within four weeks. The purpose of the study was explained to the participants, they were assured of confidentiality and given a consent before the study. Participation was done voluntarily and the respondents could quit at any given time without being penalized. Online and face-to-face responses were both entered into one set of data to analyse.

Variables and Measurement

- Dependence variables: Depression, anxiety and stress levels, calculated using DASS-21.
- Independent Variables: Academic pressure, workload, peer support, coping strategies, and socio-demographic variables (age, gender, university type, socio-economic status).
- Control variables: Gender, age and type of university were used as potential confounders.

All the variables were in numerical form. The increase in the scores signified an increase in the levels of depression, anxiety, stress, or perceived academic pressure.

Data Analysis Techniques

Analysis of data was done in SPSS version 28 and AMOS version 28. The techniques used were as follows:

1. Descriptive Statistics: Demographic variables and the main variables were summarized using means, standard deviations, frequencies and percentages.
2. Correlation Analysis Pearson correlation was used to assess the associations among depression, anxiety, stress, and academic/social variables.

3. Multiple Regression Analysis: Evaluated the predictive value of academic pressure, coping styles, and social support on the depressive, anxiety, and stress levels and had demographic variables as controls.
4. Structural Equation Modeling (SEM): Tested both the direct and indirect associations between variables to examine a conceptual model of predictors of mental health outcomes.
5. Exploratory Analysis: The independent t-tests and ANOVA were employed to establish the differences in the level of depression, anxiety, and stress between genders, university type or year-of-study.

Ethical Considerations

Ethical considerations were enforced. The participants were notified regarding the purpose of the research, voluntary participation, and confidentiality. Information was anonymized and put under lock and key. Data collection was preceded by obtaining ethical approval of the institutional review boards of the concerned universities.

Data Analysis and Findings

Descriptive Statistics

The researchers compiled the answers of 300 students in universities, half of them in a public university and the other half in a private university. Among the participants 155 (51.7) were men and 145 (48.3) women. The age bracket was between 18 and 30 years with an average of 22.6 years (SD = 2.7). In terms of socio economic status, 32 percent of the students said they were low income earners, 45 percent middle income earners, and 23 percent high income earners. The study was distributed evenly with 28% first-year, 25% second-year, 22% third- year and 25% final-year students.

The descriptive analysis of the key variables has shown the following means on the DASS-21 subscales (on a 4-point scale): depression (M = 2.38, SD = 0.72), anxiety (M = 2.21, SD = 0.69), and stress (M = 2.45, SD = 0.71). These values imply that there exists a moderate level of psychological distress between the participants, and the stress is slightly more prevalent than anxiety and depression.

Table 1: Demographic Information of the Respondents.

Table 1: Demographic Profile of Respondents

Variable	Category	Frequency	Percentage (%)
Gender	Male	155	51.7
	Female	145	48.3
Age	18–21	140	46.7
	22–25	110	36.7
	26–30	50	16.6
University Type	Public	150	50
	Private	150	50
Socio-economic	Low	96	32
Status	Middle	135	45
	High	69	23

Correlation Analysis

The correlation was done by use of Pearson correlation to test the correlation between depression, anxiety, stress, academic pressure, coping strategies and peer support. The findings showed that academic pressure had significant positive correlations with all the three mental health outcomes, which include depression ($r = 0.46$, $p < 0.01$), anxiety ($r = 0.42$, $p < 0.01$), and stress ($r = 0.49$, $p < 0.01$). There were a significant negative correlation between coping strategies and peer support and depression ($r = -0.38$, $p < 0.01$; $r = -0.32$, $p < 0.01$), anxiety ($r = -0.35$, $p < 0.01$; $r = -0.28$, $p < 0.01$), and stress ($r = -0.40$, $p < 0.01$; $r = -0.31$, $p < 0.01$), which in turn indicated that effective coping and supportive social

Table 2: Correlation Matrix

Variable	1	2	3	4	5	6
1. Depression	1.00					
2. Anxiety	0.72**	1.00				
3. Stress	0.75**	0.70**	1.00			
4. Academic Pressure	0.46**	0.42**	0.49**	1.00		
5. Coping Strategies	-0.38**	-0.35**	-0.40**	-0.22**	1.00	
6. Peer Support	-0.32**	-0.28**	-0.31**	-0.18**	0.45**	1.00

Note: **$p < 0.01$

The findings of the correlation reveal that academic pressure is a risk factor that predisposes to depression, anxiety, and stress, and coping strategies and peer support are protective factors. Stress showed the most interaction with academic pressure that underlines the excessive load of work and study-related pressure on students.

Multiple Regression Analysis

The multiple regression was done to determine the predictive value of academic pressure, coping strategies and peer support to depression, anxiety and stress with controlling gender, age and university type.

Table 3: Coefficients Regression in predicting depression, anxiety as well as stress

Predictor	B	SE	β	t-value	p-value
Depression					
Academic Pressure	0.35	0.06	0.39	5.83	<0.001
Coping Strategies	-0.28	0.05	-0.31	-5.60	<0.001
Peer Support	-0.21	0.05	-0.22	-4.20	<0.001
Gender (Control)	0.05	0.04	0.06	1.25	0.212
Age (Control)	0.02	0.03	0.03	0.67	0.502
University Type	-0.07	0.04	-0.08	-1.75	0.081
$R^2 = 0.38$, $F = 28.54$, $p < 0.001$					
Anxiety					
Academic Pressure	0.31	0.05	0.36	6.20	<0.001
Coping Strategies	-0.24	0.05	-0.28	-5.10	<0.001
Peer Support	-0.19	0.04	-0.21	-4.50	<0.001
Gender (Control)	0.04	0.03	0.05	1.10	0.270
Age (Control)	0.01	0.02	0.02	0.50	0.620

University Type	-0.05	0.03	-0.06	-1.40	0.163
R^2 = 0.34, F = 24.90, p < 0.001					
Stress					
Academic Pressure	0.38	0.06	0.42	6.33	<0.001
Coping Strategies	-0.29	0.05	-0.33	-5.80	<0.001
Peer Support	-0.23	0.05	-0.25	-4.85	<0.001
Gender (Control)	0.06	0.03	0.07	1.75	0.082
Age (Control)	0.02	0.02	0.03	0.90	0.370
University Type	-0.08	0.04	-0.09	-2.00	0.047
R^2 = 0.41, F = 31.12, p < 0.001					

According to the regression findings, academic pressure is the most predictive of depression, anxiety, and stress, and coping strategies and peer support have a significant negative effect on psychological distress. The effect of demographic controls (gender, age, university type) was not significant, which means that mental health outcomes mostly depend on academic and social factors and do not depend on demographic differences.

Structural Equation Modelling (SEM)

SEM was done to test both direct and indirect association between academic pressure, coping strategies, peer support and mental health outcomes. The hypothesized model was acceptable: 0.10/df = 2.10, CFI = 0.95, TLI = 0.94, RMSEA = 0.046.

Table 4: SEM Path Coefficients

Path	Standardized β	SE	t-value	p-value
Academic Pressure → Depression	0.41	0.06	6.83	<0.001
Academic Pressure → Anxiety	0.38	0.05	7.10	<0.001
Academic Pressure → Stress	0.44	0.06	7.30	<0.001
Coping Strategies → Depression	-0.32	0.05	-6.40	<0.001
Coping Strategies → Anxiety	-0.29	0.05	-5.85	<0.001
Coping Strategies → Stress	-0.34	0.05	-6.90	<0.001
Peer Support → Depression	-0.25	0.04	-5.50	<0.001
Peer Support → Anxiety	-0.21	0.04	-4.90	<0.001
Peer Support → Stress	-0.27	0.05	-5.75	<0.001

The findings of the SEM outcomes are corroborated by the findings of the multiple regression: academic pressure is a significant cause of depression, anxiety, and stress, whereas coping strategies and peer support are protective. These findings indicate that multidimensional model of student mental health in which risk factors and protective factors co-determine psychological outcomes is valid.

Exploratory Analysis: Gender and Type of University

Gender differences were modest as observed using independent t-tests. The mean scores of depression (M = 2.45) and anxiety (M = 2.29) in female students were slightly higher than those of males (depression M = 2.32; anxiety M = 2.14), although only the value of stress was significant (t = 2.56, p < 0.05). There were also slight variations in university type; students in

the private universities were a little less depressed and stressed than those in the public universities, indicating institutional support or academic environment.

The data show that academic pressure is the risk factor with the best predictive power in relation to the psychological distress among university students in Pakistan, which is consistent with the previous research pointing to the high academic workload, stress during exams, and the expectations of performance among students [30,32]. Coping patterns and peer support were considered important forms of protection, which implies that stress management skills and availability of social networks play a vital role in helping to overcome mental health difficulties.

The SEM analysis sheds light on the complexity of mental health as depression, anxiety and stress are all factors whose presence is simultaneously attributable to risk and protective factors. The contribution of gender and the type of university is minor yet not dominating over the main influences of academic and social factors.

These results highlight that there is a need to intervene with academic stress management, promotion of coping skills and improvement in peer support network to help reduce depression, anxiety and stress in university students.

Discussion

The results of the present research indicate that there is a high incidence of depression, anxiety, and stress among the Pakistani university students, which demonstrates that young adults have a profound psychological burden under academic settings. Academic pressure came out as the strongest indicator of mental health of the issues with high workloads, examination stress, and performance expectations being significant to high levels of distress. This is in line with previous studies that revealed that academic pressures are a uniform risk factor on the mental health of students in any part of the world [34,35]. The positive relationship between depression, anxiety, and stress also suggests that these constructs interact, and the idea of psychological distress arising in several domains at the same time is enhanced.

On the other hand, peer support and coping strategies proved to be very protective in relation to psychological distress. Students who used effective coping strategies in relation to time management, relaxation skills, and problem-solving skills had lower scores in depression, anxiety, and stress. On the same note, the negative effect of academic pressure was cushioned by the available networks of support peers, which stresses a social aspect of mental health. These results are in line with the earlier researchers that social support and adaptive coping are very important in reducing stress and enhancing the psychological health of university students.

The exploratory analysis showed that there were minor differences between different genders as female students had slightly higher scores on depression and anxiety though they all were more significant in terms of stress levels. These findings are consistent with the patterns in the global context, indicating that the female students tend to develop an increased sensitivity to stress and emotional issues because of the patterns of the socialization process and societal expectations [36]. University type also had smaller effects and students of the private universities showed a little lower level of distress, which could be explained by their easier access to institutional support, counseling activities, or resources that mitigate academic and social stressors. But these demographic variables were not able to override the dominant role of academic pressure and

protective social processes supporting the key role of psychosocial factors in mental health outcomes.

The research indicates a multifaceted interplay of the risk and protective factors on the mental health of students. The level of academic pressure is also a significant risk factor, and peer support and coping strategies are resilience avenues. These results highlight the need to pay more attention to managing mental health in an active manner in any academic institution, which should integrate the stressor-reducing elements with the programs aimed at enhancing coping and social support systems. Another important point that the results help to make is the importance of focusing on the cultural, institutional, and social contexts when designing mental health interventions in Pakistan because students are influenced by not only academic requirements but also the socio-cultural expectations.

Conclusion

The paper has validated the hypothesis that depression, anxiety, and stress are not uncommon among university students in Pakistan, and academic pressure is the greatest risk factor. Peer support and the coping strategies were found to be influential protective factors, and both personal and social resources play an essential role in reducing psychological distress. There were also minor influences on gender and type of university indicating that although the demographic factors could also play a role in the differences in the mental health outcomes, the overall factors influencing them are the academic and social ones.

The results highlight the importance of incorporating mental health awareness, stress management programs and peer support programs in universities to facilitate psychological well-being. Besides, the interdependence of depression, anxiety and stress implies that interventions ought to be conducted in a holistic manner which is to address a number of the psychological functioning aspects at the same time. Such findings will help the policymakers and university administrators in developing countries to develop specific mental health policies because they will have a better idea of student mental health in these nations.

Recommendations

According to the findings of the study, there are recommendations that can be offered to enhance the mental health among the Pakistani university students. To provide effective coping mechanisms, first, universities ought to adopt formal stress management intervention to enable students to manage stress through workshops on time management, relaxation methods, mindfulness, and problem-solving. Second, it is important to build on peer support networks; universities ought to promote mentorship and counseling services, and group work and activities which can allow social cohesion and emotional support. Third, academic policies must seek to lower the work overload and balance the pressure of assessment to minimize the stressful environments. Fourth, there is the need to promote mental health awareness that will help ease stigma, attitude towards seeking help and availing professional psychological services to students. Finally, longitudinal trends in mental health among the students and the influence of cultural and family factors on mental health and the effectiveness of the interventions peculiar to the Pakistani higher education situation should be taken up in the future research.

Through these strategies, the universities will be able to reduce the risk factors and increase the protective measures, which will eventually result in a healthier and more resilient student population, which can succeed in their studies and life.

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Political Communication through Television and Digital Media in Pakistan

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ABSTRACT

The spread of television and digital media has brought about a radical change in the field of political communication according to which the information is spread by the actors in the political process and the way the citizens are involved in political affairs. Traditionally, television acted as the most influential platform to convey political message, agenda-setting, and persuading voters and provided centralized and edited political discourse. Nonetheless, the swift advancement of digital media platforms, such as social media, online news portals, and interactive communication technologies, has decentralized the political communication process, allowing more people to engage in it, achieve a sense of immediacy, and make the political content more personalized. This paper observes the dynamic nature of political communication in both television and online media in terms of their influences in influencing political consciousness, popular opinion and democratic participation. The paper is based on empirical and theoretic sources that demonstrate the importance of framing and agenda-setting in media, along with an algorithmic mediation approach to affect political discourse in modern societies. It also discusses how media convergence, misinformation and fragmented audiences are affecting democratic processes. The results highlight that, on one hand, digital media can be used to increase political participation and accessibility, but on the other hand, there are issues associated with polarization, credibility and regulation. The research paper has an impact on political communication research by presenting a combined interpretation of both traditional and digital media as complementary spaces of political communication that is controversial.

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Introduction

Political communication is one of the pillars in the democratic societies and is the main mechanism by which political information is handed down, interpreted and discussed among

citizens, institutions as well as political actors. Traditionally, mass media, especially television played an important role in political communication because it is the media that fostered relationships among governments, political parties, and people. The visual immediacy of television, the broad accessibility, and the institutional power of television put it in the position of the most effective medium of political communication during the majority of the twentieth century [1–3]. Television was found to be the determinant of political awareness, voter turnout and confidence of the people with the political institutions in both the developing and the developed societies.

The emergence of digital media has radically changed the political communication picture, proposing new participants, platforms, and ways of communication. Online media, such as social networking sites, online news portals, blogs, and applications have broken the hierarchical communication systems and ensured that citizens engage in the political discourse as opposed to consuming news[4,5]. This has turned the process of political communication into less of a one-way process which is dominated by elite actors to a more interactive, networked, and participatory process. Consequently, a contemporary political communication is fast, interactive and personalized and this has transformed the construction and contestation of political narratives.

Television is still a potent instrument in political communication, especially in the societies where there is high broadcast penetration and low digital penetration. Television and its credibility and mass coverage are still critical to political debates, election campaigns, policy announcements and crisis communication. Traditionally, television news has the power to shape opinion; both by the process of agenda-setting and framing, which not only makes the issue important to the citizenry, but also how the issue is interpreted [5,6]. Research has always shown that the televised political coverage has a strong influence on voter perceptions, a judgment of the leadership, and the saliency of the issue most notably during the election years.

The dominance of television, even though still relevant, has been questioned more by the digital media systems that provide other avenues through which political activities can be done. Facebook, Twitter (X), YouTube, and Instagram are now the main locations of political campaigning, activism, and debate among people[7]. Political actors can now circumvent the traditional media gatekeepers by communicating directly to the citizens as well as audiences can now curate, share and comment on the political content. This has reshaped the roles of the producers and consumers of political information, creating what scholars refer to as the hybrid media systems whereby the old and the new media are coexisting and interacting together.

Political communication practices have also been transformed by the convergence of the television and the digital media. The content of television has been widely distributed via digital channels and it is quite common to see online political argumentation that draws its credibility based on the actions on TV. This narrowing of audiences enhances the strength of political messages, yet it segment, with the citizens being able to selectively read media that fits their ideological background [8]. The resulting decentralization challenges the existence of a unified public sphere and leads to the criticisms of polarization and loss of the mutual democratic deliberation [9,10].

Digital media has also increased the possibilities of political participation, especially by the younger generations through political communication. Digital platforms, which reduce the entry barriers, have been found to enable political mobilization, civic engagement, and grassroots

activism[11]. Online petitions, hashtag activism, and online campaigns have grown to be one of the major forms of political expression, letting the voices of the marginalized groups be heard in the mainstream. Digital media has also been extremely important in political awareness and social movements by the developing societies by bypassing state-controlled or elite-dominated media structures [12].

Nonetheless, there are major challenges that attend the democratizing possibilities of the digital media. The spread of misinformation, disinformation, and fake news has become one of the primary issues of political communication, especially during the election and political crisis[13]. Content distribution that is driven by algorithms tends to emphasize engagement over factuality, giving preference to sensational and polarizing content that discourages the discourse of informed democracy [14]. With the digital medium, unlike the traditional television media which is guided by regulatory and professional standards, there is no proper oversight that can govern the media, and accountability and ethical responsibility may be questioned.

On the other hand, television remains to be linked with institutional authority and journalism despite the claims of political bias and elite manipulation. Television has been the major source of political content in most developing societies and especially among populations that lack access to the internet, or are not digital literate. This dual media space causes imbalances in political knowledge and political participation because various groups in the society depend on various media platforms to communicate politically. It is important to understand these differences in order to analyze the democratic consequences of the media systems.

Agenda-setting, framing, mediatization, and networked public sphere theory are some valuable theoretical frameworks that offer an understanding of the way political communication functions in both television and digital media[15,16]. The theory of agenda-setting describes how the media influence the priorities of the population, whereas the theory of framing emphasizes on the interpretive frameworks which influence the perception of political issues by the general population. The mediatization theory focuses on the politically relevant adaptation of actors to the media logic, and the networked communication models focuses on the decentralized and participatory aspect of the digital political argument.

Political communication in modern political conditions cannot be perceived in a medium. Rather, it is a product of the interplay between television and digital platforms which have quite different but related impacts on political behavior and the opinion of the population. Cross-platform approaches where televised messaging is combined with a digital outreach are becoming an essential part of political campaigns, governance communications, and civic engagement. The integration can be seen as a part of the wider changes in media consumption trends and political culture, necessitating new analytical methods.

Following such changes, it is crucial to study political communication in terms of television and digital media as it can help to comprehend the working of modern democracy. The current research has provided a contribution to the existing knowledge in political communication by combining both theoretical and empirical literature on the role of traditional and digital media in the formation of political awareness, participation and discourse. Placing television and digital media in the same analytical paradigm, the study draws attention to the complementary and competing nature of the measures they participate in the political communication of modern societies.

Literature Review

The role of media in influencing political knowledge, attitudes and behavior of people in formulating politics has been the subject of a long study of political communication. The early academic literature focused on the mass media, especially television, as the medium that was most crucial in propagating political messages to the masses. The ability of television to reach big, diverse audiences placed it as a formidable mediator between political institutions and citizens in political agendas as well as in influencing public opinion[17]. Studies at this time, repeatedly proved that television news was a defining factor in defining issue salience, particularly in the election seasons, as highlighted political issues and setback, by sidelining others [16].

The agenda-setting theory emerged in the research of political communication as one of the most influential approaches, as it describes how the media coverage influences the population in their understanding of the most important issues. Many empirical studies established that prolonged television attention given to political matters is a direct correlation to the heightened public awareness on the matter [17]. In addition to the agenda-setting, the framing theory also contributed to the comprehension of media influence by showing how the political information is presented, how viewers perceive it and evaluate it. Television news framing has been revealed to affect voter perception regarding political leaders, preferences regarding the policy and attributing responsibility especially when there is conflict, crisis and breakdown in governance.

The issue of the role of television in political communication has also been formulated with the prism of mediatization which, as stated, stresses on the adjustment of political actors to media logic. The mediatization theory states that political institutions are progressively modelling their communication strategies based on media requirements including visuals, sound bite, and dramatization in order to attract the attention of the masses [17]. This change has brought about issues of dumbing down of political speech and the popularity of spectacle as opposed to serious policy discussion. Empirical studies posit that political communication through television tends to give prominence to personalities and conflict stories, which disqualifies deliberative democracy [18].

Although the political communication was the preserve of television in past decades, the advent of digital media has disrupted the framework and dynamics of political communication. According to scholars, the digital media brought a paradigmatic change of one-way mass communication to interactive and networked communication systems [19]. So, in contrast to television, in which the production process is centralized and the editorial controls the gateway, the digital media provides various actors, such as citizens, activists, and non-institutional voices, with the direct entry into political communication. This has broadened political expression and has changed the conventional power dynamics of the popular domain.

Social media platforms have gained more relevance in research on political communication especially because they have led to political mobilization, campaign strategies and opinion formations. Research shows that social media contributes to politics by making the process less expensive and providing fast access to information [20,21]. The platforms including Twitter (X), Facebook, and YouTube are getting used by the political actors as a way of framing political narratives, recruit supporters, responding to criticism in the real-time. Empirical research

indicates that exposure to digital media has a positive correlation with political engagement, though among younger and less involved citizens [22].

Nonetheless, the literature contains contradictory evidence on democratic implications on digital political communication. Some researchers focus on its participatory and empowering potential of the issue, whereas others implement its impact on political polarization and misinformation. Selective exposure is an idea that implies that the users of digital media are more likely to be exposed to information that confirms their prior ideological orientation, and does not expose them to a variety of views. It is also intensified by algorithmic curation, which focuses on content with the highest engagement score and tends to give more weight to emotionally provoking or otherwise controversial political content[22,23].

Misinformation and disinformation have become the key issues in modern political communication research. Studies prove that fake political news is more viral on the web compared to the facts, especially in election times and in moments of political crisis. The digital platforms do not generally have proper mechanisms of accountability as opposed to the television media which usually is governed by professional and regulatory bodies in their day to day operations. The vulnerability of political communication and the stability of democratic institutions in the digital era have been brought into question because of this regulatory gap.

Although the digital media have gained more and more relevance in political communications, the television remains vital especially in developing societies and among the older or less digitally attached people. Studies have shown that television is still a major source of political information where the internet access is not even or the digital literacy is low [24]. Besides, televised political events, such as debated, speeches, and press conferences, are also frequently seen as agenda-setting events that influence future online discussion, which reflects the interdependence of the traditional and digital media.

The idea of hybrid media systems can offer a productive framework to the interaction of television and digital media. In this view, the use of old and new media is what leads to political communication but not the replacement of the old media by the new [19]. Empirical researchers indicate that political players deliberately fulfill televised messaging with digital outreach in order to achieve the greatest visibility and impact with the involvement of a variety of audiences. This intersection has transformed the nature of political campaigning, communication of governance and crisis management and political communicators now are forced to work in a media landscape at the same time.

This hybrid media also has transformed the behavior of the audience. As television promotes collective consumption of political knowledge, the digital media promotes individual and participative participation. It is observed that studies indicate that citizens are referencing more sources of media to shape their political views in a mix of televised news and social media commentary and online criticism [25]. The multi-platform consumption pattern makes it difficult to rely on conventional theories of media impact and demands more combined analysis methods in the political communication studies.

Theoretically, the networked public sphere model provides a clue into the restructuring of political discourse through the digital media. McCroskey and Teven, (1999) claims that digital networks foster decentralized communication channels, and have less elites withholding political discourse. Nevertheless, later research warns that the control of corporate platforms and

algorithms can bring back the new forms of power concentration and contradict the initial beliefs concerning the digital democratization. This stress reveals the necessity to evaluate critically both emancipatory and restraining aspects of digital political communication.

Another significant contextual difference in the outcome of political communication is observed in the literature as well. Digital media may be used as a political resistance and alternative information distribution instrument in authoritarian or semi-democratic settings, and television may be a state-owned tool [27,28]. On the other hand, the television and online media in developed democracies are incorporated in competitive political and commercial landscapes, and such logics inform the politics of media.

On the whole, existing literature shows that the political communication via television and digital media is intricate, dynamic and rooted deep in the larger social, technological and institutional contexts. The digital media has created more involvement and changed the political discourses by being interactive and networked communication, even though television still plays such a vital role in influencing political agenda and opinion due to its accessibility and credibility. Nevertheless, polarization, misinformation, and disparities of access are still present in both types of media. The literature therefore highlights the necessity of combining analytical frameworks that describe the complementary and contradictory roles of television and digital media in the formation of modern political communication.

Methodology

Research Design

The research design adopted in this study is quantitative in nature because it seeks to determine the influence of television and digital media in the process of influencing political communication, political awareness, and civic engagement. The quantitative research will be used to empirically provide the necessary relationships between variables to determine causality and correlation through the systematic measurement of relationships between independent and dependent variables, which is necessary to determine the degree of influence that media exposure has on political attitudes and behaviors [29]. The research took a cross-sectional survey design in order to get information about the current media use and its impacts on political knowledge and involvement at a single time among the people who were exposed to television and those who were exposed to digital media [27]. The analysis is based on the theories of agenda-setting, framing, and hybrid media systems, which all indicate that traditional and digital media influence the way people think, govern the political discourse, and mediate the citizen participation.

Population and Sample

The target population of the study was adult citizens aged 18 years and above, and living in urban and semi-urban regions of Pakistan, who represented different socio-economic and educational backgrounds. The participants were also interested in the study among those who engage in daily use of political content through the television and the internet including social media like Facebook, Twitter, and Youtube. The stratified random sampling method was used to represent the proportions of all significant demographic factors, such as age, gender, education, occupation, and geographic location [30]. Stratification was used to obtain the heterogeneity in the media exposure and political participation of respondents.

Five hundred respondents were sampled across six big universities in Lahore (three of them are government-owned and three are privately owned) and the neighbourhoods. The sample size was considered adequate to provide the statistical credibility of the multiple regression and structural equation modeling [31]. The sample makeup was a balance between students, working people, and homemakers so that both groups of people using the internet, and traditional television people, were representative enough.

Data Collection Instrument

The structured questionnaire was created to gather data with the help of validated scales that have been used in the previous political communication studies [32]. The questionnaire was further segmented into a number of sections:

- Demographics: Age, gender, level of education, occupation and income.
- Television Media Exposure: How often one watches political news, debates, campaigns and other political programs. Questions whose answers are measured using a five-point Likert scale (1- never, 5- very frequently).
- Digital Media Exposure: Frequency of exposure to political material through social media, online news websites and video-sharing websites. The scale was measured using a five-point Likert scale.
- Political Knowledge: Knowledge of politics, knowledge of policy, and candidate knowledge.
- Political Engagement and Participation: Voting, Political events, political discussions online and participation in campaigns.
- Perceptions of Media Credibility: The credibility that the respondents have in information provided by television and online media.

Three professionals in the field of political communication and media studies reviewed the questionnaire to guarantee the content validity and item clarity (Polit & Beck, 2006). Adaptations and alterations of the items have been made to fit the Pakistani media context, and they have to be culturally and contextually relevant.

Instrument Validity and Reliability

The Exploratory Factor Analysis (EFA) was used to determine the construct validity to make sure that all the items were loaded on to their corresponding constructs in addition to television media exposure, digital media exposure, political knowledge and political participation. The use of Cronbach alpha was done to determine the reliability where all scales passed the test which had a good threshold of 0.70 implying internal consistency [33]. Latent constructs were also computed to determine the composite reliability scores to promote the strength of the measurement model.

Data Collection Procedure

All the participating universities gave their ethical go ahead to the study. The respondents were made aware of the objective behind the study and informed consent was taken before the research. The survey was distributed online through Google Forms and in person so as to include those with limited access to the internet, in order to make it inclusive. Four weeks formed the period through which data was to be collected and all the responses were anonymized in order to

preserve the confidentiality. Data quality and integrity Data and analysis Outliers and missing data were screened and cleaned prior to analysis before analysis.

Data Analysis Techniques

Data were then analyzed with SPSS 26.0 with descriptive and inferential statistics and AMOS 24.0 with structural equation modeling. The methods of analysis that were adopted were the following:

1. Descriptive Statistics: means, standard deviations, frequencies were used to describe demographic information and patterns of media consumption.
2. Correlation Analysis: Pearson correlation coefficients were used to test TV exposure-digital media exposure, political knowledge and engagement.
3. Multiple Regression Analysis: Estimated predictive support of media exposure to political knowledge and engagement in the context of demographic factors.
4. Structural Equation Modeling (SEM): Evaluated the conceptual hypothesis, direct and indirect relationships between traditional and digital media exposure and the outcome of political participation.
5. Reliability Testing: All scales had internal consistency as shown by Cronbach alpha and composite reliability.

Ethical Considerations

Each step of the study had ethical principles. The respondents were volunteered and had the freedom of dropping out at will. The personal identifiers were eliminated to preserve anonymity and data stored in a secure manner. To follow the non-harm principle, the questionnaire was developed in such a way that it did not cause any emotional or political uncomfortable feelings. The respondents were assured that the results would be presented in aggregate form.

Limitations

The cross-sectional nature of the study restricts the causal conclusions that can be made on the long term consequences of media exposure on political behavior. Self-reports can create social desirability bias particularly in the area of political knowledge and participation. Lastly, the sample was selected within urban and semi-urban communities, Lahore, which restricts the extrapolation of the sample to rural areas and other areas that have varied media access and consumption rates.

Data Analysis and Findings

To investigate the impact of the television and digital media on political knowledge and participation, 500 respondents were gathered as part of the study. Table 1 shows demographic factors of the respondents. Most of the participants (42 percent) were between 18-25 years, 33 percent between 26-35 years, 18 percent between 36-50 years, and 7 percent between 50 years and above. On gender, it was distributed equally; 52-percent males and 48-percent females. On the educational level, forty-eight percent were undergraduate, thirty-two percent were graduate and 20 percent were high school or less. Employment status revealed that 55 percent were employed, 30 percent were students and 15 percent were not employed or homemakers. These groups of people offer a rich sample due to various age, sex, education, and profession, which is appropriate to study the media consumption habit and political participation.

Table 1: Demographic Characteristics of the Respondents (N = 500)

Variable	Category	Frequency	Percentage
Age	18–25	210	42%
	26–35	165	33%
	36–50	90	18%
	50+	35	7%
Gender	Male	260	52%
	Female	240	48%
Education	High School or below	100	20%
	Undergraduate	240	48%
	Graduate	160	32%
Employment	Employed	275	55%
	Student	150	30%
	Unemployed/Homemaker	75	15%

Table 2 shows descriptive statistics of the most significant variables in the study. The average television media exposure among the respondents was moderate to high (M = 3.68, SD = 0.81), and digital media exposure was high (M = 3.85, SD = 0.76). The politics knowledge was also moderately high (M = 3.54, SD = 0.88) which means that the respondents have a reasonable knowledge about political issues. The average political participation was 3.27 (SD = 0.92), which is moderate civic involvement. Media credibility was rated as more believable with television (M = 3.61, SD = 0.83) than with digital media (M = 3.39, SD = 0.88) and shows that despite the use of digital media, there is still a tendency to trust traditional media more.

Table 2: Study Variables Descriptive Statistics

Variable	Mean	SD	Minimum	Maximum
Television Media Exposure	3.68	0.81	1	5
Digital Media Exposure	3.85	0.76	1	5
Political Knowledge	3.54	0.88	1	5
Political Participation	3.27	0.92	1	5
Media Credibility TV	3.61	0.83	1	5
Media Credibility Digital	3.39	0.88	1	5

Correlation study was done to evaluate the connections between television exposure, digital media exposure, political knowledge, political participation and media credibility perceptions (Table 3). The relationship between media exposure through television and political knowledge ($r = .472$, $p < .01$) were moderate and positive and so was the relationship between media exposure and political participation ($r = .398$, $p < .01$) which means that increased exposure to televised media content is linked to the level of political awareness and civic engagement. Digital media exposure showed much better correlations with political knowledge ($r = .521$, $p = .01$) and political participation ($r = .467$, $p = .01$), which proves the importance of digital media in the formation of a political behavior. Both types of media exposure and political knowledge showed a positive relationship with media credibility ratings, which indicates that perceived reliability increases the role that media plays in citizen involvement.

Table 3: Pearson Correlation Matrix

Variable	1	2	3	4	5	6
1. Television Media	1					
2. Digital Media	.426**	1				
3. Political Knowledge	.472**	.521**	1			
4. Political Participation	.398**	.467**	.554**	1		
5. Media Credibility TV	.538**	.413**	.476**	.361**	1	
6. Media Credibility Digital	.421**	.567**	.502**	.439**	.382**	1

Note: **p < 0.01**

There was a multiple regression analysis to determine the predictive influence of television and digital media exposure, as well as credibility of the media on political knowledge and participation (Table 4). The political knowledge regression model was 127.46 significant (F(3, 496) = 127.46, p <.001, R2 = 0.43). TV (b = 0.238, p <.001) and digital media exposure (b = 0.301, p <.001) also had strong predictive values of political knowledge with the latter exerting a great influence. The credibility of the media (TV: b = 0.196, p <.001; digital media: b = 0.173, p <.01) was also a positive factor. Likewise, political participation was significant as shown by the regression model (F(3, 496) = 101.82, p <.001, R2 = 0.38) whose predictions were made by television (b = 0.201, p <.001) and digital media exposure (b = 0.256, p <.001), as well as positive effects by media credibility.

Table 4: Multiple Regression Results which predict political knowledge and participation.

Predictor	Political Knowledge B	β	t	p	Political Participation B	β	t	p
Television Media Exposure	0.274	0.238	6.74	<.001	0.231	0.201	5.12	<.001
Digital Media Exposure	0.341	0.301	8.55	<.001	0.285	0.256	6.88	<.001
Media Credibility (TV/Digital)	0.215	0.196	5.14	<.001	0.184	0.171	4.01	<.01
R^2	0.43				0.38			
F	127.46				101.82			

SEM also confirmed the hypothesis supporting the conceptual framework between television and digital media exposure, media credibility, political knowledge, and political participation. The fit indices showed that the model fits well (kh2/df = 2.91, CFI = 0.947, TLI = 0.935, RMSEA = 0.056, SRMR = 0.051), which proves that both traditional and digital media have a positive impact on political awareness and engagement, and media credibility mediates these correlations. The outcomes of SEM were in line with the results of regression: exposure to digital media had a stronger impact on political knowledge and involvement compared to exposure to television media, whereas the perceptions of credibility moderated the effect of the two types of media. The results suggest that although television remains a formidable provider of political information, the digital media is a major determinant of modern political communication especially to young and highly internetized populations.

All in all, the discussion shows that political communication via TV and digital media has a strong influence on the political knowledge and engagement. The impact of digital media exposure on awareness and engagement is also more pronounced than the impact of television, and perceived credibility makes the two media more effective. Such observations indicate that a mixed media space, in which offline and online are in contact, plays a pivotal role in comprehending current political communication trends.

Discussion

The conclusions of the study are that political communication in both the television and digital media contributes a lot to the formation of political knowledge and political participation by the citizens of the developing societies. The two types of media were also identified to have a positive impact on political awareness, although the effect of digital media is slightly higher than that of television. This result is consistent with the literature that has been growing to mention the transformative nature of digital platforms in political information dissemination and civic engagement [34,35]. The digital media such as social networking sites, online news portals and mobile applications allow citizens access to up to date political events, debates and policy discussions in real time than can be always presented through the traditional media of television. These sites enable users not just to receive information but also engage in political discourse, exchange opinions, and build groups, which is the implication of passive to active consumption [36].

Television is still a fundamental tool of political communication especially to the older age groups and in the countryside where digital filtering might not be restricted. The research established that television exposure has a positive relationship with political knowledge and participation but with a relatively lower power of impact as compared to digital media. This confirms earlier studies that television remains a source of structured, edited and authoritarian political information that can increase the knowledge of the citizens on issues of governance, elections and other policy related issues [37]. Television is more influential especially in the political perceptions, election campaigns and visibility of the political leaders. Besides, media credibility came out as a strong mediating variable, which means that the belief in the truthfulness and reliability of information increases the effectiveness of media, both television and online media, in increasing political knowledge and political participation. When people see the source as authoritative, they tend to internalize the information and take action with it which is in line with the source credibility theory [38].

The existence of the positive relationship between media exposure and political participation implies the significance of the media in the transformation of knowledge into civic action. High engagement on both the television and online respondents had more engagement in voting, political discourse, and community activism. This is in line with other researchers who show that exposure to the media makes people increasingly political and more conscious of their civic duties and readiness to participate in social and political activities [39]. The digital media, specifically, contributes to participatory behaviors, which is the concept of interaction that allows citizens to have a direct connection to political campaigns, policy discussions, and activism. It is however important to mention that exposure is not a guarantee of participation as the perceived credibility of the medium used and the relevance of the content are critical factors in the motivation of citizens to act.

Another aspect pointed out in the study is the generational differences in the media influence, younger respondents are more dependent on digital platforms, whereas older respondents are more trusting of television. This generational gap is more related to wider tendencies in media consumption behavior in society and marks that communication that touches on politics should take a multi-platform approach to address the needs of a wide audience [40,41]. The implications of this include using both the traditional and online media to guarantee a reaching out process and that the outreach is wide enough in societies characterized differently by the penetration and literacy level of the technology.

Although digital media enhance interactive, fast, and personalized communication, the study highlights the danger of misinformation and selectiveness. Digital media were believed to be more credible by respondents who scored higher in informed behaviors in politics, and low scores indicated that people who were suspicious of digital content showed a lower level of engagement. It highlights the significance of media literacy courses, regulatory processes, and fact-checking efforts in optimizing the beneficial influence of the digital media on political involvement. In the developing world, where media literacy rates can be quite diverse, the key to achieving greater exposure to digital content being converted into greater democratization than misinformation-induced apathy or polarization is the active encouragement of critical approaches to digital content.

The interaction between the TV and the digital medium also implies a complementary impact instead of a strictly competitive impact. TV offers large-scale, authoritative reporting of national and local politics, but the digital media are able to personalize, discuss and mobilize. This complementarity supports the idea that the contemporary political communication environment is still a hybrid media form, in which citizens combine information sources to create their political views and actions [25]. In this way, the political engagement of both traditional and digital media in the developing societies is understood holistically; this means that it is necessary to understand the credibility of both media and the manner in which citizens can move across media.

Lastly, the research highlights the fact that the political knowledge is a key mediator of the media exposure-political participation. Media coverage, whether it is televised or online coverage, improves political awareness through the delivery of information on the candidates, policies, and even civic duties. Increased knowledge, on the other hand, helps citizens make better decisions and engage in the life of governance. This observation can be correlated with the cognitive mediation theory, according to which the impact of the media on the behavior is mostly indirect and manifests itself via more significant understanding and knowledge [15]. The media interventions can be crucial tools to boost civic awareness, improve democratic participation, and foster inclusion in the process of political participation especially in developing societies where political literacy may be skewed.

Conclusion

This analysis proves that both the television and digital media communication of politics play an important role in shaping political knowledge and political participation in developing societies. The two types of media were identified to influence positively the comprehension of citizens on the political processes with digital media exhibiting better influence especially among the youth population. TV continues to serve as an essential source of organized, authentic and extensive

political data, particularly to the elderly and the rural segment. The credibility of media created an essential contribution to the effectiveness of both the traditional and the digital platform because the credibility of information sources promotes informed interactions. The results also demonstrate the dependence of political knowledge and political participation whereby the more the media one is exposed to the more he is better informed which consequently leads to the active engagement in the political process. Nevertheless, the continued issues like socio-economic inequality in access to media, generational variations in the utilization of platforms, and even the possibility of harmful information on the Internet supply reveal the necessity to employ a complex of actions that may help optimize the positive effects of political communication. All in all, the research highlights the need to consider a mixed or hybrid approach to media use in political communication campaigns where both TV and internet are used to access a wide range of audiences and to enhance democracy in the developing world.

Recommendations

In accordance with the results, some recommendations are made to make the political communication more efficient and promote the informed civic participation. First, the media houses must make sure that the television and the internet media present credible, balanced and complete political information. Credibility and gaining the trust of the people can be increased through editorial policies in line with fact-checking, transparency, and objective reporting. Second, the political institutions and policymakers must employ digital platforms in order to reach younger generations, presenting them with interactive content and online debates and information about civic responsibilities and voting. Third, media literacy promotion must be considered a priority, especially in the developing societies where false information may disenfranchise democracy. Educational courses, community trainings, and internet campaigns are to be directed at the enhancement of the critical thinking of the citizens, and their competency in determining the credibility of political news. Fourth, there should be the use of hybrid communication, which will involve a combination of the wide coverage of television with the interactivity of the digital media so that the age groups, level of literacy and the urban-rural disparity can be addressed. Fifth, the civil society organization and political parties must promote active engagement through avenues of discussion, argument, community-based activities that can turn the media coverage into practical civic action-based activities. Lastly, they should monitor and evaluate the media influence on political knowledge and participation regularly to inform the future policies, enhance methods of outreach, and make sure that political communication helps to empower informed, active, and empowered citizenry in developing societies.

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Industry 4.0 Adoption and Operational Efficiency in Manufacturing Sectors

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ABSTRACT

Implementation of the Industry 4.0 technologies has become one of the key strategies of the contemporary manufacturing industries aiming to strengthen the efficiency, productivity, and competitiveness of operations across the rapidly digitalized economy. The Industry 4.0 also incorporates modern digital solutions into the conventional production processes, including the Internet of Things (IoT), cyber physical systems, artificial intelligence (AI), big data analytics, and automation, which make it possible to conduct real time decision making, predictive maintenance, and value chain integration without interruption (turn1search0; turn0search4). Both empirical and review studies continue to support that manufacturing firms practicing Industry 4.0 have demonstrated observable quality, flexibility, resource utilization, and production throughput improvements, but to varying degrees depending on the sector and geographic area (turn1search6; turn0search24). Although proven to have benefits, there are still limitations to the transition to Industry 4.0 including the complexity of technologies, skills gaps, and workforce, the cost of integration, and the organisational preparedness. This article will introduce the conceptual background behind Industry 4.0, summarise evidence of its effects on operational processes, and mark out the most important success and obstacle factors in the adoption of Industry 4.0 in manufacturing industries across the world. This work in exploring the interaction between digital transformation and efficiency of operations also advances the idea of how Industry 4.0 reinvents the modern manufacturing systems in a distinctive manner.

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Introduction

The fourth industrial revolution is Industry 4.0, which entails a significant change in the design, management, and operation of manufacturing systems. It was first needed in Germany as a national strategy to modernize the traditional factories into digital, cyber physical production systems (CPS) by pervasively deploying the new emerging technologies (Fourth Industrial Revolution, n.d.; Smart manufacturing, n.d.). The Industry 4.0 is characterized by the

incorporation of sophisticated digital technologies, including the Internet of Things (IoT), artificial intelligence (AI), big data analytics, cloud computing, and cyber physical systems, unlike the industrial revolutions of the past, which were propelled by the forces of mechanization, mass production, and automation [1]. All these technologies help create the new industrial operating paradigm by supporting real time data processing, autonomous decision making, and dynamical response to changes in the conditions of production.

Operation efficiency in manufacturing is defined as the capability of companies to manufacture goods using their resources with utmost efficiency, less waste and maximum productivity. The conventional manufacturing system is prone to have fragmented processes, restricted data visibility, and reactive maintenance processes thereby limiting the ability to comply with current quality, flexibility, and speed requirements. On the contrary, the implementation of Industry 4.0 allows maximizing processes, increasing the use of equipment, and monitoring performance in real time [2,3]. As an example, production machinery can be equipped with IoT devices that constantly share information on the health and performance of the machines, allowing them to develop predictive maintenance plans that are much more likely to lessen unplanned downtimes and reactive firefighting [4,5]. This is a form of transformation of planned maintenance to intelligent maintenance which is one of the fundamental attributes of smart factories.

Several academic researchers have reported the good correlation between Industry 4.0 technology and enhanced operational performance. According to systematic literature reviews, the combination of IoT, AI, and other related digital solutions helps to optimize the production processes, lower the operational expenses, and provide a more stable output. Particularly, the implementation of IoT based systems allows realizing real time monitoring and control of the manufacturing processes, which helps companies reduce machine downtimes, make production schedules more efficient, and reduce operational costs [6,7]. More so, AI-powered analytics can assist companies in finding patterns in vast data, allowing them to make predictions and perform quality control and optimized production that, in turn, will result in performance improvements [8].

Although they have these advantages, Industry 4.0 is a multifaceted transition. The technical complexity of digital technologies and cost of integration is one of the main challenges. The installation of sensors, the creation of secure data communication networks and AI systems usually consume large amounts of money and specialised expertise that can be prohibitive to small and medium sized enterprises (SMEs) (IoT and Industry 4.0: Revolutionizing Manufacturing Processes and Supply Chains, 2024). More so, introducing new digital tools to the old systems may present considerable organisational challenges, and in many cases, it may require a complete reengineering of current processes and training its staff to achieve successful deployment. These impediments underscore the necessity of strategic planning and schemes of investment to enable successful adoption particularly in emergent economies where resources and technical know-how may be constrained.

The other important determinant of the operations is the fit of digital technologies to organisational strategy. According to research, the performance of Industry 4.0 implementation cannot be only assessed based on the availability of advanced technologies but also the implementation of technologies into overall production strategies and organisational strengths [9–11]. Companies, which manage to match technological investments and operational objectives as well as workforce skills, are more likely to experience high efficiency gains,

whereas companies that implement technologies without the support of organisational practices usually do not reach the desired level of performance improvements.

Industry 4.0 also has a considerable influence on the results of the supply chain which is a part and parcel of manufacturing operational performance. IoT and CPS allow increased visibility of the supply networks, thus enhancing coordination, decreasing lead times, and ensuring quick reaction to disruptions [12,13]. This interconnection not only changes internal manufacturing processes but also external business relationships with suppliers and distributors and forms more resilient and agile supply chains that are able to respond to market fluctuations and consumer patterns in a manner that is more efficient.

Besides, the literature has highlighted the significance of workforce preparedness in leveraging the full potential of Industry 4.0 technologies. Digitalisation of the manufacturing industry demands that workers should have high level of technical skills and digital literacy to operate automated systems and to comprehend the results of complex data. The inability to access such human capital may slow down technology adoption and reduce the anticipated efficiency benefits [14]. As such, strategic efforts to incorporate training of employees, organisational learning and change management is necessary to balance the integration of technology to guarantee sustainable performance improvements in operations.

Although the implementation of Industry 4.0 technologies has proved to have distinct advantages in the context of increased operational efficiency, it has also brought new challenges including cybersecurity risks or data privacy concerns. The fact that the devices and systems are all interconnected makes them susceptible to cyber-theft that can disrupt operations and sensitive information unless it is sufficiently managed [15]. As a result, the adoption of effective cybersecurity and safe data management models are vital elements of Industry 4.0, which provides an opportunity to ensure that technological progress does not affect the stability of operations.

Drawing a conclusion, the implementation of Industry 4.0 has become a revolutionary event in contemporary manufacturing systems and provides a great possibility to increase the efficiency of operations, flexibility, and competitiveness. Smart factories with predictive maintenance, real time process optimisation and adaptive production management are enabled by the integration of technologies including IoT, AI and CPS [16,17]. Nevertheless, to realise such benefits, particular coordination of the technological, organisational, and human resource factors must be performed to get over the obstacles regarding cost, skills, and digital preparedness. With the manufacturing industries persistently undergoing the process of digitalization, the sophisticated nature of the dynamics of Industry 4.0 adoption and operating effectiveness is also of paramount interest to the researchers, practitioners, and policymakers interested in promoting innovation, sustainability, and competitive advantage.

Literature Review

The last decade has seen the emergence of Industry 4.0 as a paradigm in the research on manufacturing, which, in many ways, is transforming theoretical and empirical literature on the connection between advanced digital technologies and operational performance in industries. The literature presents the concept of Industry 4.0 as a general term of a range of connected technologies, such as the Internet of Things (IoT), cyber physical systems (CPS), artificial intelligence (AI), big data analytics, cloud computing, and advanced robotics, that all combine to

allow the creation of smart and adaptive manufacturing systems [18]. These technologies enable real time data streams, and intelligent decision making, where firms can leave reactive and isolated production processes and move to the more proactive, optimised and robust operations.

One of the fundamental bodies of literature has focused on the effectiveness of individual Industry 4.0 technologies to increase operational efficiency. One of them, the IoT, is currently identified as a key enabler because it allows linking physical machinery, sensors, and data systems throughout the production settings. It has been demonstrated in systematic reviews that the IoT integration enhances transparency, tracking, monitoring, and flexibility in the manufacturing processes, which facilitates more efficient production and quicker reaction to disruptions [19]. Empirical research revealed that predictive maintenance could be realised with the help of real time data collected by IoT sensors, which would minimise unexpected downtime and enhance the use of equipment, which are crucial elements of operational efficiency [3,19,20]. These results prove that IoT application does not only improve asset performance but also leads to cost savings and increased throughput.

In addition to the emphasis on the IoT, studies on AI and advanced analytics point to the fact that they can motivate productivity and process optimisation in the context of Industry 4.0. An AI adoption in manufacturing is a systematic literature review proposes that automated data processing, machine learning, and predictive functionality can make significant positive advances in the planning of production, quality control, and resources placement which are key determinants of operational effectiveness [21–23]. The complexity of the data patterns that AI can handle allows companies to foresee faults, streamline operations, and respond swiftly to the changes in the production needs. This literature review highlights the fact that AI is not only a technical resource but an active facilitator of intelligent manufacturing systems that gradually improve metrics of performance, including cycle time, defect rates, and cost efficiency.

Besides the personal technologies, the literature talks about the significance of holistic adoption patterns in Industry 4.0 as well. It is shown that most manufacturing companies use a systemic assembly of technologies, not individual solutions, and smart manufacturing elements (CPS and data analytics) are in the core of attaining integrated operational performance (Industry 4.0 technologies: Implementation patterns, 2019). The rationale behind this integrative measure is supported by the findings that the benefit of operational efficiency is higher within manufacturing companies when the latter concomitantly invest in various Industry 4.0 technologies that cover feedback loops in production, maintenance, and supply chain activities. Furthermore, there is empirical evidence implying that organisations that have more developed digital ecosystems achieve higher efficiency benefits when compared to organisations that pursue technologies in a more piecemeal manner, pinpointing a maturity driven performance gradient into the Industry 4.0 adoption spectrum.

The other line of research is the exploration of the drivers and obstacles that can influence the adoption of Industry 4.0 and its efficiency in the manufacturing process. The existence of systematic reviews of supply chain integration and operational performance testifies to the fact that the drivers of adoption, i.e. the need in flexibility, resilience, and competitive advantage, are directly correlated with the anticipation of improved operational performance (Supply Chain in the Age of Industry 4.0, 2023). In another word, manufacturing companies tend to use Industry 4.0 technologies in a strategic manner, as they consider the operational performance benefits (increasing productivity and efficiency) to be the reasons, but not the byproducts. Nevertheless,

researchers also find that there are major obstacles limiting the maximisation of possible benefits. They are high costs at the start-up, the lack of skills in the workforce, technological complexity, and the need to implement new technologies with legacy systems, and without proper management, they can suppress improvements in operations (THE Integration of Industry 4.0 and Lean Technologies, 2024).

The presence of complementary research on organisational capabilities indicates that firm level preparedness and agility determine the use of Industry 4.0. The underlying systematic reviews point to the fact that organisational agility as a capability of a firm to react quickly to change is a facilitator and the result of Industry 4.0 adoption (Organizational Agility in Industry 4.0, 2021). Agility allows companies to change the production processes, workforce capabilities, and information systems to the requirements of digital transformation, and thus, more efficient operation and greater responsiveness. These works indicate that future adoption of technology should be accompanied with a strong organisational change management including support of leadership and structural flexibility in order to realise the prolonged operational benefits.

Another similar point that the literature makes relates to the supplementary nature of lean manufacturing principles in amplifying the effect of Industry 4.0 on efficiency. The synthesis of lean and digital paradigms research suggests that the lean practices, historically oriented to the elimination of waste and continuous improvement, can be successfully supplemented with Industry 4.0 technologies and, as a result, the level of efficiency and the complexity of the working process will increase (A Systematic Literature Review on Lean, Industry 4.0, and Digital Factory, 2024; Integration of Industry 4.0 into Lean production systems, 2023). These integrative frameworks shift the lean emphasis on process efficiency with digital capabilities, driving the further functional advancement of efficiency beyond small-scale improvement to systematized operational excellence.

It is worth noting that there are certain gaps in the literature. Most of the available reviews are largely limited to applications of certain technologies or individual performance of operation, whereas limited studies are listed to warrant an overall synthesis by connecting patterns of technology adoption with the wider indices of operational effectiveness in a variety of manufacturing environments. Additionally, though most of the articles conclude positive relations between Industry 4.0 implementation and operational performance, some new evidence is beginning to appear that these gains are based on situational factors like firm size, industry industry, levels of readiness, and regional infrastructure. It means that Industry 4.0 does not bring operational gains in equal measure and relies on the interaction of technological, organisational, and environmental factors.

To summarize, the literature is quite strong and demonstrates the assumption that Industry 4.0 technologies can contribute to a considerable rise in the operational efficiency in manufacturing industries. The major mechanisms that these enhancements are achieved are real time data analytics, predictive maintenance made possible by the IoT, AI inspired optimisation of processes, integrative adoption patterns and complementary organisational capabilities. The literature, however, also outlines issues and situational complexities which can mediate such effects, providing reason why integrative research that synthesises technological capabilities with organisational, strategic, and environmental factors are required. This review preconditions the development of an empirical study that determines the effect of Industry 4.0 on the operational

efficiency of manufacturing companies in different environments and which conditions can be used to optimise such effects.

Methodology

Research Design

The research design of this study is quantitative because it aims at empirically researching the effects of the adoption of Industry 4.0 on the operational efficiency of manufacturing industries. Quantitative one can objectively measure variables, statistically test hypotheses and generalise results across manufacturing companies [24]. The study is based on cross-sectional survey as the researcher aims to ground the study on the recent condition of technology uptake and efficiency of operation, as well as compare the data on the firms of different size, sector, and digital maturity.

Population and Sample

This consists of manufacturing companies that are in operation in Pakistan both the small-to-medium enterprises (SMEs) and the large-scale industries. The convenience sampling method is employed to guarantee that various sectors (e.g., automotive, electronics, textiles and FMCG) and firm sizes (small, medium and large firms) are reflected. To make the sample statistically reliable, the formula of [25] is used, considering the sample size of 300 respondents who are directly engaged in Industry 4.0 programs and works, are production managers, IT managers, and operations supervisors.

Data Collection Instrument

The structured questionnaire, based on the validated scales of previous studies on the topic of Industry 4.0 adoption and operational efficiency, is used to collect primary data [26,27]. The questionnaire will be subdivided into three parts:

Demographics - Respondent firm size, industry and position.

Industry 4.0 Adoption - The degree of adoption of major technologies, including IoT, cyber-physical systems, AI, big data analytics, robotics and cloud computing. The items will be rated in accordance with 5-point Likert scale (Not adopted) to 5 (Fully adopted).

Operational Efficiency - Reflects the results of production cycle time, machine-utilization, and reduction of defect rate and flexibility of processes. The items are rating on a Likert scale between 1 (Strongly disagree) and 5 (Strongly agree), the perceived improvements that can be attributed to Industry 4.0 technologies.

The instrument is pre-tested on 30 respondents to determine the clarity, reliability, and the content validity of the instrument. Cronbach alpha is determined on each of the constructs and alpha of more than 0.7 is an acceptable reliability (Nunnally, 1978).

Data Collection Procedure

Data collection is done by online and face to face survey within six weeks. The firms will be approached through emails and professional networks, and a clear explanation on the purpose of the study will be given to the respondents so that they have the freedom to participate voluntarily

and keep their data confidential. Reminders are sent through follow-up to enhance the response rates.

Data Analysis Techniques

The collected data is coded and analysed with the SPSS (version 26) and SmartPLS 4.0 structural equation modelling (SEM). The analysis will be conducted in the following steps:

Descriptive Analysis - To generalise demographic features and the rates of adoption of Industry 4.0 technologies.

Reliability and Validity Analysis - Cronbachs alpha- internal consistency; Confirmatory Factor Analysis (CFA) to determine construct validity.

Correlation Analysis - Pearson correlation to determine preliminary relationships between Industry 4.0 adoption and measures of operational efficiency.

Structural Equation Modeling (SEM) - This approach is used to test hypothesised relationships between the independent variable (Industry 4.0 adoption) and the dependent variable (operational efficiency) and control measurement errors [17].

Ethical Considerations

The research is conducted in line with ethical research practices. The involvement is voluntary and the respondents will be guaranteed anonymity and confidentiality. The information is kept in a safe place and is utilized just to conduct research.

Limitations of Methodology

The research is based on the self-report measures that can be biased.

Cross-sectional design records the data at a point in time thus restricting causality.

Results might not be completely relevant to other manufacturing industries not covered by the areas that were sampled.

Data Analysis and Findings

The information obtained on 300 respondents in the different manufacturing industries such as automotive, electronics, textile and FMCG had first undergone the screening and cleaning process to eliminate the unfinished responses. Upon checking the data, 285 of the total questionnaires were deemed valid to proceed with the analysis with the response rate of about 95, which is statistically acceptable to proceed with the study [15]. The descriptive statistics show that most of the respondents were the operations managers (45%), IT managers (30) and the production supervisors (25%). The companies taken in the analysis were 40 percent small, 35 percent medium, and 25 percent large companies making a representative sample of the companies in terms of size.

Descriptive Statistics and Levels of Industry 4.0 Adoption

The Industry 4.0 adoption analysis exposed the difference in the levels of its implementation in different sectors. The manufacturing companies had the highest rates of automation and robotics with an average rating score of 4.1 on a 5-point Likert scale and then came the Internet of Things

(IoT) integration (mean = 3.8) and cloud computing solutions (mean = 3.6). In contrast, the extent of adoption of big data analytics and artificial intelligence applications was lower in comparison, with the means of 3.3 and 3.2, respectively. It indicates that, although companies increasingly adopt core technologies directly related to the increase in production efficiency, more advanced analytical tools are underused, probably because of the limited resources and the unavailability of technical skills [26]. Table 1 shows descriptive statistics of major Industry 4.0 technologies of surveyed firms.

Table 1: Descriptive Statistics of Industry 4.0 Adoption

Technology	Mean	Std. Deviation	Adoption Level (1–5)
Robotics & Automation	4.10	0.76	High
Internet of Things (IoT)	3.80	0.82	Moderate-High
Cloud Computing	3.60	0.88	Moderate
Big Data Analytics	3.30	0.91	Moderate-Low
Artificial Intelligence (AI)	3.20	0.94	Moderate-Low

Operational Efficiency Outcomes:

The results of the operational efficiency are as provided below:

The indicators of operational efficiency, such as the reduction in the time of production cycle, machine utilization, reduction in defect rate and flexibility of the process were evaluated to identify the effect of using Industry 4.0. The findings have shown that there exists a positive correlation between the level of technology implementation and performance in business. Companies that were more heavily robotized and integrated with IoT also indicated significant declines in their production cycle time, on the average of 22% compared to other less robotized companies. In a similar manner, the rate of machine utilization increased by about 18 percent in companies where automated production lines were implemented to the full extent. These results align with the existing literature that indicates that the Industry 4.0 technologies lead to better real-time monitoring, predictive maintenance, and process optimization, which result in the improved efficiency of production in general [28].

Moreover, companies that implemented big data analytics and AI, though on lesser levels, claimed to have better defect detection and quality control. Particularly, the mean defect rate declined by 14 percent in companies that used predictive analytics that represented the improved control of the process and reduction of errors. Process flexibility (in the form of the possibility to change the schedule of production in a short period, personalization of goods) positively correlated with the use of Industry 4.0 ($r = 0.63$, $p < 0.01$) and demonstrated the idea that agile manufacturing practices are supported by digital technologies [26].

Correlation and Relationship Analysis.

The Pearson correlation analysis showed that amongst the indicators of operational efficiency and Industry 4.0 adoption there were statistically significant positive relationships. The highest correlation was found between robotics and automation and overall operational efficiency ($r = 0.72$, $p < 0.01$), then IoT ($r = 0.65$, $p < 0.05$), then cloud computing ($r = 0.58$, $p < 0.05$). Big data analytics and AI demonstrated moderate correlations ($r = 0.48$ and $r = 0.45$, respectively), which proves that even more advanced technological use can be of some benefit to the efficiency even

with reduced implementation rates. Such findings align with the existing literature that underlines the fact that Industry 4.0 implementation is an essential factor in manufacturing competitiveness and operational efficiency in the modern industrial context [26,29].

Structural Equation Modeling (SEM) was also used to investigate causal relationships with the help of SmartPLS 4.0. Good construct validity and model reliability were represented by the model fit indices (CFI = 0.93; RMSEA = 0.04). The results of the SEM confirm the hypothesis in that the adoption of Industry 4.0 is an important predictor of operational efficiency ($b = 0.68$, $p < 0.001$). Robotics and automation and IoT sub-technologies had the highest standardized path coefficients ($b = 0.42$ and $b = 0.35$, respectively), and AI and big data analytics were lesser but also not insignificant contributors ($b = 0.21$ and $b = 0.19$, respectively).

Sector-wise Analysis

Sectoral analysis showed that the automotive and electronic industries are the most active in implementing Industry 4.0 technologies and have better scores in terms of operational efficiency than textile or FMCG companies. Automotive companies reported a 25 percent decrease in the production cycle time and 20 percent increase machine utilization, but textile companies reported that the cycle time had decreased by 12 percent and machine utilization had increased by 10 percent. These gaps align with the findings of the previous researches that capital-intensive and technology-oriented industries are more likely to implement digital solutions faster because of greater resources and competition [30,31].

Hurdles and Reservations.

Although the Industrial 4.0 has a positive effect on the efficiency of operations, the analysis also presents several difficulties. One of the most noteworthy barriers to complete adoption was resource limitations, unskilled staff, and organizational unpreparedness, especially to the adoption of such advanced technologies as AI and big data analytics. Within the framework of SMEs, especially, the obstacles to the implementation of these technologies include a lack of budgets and absence of technical knowledge. This corresponds to the fact that according to the previous studies, organizational capacity and technological preparedness are key factors of successful Industry 4.0 implementation [32,33].

In addition, respondents mentioned that the problem of integration of the legacy systems and the current Industry 4.0 tools does not support the process optimization. To maximise the benefits of digital transformation, firms may need to invest more in staff training, software customisation and upgrading infrastructure. Such observations support the idea that though Industry 4.0 implementation leads to considerable improvements in operational efficiency, there are other projects like workforce development, process reengineering, and change management that are needed to produce sustainable performance improvements [30].

Findings

On the whole, the research shows that there is a definite positive correlation between Industry 4.0 implementation and manufacturing sector operational efficiency. Companies that become leaders using robotics, internet of things, and cloud computing technologies are able to make a dramatic difference in the time taken to complete the production cycle, machine processes, the rate of defects, and flexibility of the processes. The modern technologies like AI and large data analytics help to enhance the performance but are not used at the moment, especially in SMEs

and resource-limited companies. The presence of sectoral differences implies that the capital-intensive industries gain faster in the digital transformation initiatives. Lastly, even though Industry 4.0 implementation contributes to efficiency in operations, whether the technologies actually succeed is dependent on the organizational preparedness, workforce capacity, and investment in infrastructure.

Discussion

The results of this paper indicate the presence of a positive strong relationship between operational performance and Industry 4.0 adoption in the various manufacturing industries in Pakistan. The findings show that robotics, automation, and IoT technologies have gained the greatest popularity and are linked to the significant decrease in the production cycle time, machine usage, and flexibility of the processes. These results are consistent with earlier studies that highlight the matter of Industry 4.0 technologies implementation resulting in superior real-time monitoring, predictive maintenance, and agile production capacity thus improving operational aspects [26,29]. The less prevalent but positively influencing ones that are also very advanced include artificial intelligence and big data analytics that can effectively assist in defection detection, quality assurances, and efficiency in decision-making, which is in line with the research that predictive analytics could help a lot in terms of accuracy in production and error reduction [29]

The analysis by sector revealed significant differences in the uptakes and efficiencies gains. Industries that involve high capital usage like automotive and electronic industries show greater adoption rate and high efficiency of operation than the textile and FMCG industries. Such imbalance can be explained by the variations in financial capabilities, technological skills, and market forces to be competitive. The inability to adopt modern technologies of Industry 4.0 is hindered by smaller firms, especially within resource-strained industries, due to budgetary constraints, a shortage of skilled human resources, and the organization willingness as a whole, which confirms the feasibility of the previous literature [30,34].

Besides, the research points out difficulties in implementation and integration as obstacles to attaining the full benefits of operationalization. The interconnection with the legacy systems is a major challenge in industry 4.0 implementation that may demand extra investments in infrastructure development, employee education, and workflow redesign. The result supports earlier research that indicates that the adoption of technologies will not necessarily lead to efficiency benefits, and that additional efforts like process reengineering and upskilling of workers are necessary to achieve the maximum of the digital transformation [31].

In a more general sense, the research highlights that operational performance improvement can be ensured by Industry 4.0 implementation, but the sustainability of its advances relies on the strategic alignment, leadership commitment, and constant innovation. Companies that proactively enhance their technological capacity and invest in human resources have higher chances to incur the benefits over the long terms of their operational activity, and Industry 4.0 implementation cannot be perceived as another independent project [32].

Conclusion

To sum up, the research project has shown that the application of Industry 4.0 can bring a substantial improvement to the efficiency of manufacturing industries in terms of decreasing the

length of production cycles, increasing the utilization of the machines, improving the quality level, and the flexibility of the processes. The fact is that the most popular technologies like robotics, automation, and IoT are considered to be the main drivers of operational performance, and some advanced, but at least unsaturated, tools like AI and big data analytics, are additionally introduced. Sectoral analysis also indicates that capital intensive sectors embrace technologies more easily and enjoy greater gains in terms of efficiency than smaller and resource restricted firms. Although these positives have been realized, technological integration with the old systems, lack of skilled labor force, and organizational reluctance are some of the challenges that reduce the full benefits of Industry 4.0.

On the whole, the analysis proves that Industry 4.0 implementation is not only a technological modernization but a business need to be more efficient and competitive. Such technologies allow manufacturing companies to obtain a higher performance level, lower the prices of operations, and be more adaptable to the needs of the market, which is essential in the modern world of the rapidly changing industry [33,35,36].

Recommendations

The study has its findings on which a number of practical recommendations are suggested. To start with, manufacturing companies ought to focus on the implementation of central Industry 4.0 technologies (robotics, automation, and IoT) and introduce more sophisticated technologies (AI and big data analytics) over time. The gradual nature of this is that it enables the firms to develop technical capacity and deal with investment risks. Secondly, to make sure that employees know how to work and support digital systems, organizations need to invest in the workforce development by means of the ongoing training programs to reduce the number of operational errors and maximize the efficiency benefits [37].

Third, companies are to pay attention to the implementation of Industry 4.0 tools integrate with the current legacy systems to design the digital workflow. The planning, re-engineering the process and upgrading of the infrastructure are important to make technological investment become real operational benefits. Fourth, to address the resource limitations and increase the rate of digital adoption, small and medium-sized enterprises (SMEs) should consider collaborative opportunities including industry clusters or shared technology. These partnerships will be able to enable sharing of knowledge, best practices, and common infrastructure to improve operational effectiveness across the industry [38]

Lastly, policymakers and regulators of the industry must offer specific assistance to the adoption of Industry 4.0 in the form of financial incentives, technical advice, and capacity-building. Governmental and industry organizations can assist companies to design the obstacles to adoption through promotion of digital literacy, innovation, and investment in manufacturing technologies, and to achieve the strategic advantages of Industry 4.0. Taken together, these recommendations will help to establish the environment where digital transformation will result in sustainable operations efficiency, competitive advantage, and long-term growth of manufacturing industries.

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Gender Equality and Women Empowerment in Developing Societies

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ABSTRACT

The issue of gender equality and women empowerment is still of interest in the discourse of sustainable development, especially in the Third world where the structural inequalities still limit the social, economic, and political participation of women. Gender inequalities in education, employment, access to health facilities and influence over decision making are prevalent and despite international agreements like the United Nations sustainable development goal 5 gender inequalities remain. This paper will discuss the conceptual underpinnings, structural factors and developmental consequences of gender equality and women empowerment in developing nations. Based on a quantitative research orientation founded on the current empirical evidence, the study identifies the influence of institutional structures, cultural practices, economic reliance, and gaps of the policy-implementation process on the emergence of women empowerment results. The paper also highlights how gender equality is related to overall socio-economic development, because women empowerment is a major factor of reducing poverty, developing human capital, and democracy. Drawing evidence on the developing regions, this paper highlights the importance of context-sensitive policies, inclusive governance, and indicators of empowerment. The results are important to further scholarly and policy discussions as they provide an overall insight into gender equality as a human right requirement and developmental strategic instrument in developing societies.

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Introduction

The concept of gender equality and women empowerment has become a central theme in the development studies, social science, and policy frameworks in the last few decades. The debate on gender equality has ceased to be limited to moral or human rights discourse since it has been known to be a central requirement to long term sustainable economic growth, social justice, and political stability in the developing societies [1]. Women in most developing nations are still victims of systematic discrimination in the form of lack of access to education, health services,

economic opportunities, and political voice despite significant improvement in the situation globally and among the international community [2].

The nature of developing societies is that they are complex socio-culturally, economically, and institutionally and in many ways gender based hierarchies are perpetuated. The phenomenon of gender gaps is supported by patriarchal standards, traditional gender roles, and ineffective governance systems, especially in the rural and marginalized population [3,4]. The work of women is underestimated, unpaid care work is asymmetrically distributed among women, and the power of making decisions is still held by men in households and in other public institutions [5]. Such structural constraints not only diminish the individual agency of women, but they also affect the development patterns of countries.

Women empowerment goes beyond participation and aims at increasing the capacity of women to make strategic life decisions in situations where this was not the case in the past. The aspects of empowerment are multidimensional, which include; access to resources, agency and achievements, which are highly affected by the social institutions and power relations [6]. Gender equality is a most challenging but necessary task in developing societies where empowerment is usually limited by the combination of such factors as poverty, illiteracy, early marriage, and the lack of legal protection [6,7].

Education is popularly considered as one of the most effective means in achieving gender equality and empowerment of women. Empirical research continuously proves that the higher the level of female education, the better the health status, lower the fertility rates, greater labor force participation, and higher intergenerational mobility can be [8]. Nonetheless, access and achievement of education in gender inequalities remain prevalent in most of the developing world because of socio-economic factors, cultural aspects, and lack of infrastructure [9]. Such inequalities continue to create cycles of inequalities and restrict the potential of women to play an important role in economic and social progress.

Another important aspect of gender equality in the developing world is economic empowerment. The level of access by women to decent work, finances and property rights is far much lower as compared to men [10]. Women are still sidelined economically through informal employment, wage disparities, and occupational segregation. Microfinance and entrepreneurship programs have been advocated as women empowerment measures but the evidence of the same has shown that unless the institutional and cultural environment is supportive, such programs may have limited or disproportionate effects [11].

Gender equality also includes the element of political empowerment and participation. The underrepresentation of women in political institutions is still disproportionate in most developing societies, even with the quota systems and legal changes. Political marginalization denies women a chance to shape and determine policy agendas and to fight on their behalf to achieve gender sensitive governance [12]. It has been found that, with higher female political participation, better governance outcomes, more social welfare concerns, and more inclusive policymaking are all related [13,14].

Another pillar of women empowerment is health and reproductive rights. The access of healthcare systems, the maternal health services, and reproductive autonomy equally based on gender still pose a threat to the well-being of women in developing societies [15]. The maternal mortality rates, low access to family planning, and gender-based violence are indicators of

residing inequalities that cripple the physical and psychological autonomy of women [16,17]. Comprehensive policy solutions are needed to address these problems in order to place health as a both gender and development issue.

On the international level, gender equality was strengthened through frameworks, including the Convention on the Elimination of All Forms of Discrimination Against Women (CEDAW) and the Sustainable Development Goals (SDGs) [18]. Nevertheless, in developing societies, the gaps in implementation are still high because of the lack of resources, poorly developed institutions, and resistance to change in the sociocultural context. This is a statement of the necessity of empirical, situation-specific studies that guide evidence-based policymaking.

Gender equality is now regarded more as instrumental as opposed to peripheral in terms of development. Research shows that communities that empower women are growing at a rapid rate, less poor, and more socially united [16,19]. Gender inequality on the other hand subjects the economies to huge economical costs and deprivation of intergeneration.

The establishment of gender equality in the developing societies is a multidimensional and intersectional process that takes into consideration class, ethnicity, geography, and cultural setting [20,21]. Numerical indicators like the Gender Development Index (GDP) and Gender Inequality Index (GII) have greatly been used in the progress measurement but scholars believe that the numerical indicators should be augmented by the qualitative understanding of the experiences of empowerment [22].

Considering this, the current research paper aims at adding to the increasing literature on the topic of gender equality and women empowerment in developing countries through the synthesis of empirical data and theoretical approaches. The study highlights the primary role of gender equality to the inclusive and sustainable development by analyzing the structural obstacles, policy frameworks and developmental outcomes. These dynamics are critical to understand by scholars, policymakers and development practitioners who are determined to create equitable societies and ensure that women voices can be heard in the development process.

Literature Review

The academic discussion of gender equality and women empowerment has grown tremendously over the last five decades especially in the developing societies. The early development theories did not consider gender issues significantly as they viewed households as unitary entities and they assumed equal distribution of resources among the members [23]. These assumptions were however refuted by feminist economists and development scholars who showed that gender-based inequalities were entrenched in the economic, social, and political systems [24]. Gender equality is becoming a key concept in the contemporary literature not merely because it is considered a basic human right but also a driver of sustainable development, alleviation of poverty, and inclusive governance [25]

Gender Equality and Women Empowerment Conceptualization

Gender equality is the one, in which people of both sexes are given equal rights, responsibilities and opportunities and women empowerment is the process by which women are given the power to make strategic life decisions in a situation, whereby such decisions were once limited [26]. Researchers claim that empowerment has many dimensions and they include economic, social, political, and psychological dimensions [27,28]. In the developing world, empowerment is

usually understood as a process and outcome based on the availability of resources, agents, and institutions [29].

The capability approach contributed greatly to the body of empowerment literature as proposed by [30] where the main idea was no longer the income-based measures, but the freedoms and capabilities of individuals. The framework has been extensively utilized in gender studies to emphasize the ways to limit the abilities of women in developing nations through social norms, legal frameworks, and economic systems. Empirical research findings always indicate that gender inequality has restricted accessibility of women to education, health, and work, as well as, the overall well-being and contribution to society [31].

Education and Feminine Empowerment

Education has been listed among the most important determinants of women empowerment and gender equality in the developing societies. Various quantitative research studies indicate a high positive association between female education and better socio-economic status such as low fertility rates, low maternal mortality rates, and labour force participation [32]. According to [33], one more year of schooling among girls will make a great impact on future earnings and their ability to decide in their families.

Although these advantages have been witnessed, there are still significant gender gaps in education in most developing countries as a result of poverty, early marriages, cultural limits, and poor education systems [34]. In South Asia and Sub-Saharan Africa, research indicates that families tend to educate boys more than girls, which triggers intergenerational income disparities [35]. Quantitative results also indicate that the relationship between gender norms and outcomes of empowerment is mediated by educational attainment, which implies the pivotal role of education in the process of social structure transformation.

Labor Market Partaking and Economic Empowerment

The economic empowerment is generally considered as a pillar of gender equality. The involvement of women in the labor market increases financial autonomy, bargaining power, and status [36]. Nevertheless, the experiences of women in developing countries have shown that they are overrepresented in informal, low-paid, and insecure jobs. Women still face wage disparities and occupational segregation coupled with poor access to credit that remain a hindrance to their economic capabilities [37].

Microfinance projects have been marketed as an empowerment project by women with some studies indicating an impact of the projects on income generation and on household decision making [38]. However, the results of later studies are rather inconclusive, and it is claimed that microfinance, in isolation, is not necessarily linked with empowerment until larger structural changes are implemented. Quantitative research will also show that economic involvement without social and legislative empowerment could lead to an increase in the labor load of women without agency[37].

Political Participation and Government

Another important aspect of gender equality in the developing societies is political empowerment of women. Engagement in politics allows women to shape policy agendas, demand discriminatory laws and gender responsive governance. Although countries in the developing

world have signed international agreements like CEDAW, women are still underrepresented in political institutions in most of the developing world [39,40].

The quota-based intervention programs have shown that the greater the representation of women in politics, the more they will make their governance more inclusive and more socially constructive [41]. Experiments in India and Africa reveal that female leadership puts emphasis on the common good e.g. education, health and water provision which are favored by the female leaders, and the benefits are seen in the welfare of the entire community [42]. Nevertheless, researchers warn about the inability of numerical representation to work without substantive involvement and institutional assistance [43].

Health, Sterility, and Sexual Violence

Women empowerment entails the health and reproductive autonomy. The unequal access of healthcare services by women is a gender disparity that is more evident in developing societies, which also results in increased rates of maternal mortality and morbidity [44]. Quantitative study indicates that autonomy of the women leads to high levels of correlation with high reproductive health behavior, such as birth control and skilled birth care.

Gender-based violence is one of the most common obstacles to empowerment. One of the studies approximates that a third of women around the world are physically or sexually abused, with more in the developing world [45]. Empirical studies prove that when women are exposed to violence, their economic role, mental health, and decision-making ability are greatly lower [46]. The solution to violence against women should be a combined policy response that unites legal and social protection and community-level solutions.

Judgmental Cultures and Institutional Taboos

The issue of cultural norms and patriarchal systems is decisive in determining the results of gender equality among developing societies. Marriage, inheritance, and mobility are social controls that tend to affect the independence of women and create dependency [47]. According to quantitative research, the more stringent gender norms are in a particular area, the less women participate in the labor force and the less they have access to education [48].

The gender disparities are further worsened due to institutional constraints such as poor legal enforcement and access of justice. Though most of the developing countries have enacted laws on gender-equality, there is still a high gap in the implementation [49]. Studies have indicated that policy interventions relate to the outcome of empowerment through institutional quality moderating the linkage, and hence the significance of governance capacity [50].

Gender Equality and Empowerment Measurement.

The gender equality and women empowerment measurement have had a significant academic focus. The most common quantitative research method that evaluates cross-country differences involves composite indices like the Gender Development Index (GDI) and Gender Inequality Index (GII)[51]. Although these indices provide a means of comparative analysis, academics are telling us that they can simplify a complicated social reality [52].

Recent research recommends applying multidimensional measurement systems incorporating economic, social as well as political measure [53]. These have been used in more quantitative household surveys as well as structural equation modelling in order to investigate causal

pathways between education, employment, autonomy, and empowerment [54]. The developments in methodologies increase the strength of empirical results and contribute to evidence-based policymaking.

Synthesis and Research Gap

The analyzed literature evidence proves that gender equality and women empowerment are multi-dimensional processes influenced by education, economic involvement, political inclusion, access to health services, and socio-cultural traditions. Although there is a significant number of empirical studies that support the optimistic outcomes of women empowerment in development, the existence of persistent inequalities in the area implies uneven progress across regions and social categories [55,56]. Besides, several quantitative researches target single aspects of empowerment without taking into account the relationships between the structural factors.

There is a significant gap in context-specific and integrated quantitative studies that will consider the impact of institutional quality and socio-cultural norms on the effects of empowerment in developing societies. It is crucial to fill this need to formulate effective, evidence-based interventions that would go beyond the symbolic pledges of gender equality to substantive ones.

Methodology

Research Design

In this study, the research design adopted is quantitative research design to determine the factors that determine gender equality and women empowerment in developing societies. Quantitative research enables the measurement of relationships between variables with the help of statistical testing and the testing of the theory with empirical evidence [10]. The research employed the cross-sectional survey design, which would gather the data among women living in various regions, how they feel empowered, and how they view gender equality at one moment in time.

The research is based on theory of gender inequality in social and structural relations, where women empowerment depends on the socio-cultural norms, resources, institutional support and policies [47]. The conceptual framework establishes the factors that have a significant influence on empowerment such as education, economic participation, political inclusion, access to health, and socio-cultural norms.

Population and Sample

The researchers will use adult women (18 years old and older) who live in towns and villages in developing societies, namely, South Punjab. Six universities in South Punjab, Pakistan (three public and three private) and the local communities that have different socio-economic backgrounds were used to collect data.

To conduct a proportional representation of women, a stratified random sampling method was used to guarantee that women belonging to the various socio-economic, educational, and cultural groups were represented [9]. Criteria of stratification were:

- Urban vs. rural residence
- Educational attainment
- Employment status
- Age groups (18–25, 26–35, 36–50, 50+)

The surveyed respondents were 500 people, which allows the regression and structural equation modeling to be statistically powerful.

Data Collection Instrument

The structured questionnaire was used to collect the data relying on validated scales utilized in past research. The questionnaire will have a number of sections:

1. Demographics: Age, education, occupation, marital status, household income.
2. Education: Years of schooling, provision of higher education, level of literacy.
3. Economic Participation: Labor market status, economic empowerment, monetary empowerment, accessibility to microfinance [6].
4. Political Participation: Voting, knowledge on political rights, the decisions making bodies.
5. Health Access & Reproductive Rights: Healthcare, maternal health, family planning [4].
6. Socio-cultural Norms: Gender-role perception, limitation of movement, domestic chores [1].
7. Women Empowerment: The index is assessed by the Women Empowerment Index (WEI) that includes decision-making, independence, confidence, and social ability [6].

The quantitative analysis of all items was based on a five-point Likert scale (1 = strongly disagree, 5 = strongly agree).

Instrument Reliability and Instrument Validity

- Content Validity: The questionnaire was checked by three experts in gender studies as relevant and understandable [9].
- Construct Validity: Exploratory Factor Analysis (EFA) was used to allow the items in the questionnaires to load on the desired constructs.
- Reliability: internal consistency Cronbach alpha was used to check the reliability and alpha values greater than 0.70 were accepted as an acceptable value of reliability.

Data Collection Procedure

1. Ethical Approval: Universities were reached out through clearance.
2. Consent: It was an informed consent with the respondents assured of confidentiality.
3. Survey Administration: The questionnaires were provided online (Google Forms) and face-to-face because of the different levels of digital access.
4. Data Screening: Before the analysis, the data were verified with missing values, outliers and normality.

Data Analysis Techniques

The SPSS 26.0 and AMOS 24.0 have been used to analyze the data:

1. Descriptive Statistics: Means, standard deviations, frequencies and percentages characterized demographic and variables distributions.
2. Correlation Analysis: Pearson correlation coefficients were used to measure the relationship between independent variables and empowerment.
3. Regression Analysis: Multiple linear regression was used to determine predictive effects of education, economic participation, political inclusion, access to health and socio-cultural norms on empowerment.

4. Structural Equation Modeling (SEM): SEM identified both direct and indirect associations between variables and tested the conceptual framework [49].
5. Reliability Testing: The internal consistency was measured with Cronbach alpha and composite reliability.

Ethical Considerations

The study was conducted based on ethical principles:

- Informed Consent: The participants were well-informed and had joined the research willingly.
- Confidentiality: The personal identifiers were eliminated; the data were kept safely.
- Right to Drop out: The participants were allowed to drop out at any point without repercussions.
- Non-harm Principle: The questions were constructed in such a way so as not to stress out or psychologically torture.

Limitations

- There is the potential of social desirability bias in self-reported data.
- Cross-sectional design inhibits causal inference.

Sampling of 6 universities and communities around them could be a problem as it may not be applicable to all developing societies.

Data Analysis and Findings

A total of 500 women were sampled in the study and portrayed different age, educational, and occupational groups. Table 1 indicates that the highest percentage (42) of the participants were aged 18-25, 33 were aged between 26-35, 18 were aged between 36-50 and 7 were aged above 50. Educationally, almost half of the respondents (48) were undergraduates, 32 had graduate degrees and 20 were high-school and below. The employment status indicated that 55% of the sample were employed, 30% were students and 15% were not employed or they were home makers. These demographics show that the sample is diverse in terms of life-span and socio-economic backgrounds with regard to empowerment outcomes.

Table 1: The Demographic Characteristics of the respondents (N = 500)

Variable	Category	Frequency	Percentage
Age	18–25	210	42%
	26–35	165	33%
	36–50	90	18%
	50+	35	7%
Education	High School or below	100	20%
	Undergraduate	240	48%
	Graduate	160	32%
Employment Status	Employed	275	55%
	Student	150	30%
	Unemployed/Homemaker	75	15%

Table 2 demonstrates descriptive statistics of the key study variables. Education (M = 3.75, SD = 0.82) and health access (M = 3.60, SD = 0.88) indicated that the mean scores were rather high, which implies that the participants had access to educational and health resources. The levels of economic and political participation (M = 3.41, SD = 0.91 and M = 3.02, SD = 1.05) were moderate participation in the workforce and civic processes. The mean value of the socio-cultural norms was 2.95 (SD = 0.97), and it showed that still, there are restrictive traditional norms but with different values being expressed by different respondents. Women empowerment was the dependent variable with a mean score of 3.48 (SD = 0.85) which implies that there is a moderate level of empowerment in women in general.

Table 2: The Descriptive Results of Study Variables

Variable	Mean	SD	Minimum	Maximum
Education	3.75	0.82	1	5
Economic Participation	3.41	0.91	1	5
Political Participation	3.02	1.05	1	5
Health Access	3.60	0.88	1	5
Socio-Cultural Norms (negative)	2.95	0.97	1	5
Women Empowerment	3.48	0.85	1	5

Correlation analysis showed that there were significant relationships between the variables as it appears in Table 3. The most positive correlation was observed between education and women empowerment (r =.489, p <.01) and indicated that a high level of education resulted in a significant increase in the power of women, their confidence, and social power when making a decision. Empowerment was also positively related to economic participation (r =.442, p < .01) which means that women who were engaged in employment or other financial activities had more autonomy and agency. Empowerment was also moderately positively related to political participation (r =.368, p <.01) and access to healthcare services (r =.431, p <.01), which showed the influence of civic participation and access of healthcare services on empowerment. On the other hand, social-cultural norms showed that it was strongly correlated with the negative side of empowerment (r = -.474, p <. 01), which proves that the limiting feminine expectations and the conservative principles still act as impediments to the empowerment of women.

Table 3: Pearson Correlation Matrix

Variable	1	2	3	4	5	6
1. Education	1					
2. Economic Participation	.421**	1				
3. Political Participation	.312**	.354**	1			
4. Health Access	.388**	.401**	.287**	1		
5. Socio-Cultural Norms	-.356**	-.298**	-.225**	-.321**	1	
6. Women Empowerment	.489**	.442**	.368**	.431**	-.474**	1

Note: p < 0.01

To identify the predictive value of education, economic participation, political participation, health access, and socio-cultural norms on women empowerment, a multiple regression analysis was performed (Table 4). The general model was significant (F(5, 494) = 124.73, p <.001) and was found to explain 56 percent of the variance in empowerment (R^2 = 0.56). Education was the

most significant positive predictor (β = -0.312, p <.001), which proves that educational attainment is a determinant of the autonomy and empowerment of women. Financial independence was also important and economic participation largely predicted empowerment (β = 0.261, p =.001). The access to health (β = 0.212, p <.001), and political participation (β = 0.138, p <.001) were positively correlated, whereas the socio-cultural norms had a strong negative impact (β = 0.271, p <.001), which presents the obstacles of traditional expectations and the gender-based social order.

Table 4: The result of Multiple Regression to predict women empowerment

Predictor	B	SE	β	t	p
Education	0.324	0.042	0.312	7.71	<.001
Economic Participation	0.286	0.045	0.261	6.36	<.001
Political Participation	0.152	0.041	0.138	3.71	<.001
Health Access	0.231	0.043	0.212	5.37	<.001
Socio-Cultural Norms	-0.298	0.039	-0.271	-7.64	<.001
R^2 = 0.56, F(5, 494) = 124.73, p < .001					

There was also Structural Equation modeling (SEM) to test the conceptual framework. The fit indices showed that the hypothesized model fitted the observed data well (2/df = 2.87, CFI = 0.951, TLI = 0.942, RMSEA = 0.055, SRMR = 0.048). The regression outcomes were comparable to the SEM outcomes, in that education, economic participation, access to health, and political participation were positively related to empowerment, whereas socio-cultural norms were negatively related to empowerment. These results indicate that education, financial independence, health access, and civic engagement interventions can be used to promote empowerment, yet socio-cultural barriers should be discussed at the same time to make a significant impact.

Table 5: SEM Fit Indices

Fit Index	Value	Recommended Threshold
Chi-square/df	2.87	< 3
CFI	0.951	≥ 0.90
TLI	0.942	≥ 0.90
RMSEA	0.055	≤ 0.08
SRMR	0.048	≤ 0.08

On the whole, the discussion reveals that in developing societies, empowerment of women depends on the complex of education level, involvement in the economy, the access to health care, and political activity of women. At the same time, limiting socio-cultural norms are also a major deterrent. The explanatory power of 56 percent suggests the key of the multi-dimensional approach to empower women, which is in line with the current literature.

Discussion

The results of this paper present strong indicative evidence that women empowerment in third world countries is predetermined by a mix of educational achievement, economic involvement, political activism, availability of medical services and even socio cultural practices. In line with what has been previously established, education was found to be the strongest predictor of

empowerment, which supports the idea that women have increased abilities to make decisions, image, and social agency based on their level of education [47]. Educated women were better informed on their rights and opportunities but also displayed increased autonomy both in households and communities which points to education as a prerequisite to empowerment. The observation is consistent with the world research showing that with every one year of education, women become better negotiators, economic actors, and possess political and social power [14].

The economic participation was also relevant in defining the empowerment, which proved that the access to employment and finances empower women and increases their bargaining power and autonomy [51]. The existence of the positive correlation between empowerment and economic engagement implies that women who are engaged in generating incomes are in a better position of making decisions in the household and attaining a certain degree of self-efficacy. Regression results however, show that the size of this effect though significant is a bit smaller than that of education thus would not necessarily play out all other structural constraints in order to give rise to financial independence unless accompanied by educational and social support. This is consistent with the literature that suggests that empowerment can be enhanced through programs such as microfinance, but not necessarily, without seeking to eliminate socio-cultural and institutional constraints.

Political participation as well as health access also showed positive relationships with empowerment but with moderate effect size. Women who had knowledge of political rights, civic participation, or access to health services noted an increase in the autonomy and social influence levels. This highly reinforces that empowerment is a multidimensional concept in which political inclusion and health security form part of empowerment in making strategic life decisions [14]. These results indicate that empowerment both on the personal and collective aspect can be enhanced by encouraging women to get involved in government, as well as enhancing access to healthcare services. Besides, these findings emphasize the interdependence between structural and institutional elements as the empowerment in one sector, such as health, may support autonomy in the others, such as decision-making and economic activity.

Among the serious impediments to women empowerment were also the socio-cultural norms, which is in line with the existing literature on patriarchy and the traditional gender roles [9,57]. The correlation between negative norms and empowerment is negative, which proves the existence of the restrictive influence of the culture, resulting in the limitation of the agency of women despite their access to education, employment, or healthcare. Early marriage, limited mobility, and expectations regarding household duties are some of the practices through which women have their participation in society limited. These results are consistent with the studies that indicate that either education-based or financial-inclusion-only interventions cannot work without modifying the social and cultural frameworks that define gender relationships [2].

The structural equation model also favors the multidimensional approach of empowerment meaning that education, economic participation, health access, and political engagement have a positive impact on empowerment and the socio-cultural norms have a significant negative impact. The model explains a high share of the variation in women empowerment ($R^2 = 0.56$) which implies that over fifty percent of the variation can be explained by these factors which shows the need to have an integrated approach in the policy formulation. This observation supports earlier research that supports holistic empowerment initiatives involving education,

economic opportunities, health interventions, and normative change in order to realize sustainable gender equality [3].

On the whole, the work is a contribution to the literature as it offers empirical data with specific reference to the developing society situation with the evidence that the issue of empowerment is not a one-dimensional phenomenon but rather a combination of resources, agency and structural factors. The results indicate that policies and programs aimed at empowering women ought to focus on education as a key instrument, and at the same time ensure that they encourage women to be economically active, participate in politics, and have access to health services. Simultaneously, there should be an attempt to combat oppressive socio-cultural norms by involving the community, advocating and reforming laws, since these norms are still a strong barrier to the full involvement of women in social, economic, and political life.

Conclusion

This paper has shown that the empowerment of women in developing nations is a multi-dimensional process that is elucidated by their level of education, engagement in economic activities, political participation, access to health, and socio-cultural values. Education proved to be the greatest determinant as it gave the women the knowledge, confidence and decision making power that they need in order to navigate social and household hierarchies. Empowerment was also positively related with economic participation, political participation, and access to health services, indicating how the resources, institutional support, and civic engagement play a role in improving the agency of women. On the other hand, it was identified that the presence of restrictive socio-cultural norms has a strong negative impact on empowerment, which means that traditional demands on women and gendered behavior still restrict their opportunities issues regardless of the education level and socio-economic status. In general, results highlight the importance of a holistic and integrated way of handling structural resources and social norms to achieve meaningful empowerment. The research gives reasons to believe that education, financial self-sufficiency, access to healthcare and political participation of women, and addressing the existing limiting cultural beliefs and norms are policies and interventions that may provide a significant empowerment to women in the developing societies.

Recommendations

Through the results of the study, there are various recommendations that are advanced to boost women empowerment in developing societies. Secondly, education programs should be placed in the priority and these include initiatives that focus on enhancing female literacy, promoting higher education, and offering vocational education to enhance employability and economic self-sufficiency. Second, the economic empowerment should be extended and such measures as microfinance, entrepreneurship, and wage equality policies should be implemented to provide women with access to financial resources and decision making in the family. Third, women need to be empowered to participate in the civic and policy making activities by creating awareness, training leaders, and by use of gender quotas in the governance structures to enable women to be actively involved in political activities. Fourth, targeted services, reproductive rights education, and community health programs should be used to improve healthcare access especially in reproductive and maternal health. Lastly, it is crucial to discuss socio-cultural barriers; community education, advocacy, and legal changes should be employed to break the limiting norms, lessen gender-based discrimination, and provide female individuals with an opportunity

to be autonomous and exercise agency. The application of these strategies in a holistic approach can help in sustainable change of gender equality and empowerment of women throughout the developing society.

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