Exploring The Interplay of Psychological Distress, Workplace Incivility, and Counterproductive Work Behavior: An Equation System for Manufacturing Industries in Pakistan

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Abstract

This study examines how workplace incivility affects counterproductive work behavior in Pakistani manufacturing using fuzzy regression to address a practical problem: traditional regression gives point estimates, but managers need cost ranges to plan realistically. Survey data from 395 employees across pharmaceutical, food, and textile sectors provides the basis for this analysis. Structural equation modeling shows that psychological distress partially mediates the relationship (30%), aligning with prior research. However, fuzzy regression reveals something traditional methods miss: this mediation proportion actually ranges from 12% to 74% depending on individual differences. Prospect theory helps explain why employees with higher loss aversion respond more intensely when incivility defies their expectations about workplace treatment. The fuzzy approach offers practical advantages. It produces bounded estimates that support scenario-based budgeting, doesn't require parametric assumptions that workplace data often violate, and explicitly acknowledges that survey responses aren't perfectly precise measurements. For Pakistani manufacturers working with limited resources, these bounded estimates enable three-tiered budgeting: conservative plans using lower bounds, target budgets using center estimates, and contingency reserves for upper bounds. This matches how organizations already handle other uncertain investments. The findings also suggest that mental accounting biases likely contribute to underinvestment in workplace interventions costs get dispersed across departments while intervention expenses consolidate in training budgets.

Keywords: *Workplace Incivility; Fuzzy Regression; Behavioral Economics; Pakistani Manufacturing; Counterproductive Work Behavior.*

1. Introduction

The relationship between workplace practices, employee psychological health, and interpersonal interactions has become increasingly important in understanding organizational dynamics (Wu et al., 2012). In Pakistan's manufacturing sector, these relationships take on particular significance due to the industry's high-stress environment characterized by tight production targets, demanding hiring requirements, and rapid turnaround times. Workers in this context face elevated psychological distress, including anxiety, depression, and emotional exhaustion, which research has increasingly linked to workplace incivility (Smith et al., 2017). Workplace incivility refers to low-intensity deviant behavior with ambiguous intent to harm the target (Cortina et al., 2017). In manufacturing settings, where hierarchical structures and high-pressure environments predominate, such incivility appears particularly detrimental. The consequences manifest as counterproductive work behaviors: reduced task performance, increased absenteeism, and higher turnover intentions (Mitchell et al., 2018). Understanding how these elements interact is essential for developing effective interventions in Pakistani manufacturing organizations. Recent evidence suggests that psychological distress mediates the relationship between workplace incivility and counterproductive behavior (Hershcovis & Reich, 2013). When employees experience uncivil treatment, the resulting psychological distress creates a cycle wherein increased incivility perpetuates higher levels of distress, which in turn drives counterproductive responses. However, the strength of this mediation pathway likely varies across individuals and contexts. Pakistan's collectivist culture adds another dimension to these dynamics (Loh & Loi, 2018). In cultures emphasizing interpersonal relationships and teamwork, the impact of workplace incivility may differ from

Western contexts. Co-worker support through emotional encouragement, teamwork, and camaraderie can buffer against psychological distress (Shin et al., 2022). When employees feel supported by peers, they manage emotions more effectively and show reduced likelihood of engaging in counterproductive behaviors (Wu & Gong, 2001). Despite substantial research on these constructs individually, a significant gap exists in understanding their interconnected dynamics within Pakistani manufacturing. Most studies examine psychological distress, workplace incivility, and counterproductive behavior in isolation or in Western contexts. Few have explored how these variables interact within Pakistan's unique socio-cultural and organizational environment, and even fewer have employed methodologies that acknowledge the uncertainty inherent in measuring workplace behaviors. This study addresses these gaps through two key contributions. First, structural equation modeling tests whether psychological distress mediates the relationship between workplace incivility and counterproductive work behavior in Pakistani manufacturing. Understanding this mediation pathway has practical implications for where organizations should focus intervention efforts, addressing incivility directly versus providing mental health support. Second, fuzzy linear regression models these relationships in ways that acknowledge genuine measurement ambiguity. Traditional regression produces point estimates that force binary decisions about interventions, but workplace behavior data contain inherent uncertainty. When survey respondents rate incivility at 3.2 on a 5-point scale, this reflects fuzzy behavior, neither clearly civil nor clearly uncivil. Fuzzy regression produces bounded estimates that better support organizational cost planning and risk-adjusted decision-making, transforming psychological findings into actionable information for resource-constrained manufacturing enterprises. By integrating these methodologies within the Pakistani manufacturing context, this study provides both theoretical insights into how workplace incivility operates across cultural contexts and practical tools for organizations facing these challenges.

1.1. Problem statement

Pakistani manufacturing industries operate in highly demanding environments where workplace incivility has been linked to inefficient work behavior, employee distress, and reduced organizational performance (Wu & Gong, 2001). While research has established connections between workplace incivility, psychological suffering, and counterproductive work behavior, the specific mechanisms through which these relationships operate in Pakistani manufacturing contexts remain insufficiently understood. A critical gap exists in understanding whether psychological distress mediates the relationship between workplace incivility and counterproductive behavior, or whether incivility produces direct effects independent of distress pathways. This distinction has practical implications for intervention design. Organizations investing in employee well-being programs need to know whether addressing psychological distress will substantially reduce counterproductive behavior or whether direct interventions targeting workplace civility norms are equally necessary. Additionally, existing research typically reports point estimates that provide limited guidance for organizational decision-making under uncertainty. Traditional regression approaches yield average effects but obscure the variation managers encounter when planning interventions. Pakistan's collectivist culture, where interpersonal relationships and teamwork hold particular importance (Loh & Loi, 2018), may moderate these effects in ways that differ from Western contexts. Co-worker support has been shown to mitigate psychological distress (Shin et al., 2022), yet how this protective factor interacts with incivility and counterproductive behavior remains unclear in Pakistani manufacturing settings. This study addresses these gaps by examining the mediating role of psychological distress in the incivility-counterproductive behavior relationship, while employing fuzzy regression methods that produce bounded estimates suitable for scenario-based organizational planning in resource-constrained manufacturing environments.

1.2. Significance of the study

This study contributes to workplace incivility research in three ways. Theoretically, it extends understanding beyond Western contexts by examining how collectivist values in Pakistani manufacturing moderate incivility effects. Most existing research assumes individualist cultural settings, leaving questions about whether established relationships hold where interpersonal harmony carries heightened importance. Methodologically, the study combines mediation analysis with fuzzy regression. Structural equation modeling clarifies whether psychological distress mediates the incivility-counterproductive behavior relationship or whether substantial direct effects exist, a distinction that determines optimal intervention strategies. Fuzzy regression addresses limitations of point estimates by producing bounded estimates that acknowledge measurement uncertainty and support scenario-based planning. Practically, the findings provide Pakistani manufacturing organizations with evidence-based guidance for resource allocation. Understanding mediation pathways helps managers choose between employee assistance programs and civility training. Bounded cost estimates enable risk-adjusted budgeting across conservative, expected, and optimistic scenarios. Given Pakistan's manufacturing significance in textiles, pharmaceuticals, and food processing, these interventions can improve both employee well-being and competitive performance.

1.3. Research objectives

a) Explore the prevalence and nature of psychological distress among employees in the manufacturing sector.
b) Investigate the occurrence and manifestations of workplace incivility within the context of manufacturing industries.
c) Examine the relationships between psychological distress and workplace incivility.
d) Analyze the impact of psychological distress and workplace incivility on counterproductive work behavior.
e) Propose an equation system that encapsulates the complex dynamics among these variables.

2. Literature Review

2.1. Theoretical foundation

Social Identity Theory (SIT) is a psychological framework that can be applied to understand various aspects of human behavior, including Psychological Distress, Workplace Incivility, and counterproductive work behavior. Scheepers and Ellemers (2019) discussed the SIT theory and suggested that this theory can emphasize that individuals categorize themselves into various social groups based on shared characteristics, such as race, gender, occupation, or even workplace departments. These group identities play a significant role in shaping one's self-concept and psychological well-being. When individuals face threats or challenges to their social identity within a workplace context, such threats can lead to psychological distress. Moreover, SIT can also explain workplace incivility, which involves rude, disrespectful, or socially harmful behavior among co-workers within organizations. Regarding counterproductive work behavior (CWB), SIT

suggests that individuals may collectively resist organizational policies or actions that are perceived as detrimental to their social identity group, leading to counterproductive work behavior as a form of collective protest.

2.2. Psychological distress

Psychological distress, characterized by symptoms of anxiety, depression, and emotional exhaustion, is a prevalent concern that has garnered increasing attention in recent years (Smith et al., 2017). In the context of the workplace, psychological distress can be influenced by a multitude of factors, with workplace incivility standing out as a prominent antecedent. Workplace incivility, defined as low-intensity deviant behavior with ambiguous intent to harm the target, has been identified as a pervasive issue with detrimental effects on employees' mental health. (Cortina et al., 2017). The manufacturing sector, often characterized by hierarchical structures and high-pressure environments, may be particularly susceptible to the negative consequences of workplace incivility. Workers in commercial environments may experience psychological discomfort because of pressure on their minds, emotions, and behaviors, as well as orders from their superiors. (Loh & Loi, 2018). Among the possible causes are unrealistic expectations, a lack of support, a stressful job, and worries about striking a work-life balance. If neglected, it can lead to fatigue, decreased productivity, and negative impacts on mental health. (Pearson et al., 2005). It encourages the application of appropriate support techniques, such as creating a supportive atmosphere, providing resources, and encouraging open communication. Workplace incivility and psychological suffering are significantly negatively correlated. (Fatima, 2016). Workplace incivility is the practice of acting impolitely, making unpleasant remarks, or excluding others while subtly expressing contempt. (Shin et al., 2022). According to one study, employees may endure increased psychological distress because of these unethical activities. These unfavorable interactions may develop, resulting in increased stress, despair, anxiety, and general malaise. Creating a professional and encouraging work environment is crucial for ensuring employee well-being, as well as for enhancing organizational success and worker performance. In organizational psychology and business studies, the connection between psychological discomfort and "counterproductive work behavior" (CWB) is examined. (Pearson et al., 2005). Psychological distress encompasses an array of disagreeable affective conditions, including hopelessness, nervousness, and fatigue, that individuals may experience due to occupational demands, interpersonal issues, and job discontent. (Wu & Gong, 2001). Tardiness, disturbance, slurring, and absenteeism are the most harmful and counterproductive office behaviors. These actions imperil an organization's performance, morale, and objectives. Extreme psychological distress can cause employees to become disengaged from their work, either as a coping strategy or due to a lack of self-control and poor decision-making. (Carpenter et al., 2020). People who are torn may act aggressively towards their co-workers or the organization, quit, or fail to fulfill their responsibilities. Anguish on a psychological level can also reduce job satisfaction, which can lead to a lack of commitment to the organization's success. A lack of commitment can be shown by a variety of behaviors, including decreased effort, task abandonment, and poor use of company resources. (Wu & Gong, 2001). Employers must prioritize employee well-being and use several strategies, including developing supportive programs, dynamic and interesting work environments, and promoting a healthy work-life balance. (Pearson et al., 2005).

2.3. Co-worker support

Employee collaboration and help are vital for the success of any organization. A strong collaborative support network influences a positive corporate culture. (Loh & Loi, 2018). A culture of camaraderie that is fostered by employees actively supporting one another at work raises spirits and improves job satisfaction. In a setting like this, open conversation and information exchange are encouraged, which fosters creativity and problem-solving abilities. (Wu & Gong, 2001). When workers feel they can rely on their superiors, they are more inclined to take calculated risks and come up with novel solutions. (Shin et al., 2022). Additionally, collaboration increases productivity as well. By combining various skill sets, tasks may be accomplished more quickly and with greater quality. Knowledge gaps may be filled by assisting co-workers, allowing operations to run smoothly. (Alshurideh, 2022). Through this collaborative approach, bottlenecks are removed, and no individual becomes a single point of failure. Competencies are developed with colleagues' help. Employees may polish their present skills and learn new ones through training, experience, and mentoring. This collaborative learning strengthens the company's culture and supports continuous development. (Shin et al., 2022). Businesses that prioritize co-worker assistance tend to have higher employee retention rates, as workers who receive respect and encouragement are more likely to remain committed to and enthusiastic about their jobs. In addition to saving money on hiring and training costs, it safeguards the company's institutional knowledge. It is not acceptable to act disrespectfully or disruptively in the workplace. A confrontational attitude, a lack of professionalism, or negligence are all examples of workplace incivility. (Carpenter et al., 2020).

2.4. Incivility in work and counterproductive behavior

A hostile attitude, carelessness, or a lack of professionalism are examples of work incivility (Shin et al., 2022). Inappropriate behavior includes things like spreading rumors, acting impolitely, using harsh language, and showing disrespect for colleagues. (Wu & Gong, 2001). When these things happen, they might negatively affect the working environment, which could result in lower output, lower job satisfaction, and strained relationships among co-workers. (Huang et al., 2020). Workplace incivility may have a negative effect on employee well-being and organizational performance by creating a toxic climate that discourages cooperation and teamwork. A general phrase encompassing worker actions that affect the company is "Counterproductive Work Behavior" (CWB) (Loh & Loi, 2018). Small and major violations include things like stealing, interfering, being lazy, and initiating disputes at work. "Counterproductive work behavior" (CWB) is the term used to describe actions taken by employees to impede or undermine the productivity of their co-workers or the organization. (Wu & Gong, 2001). The COVID-19 pandemic substantially changed workplace dynamics, introducing new forms of workplace incivility beyond traditional face-to-face interactions. The rapid shift to remote and hybrid work arrangements created different contexts for uncivil behavior, with employees experiencing incivility through digital communication channels such as email, video conferences, and instant messaging platforms (Agarwal & Vaghela, 2021). Research examining post-pandemic workplace behavior shows that virtual incivility appears through behaviors such as ignoring messages, dismissive responses in video meetings, and exclusion from digital communications (Giumetti et al., 2022). The physical distance in remote work arrangements actually increased certain forms of incivility, as the reduced social cues and lack of immediate feedback in digital environments lowered barriers against discourteous behavior (Vranjes et al., 2021). Manufacturing sectors in developing economies like Pakistan faced particular challenges, as organizations struggled to maintain respectful workplace cultures while managing distributed teams and adapting to technology-mediated communication (Ipsen et al., 2021). These recent developments highlight the changing nature of workplace incivility and show the continued need for interventions that promote respectful interactions across both physical and virtual work settings.

2.5. Economic and financial implications of workplace incivility

The financial burden of workplace incivility and counterproductive work behavior goes well beyond immediate productivity losses. Research examining organizational expenditures related to workplace deviance shows that companies face substantial economic consequences through multiple channels (Porath & Pearson, 2013). Manufacturing enterprises experience direct costs through absenteeism, where employees facing psychological distress take more sick leave, and turnover expenses, which include recruitment, selection, and training investments for replacement workers (Cortina et al., 2001). Studies quantifying these costs in developing economies reveal concerning patterns. The financial impact of a single incivility incident spreads through an organization, affecting not just the target but also witnesses who experience decreased motivation and commitment (Schilpzand et al., 2016). Productivity losses represent another substantial cost category, as workers experiencing or witnessing incivility show reduced task performance, diminished creativity, and decreased helping behaviors toward colleagues (Porath & Erez, 2007). Time spent by supervisors and human resource personnel addressing conflicts and managing interpersonal issues takes away resources from value-adding activities, creating hidden administrative costs that build up over time (Welbourne et al., 2023). The manufacturing sector faces particular vulnerabilities due to its reliance on coordination and teamwork. When psychological distress triggers counterproductive behavior, the effects include quality defects, safety incidents, and equipment misuse, each carrying measurable financial consequences (Bennett & Robinson, 2000). Organizations in South Asian contexts report that workplace incivility contributes to annual turnover rates exceeding industry benchmarks, with replacement costs estimated between 50% to 200% of an employee's annual salary, depending on position and skill level (Hom et al., 2017). Healthcare expenditures present another cost dimension, as psychological distress stemming from workplace incivility increases utilization of employee assistance programs, medical consultations, and medication prescriptions for stress-related conditions (Yao et al., 2022). Intervention programs targeting workplace incivility and employee psychological well-being offer demonstrable returns on investment. Organizations implementing comprehensive stress management and civility training programs report cost savings through reduced turnover and absenteeism that outweigh program implementation expenses (Richardson & Rothstein, 2008). The return on investment for such interventions typically appears within 12 to 18 months, with sustained benefits continuing over subsequent years as workplace culture shifts toward more supportive norms (Hamberg-van Reenen et al., 2012). Preventive measures prove more cost-effective than reactive approaches, as early intervention in emerging incivility patterns prevents escalation into more severe and costly workplace conflicts (Kirk et al., 2021). Understanding these economic dynamics becomes essential for manufacturing enterprises in Pakistan, where competitive pressures and resource constraints require strategic allocation of limited budgets. The fuzzy logic framework employed in this study offers potential for quantifying these cost relationships with greater precision than traditional linear models, particularly given the ambiguous and graduated nature of psychological distress and incivility behaviors (Wu & Gong, 2001). By establishing mathematical relationships between these variables, organizations gain tools for forecasting the financial returns of investments in employee well-being and workplace climate improvement initiatives.

2.6. Fuzzy logical approaches

Fuzzy logic helps and streamlines the business processes of "the marketing and financial planning" divisions, but only the senior management group is protected. (Wu & Gong, 2001). This study has used psychological stress and fuzzy logic to provide new methods that help the working class and substitute current safety measures and protections. The manufacturing businesses' expenses can be better understood and decreased with the use of the fuzzy logic system. (Loh & Loi, 2018). Fuzzy logical reasoning has been used in these firms to pinpoint exact fixed prices of items, eliminate labor incivility, and enhance productivity levels. (Kaleva, 1987). The fuzzy logical system's accuracy claims on true and false statements will cause the working class of manufacturing concern enterprises to pay less for precautionary and safety measures. (Wu et al., 2012). They proposed a performance prediction system that incorporated support vector machine regression and fuzzy clustering, based on behavioral features and past work performance of the workers. Furthermore, when it comes to solving classification problems, machine learning algorithms offer specific advantages. As an example, (Huang et al., 2020) developed a fuzzy clustering-based performance prediction technique. Based on past performance and employee behavioral trends within the organizations, fuzzy logical inequalities facilitate support vector machine regression (Shen et al., 2019). Fuzzy logic resembles human decision-making processes. It works with uncertain, ambiguous data. It employs degrees of truth rather than the more conventional true/false or 1/0 Boolean logic, which is a blatant oversimplification of actual situations. To run automated banking and teller machines (ATMs), fuzzy logical system methodologies are employed (Dragomir & Wang, 1998). Fuzzy logic-based administration economic methods are also used to boost self-sufficient equipment and reduce predicted expenses. (Pearson et al., 2005). Language conventions determine how the system should process inputs. We can simplify our comments on risk assessments in the banking sector (applicant credit rating-banker-risk assessments) by using logical principles. (Cong-Xin & Ming, 1991). For example, in developing logical applications for automobiles, trains, and airplanes, DC inverters with automated tripping conserve energy, and automatic washing machines can employ truth assertions such as "absolutely true statements" or "absolutely false statements" when necessary. The risk lies in the decision to fund products or use neutral financing; the risk increases if crediting is insufficient. (Wu et al., 2012). The figure that follows shows how a number between 0 and 1 represents values in fuzzy systems. Here, 1.0 indicates the blatant truth, and 0.0 indicates the blatant untruth. The numerical value used to represent truth in fuzzy systems ranges from 0 to 1. Stated differently, fuzzy logic employs continuous truth values rather than binary true/false reasoning (Shin et al., 2022). This and similar images will probably help with fuzzy logic comprehension. Fuzzy logic was developed by Lofti A. Zadeh in his 1965 research paper "Fuzzy Sets". He is recognized as the founder of fuzzy logic, or decision-makers (Carpenter et al., 2020).
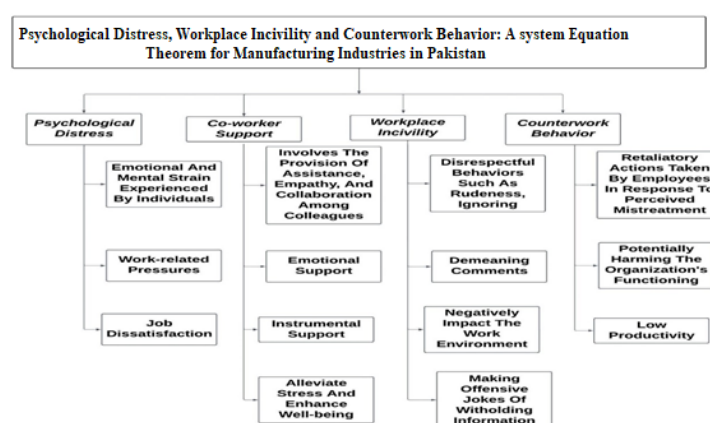
Fig. 1: Conceptual Framework.

Figure 1's graphic illustrates the connections between each explanation's reliability. We conclude that these characteristics were investigated in connection with the other factors displayed in (Figure-1). The model will be used in the study paper to increase the profitability ratio and promote staff efficiency in Pakistan's industrial sector units. Utilizing replies from respondents from a variety of industries, the relationship between these characteristics is investigated. (Loh & Loi, 2018). The model indicates that the following factors have an impact: unfavorable comments, staff support, instrument aid, work-related stress, emotional and mental strain, and job discontent.
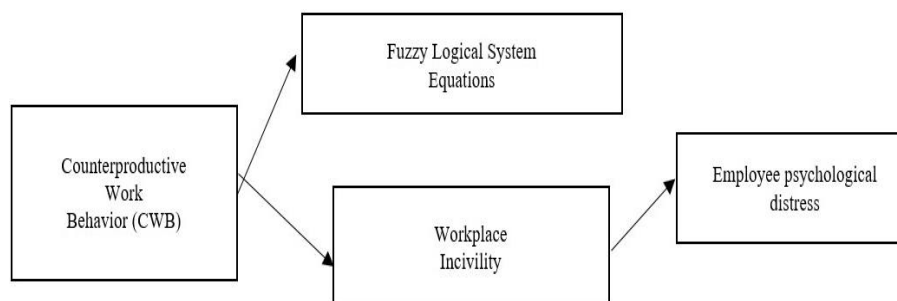
Fig. 2: Conceptual Framework.

2.7. Behavioral economics and managerial accounting integration

While workplace incivility research originates in organizational psychology, its consequences manifest as measurable accounting costs: employee turnover expenses, absenteeism-related productivity losses, quality defect rework, and safety incident costs. Understanding the economic implications requires integrating behavioral economics frameworks with organizational behavior findings. Prospect theory (Kahneman & Tversky, 1979) provides theoretical grounding for the economic significance of our mediation results. The framework demonstrates that individuals evaluate outcomes relative to reference points, with losses weighted approximately twice as heavily as equivalent gains through loss aversion mechanisms. Workplace incivility constitutes a reference point violation; employees expect baseline professional treatment, and uncivil behavior represents a loss relative to this expectation. Loss aversion amplifies the psychological impact beyond what neutral outcome processing would predict, explaining why moderate incivility triggers substantial psychological distress and subsequent counterproductive responses. This theoretical integration illuminates why the psychological distress mediation pathway (31% of the total effect) carries economic significance. The affective channel through which reference point violations translate into behavioral costs operates alongside cognitive mechanisms perceived procedural injustice, reciprocity norm violations, and reduced organizational commitment that constitute the remaining direct pathway. Individual heterogeneity in loss aversion coefficients (λ ranging from 1.5 to 3.5 across populations) generates the variation our fuzzy regression captures. Employees exhibiting high loss aversion respond more intensely to identical incivility, producing upper-bound effects, while those with lower coefficients demonstrate restrained responses reflected in lower-bound estimates. Traditional point estimates collapse this economically meaningful variation into averages that may poorly represent actual individual response distributions. For managerial cost accounting applications, this framework establishes that workplace incivility imposes quantifiable financial burdens analogous to equipment maintenance costs or supply chain inefficiencies. The fuzzy regression methodology transforms psychological constructs into bounded cost estimates suitable for financial planning and budget allocation decisions in resource-constrained manufacturing environments.

3. Materials and Methods

This study aimed to utilize novel "fuzzy logical reasoning system" methodologies in Pakistan's industrial sectors and investigate the relationship between peer support and psychological suffering, and workplace rudeness and ineffective behavior. It would help with taking the necessary actions to increase awareness of psychological stress, its importance, and the financial advantages it provides to the manufacturing and service sectors. It would also investigate how deep and wide the study is. The statistical software for the social sciences (SPSS) was the main data analysis tool used in this empirical, quantitative investigation. The research design adopted for this investigation was cross-sectional, given its appropriateness for examining the relationships between variables at a single point in time. The study involves the administration of a questionnaire to a specific population of participants, with details regarding participant characteristics and sampling procedures being rigorously defined. The main research methodology that was employed was the questionnaire methodology. A questionnaire centered on the research topic and associated elements that contributed to the problem found in the study was created to collect data. Responses from different food, pharmaceutical, and apparel manufacturing industries were gathered through surveys. The researchers

selected these three manufacturing sectors because they are vital to society and essential to Pakistan's economy in the modern period. For research purposes, 450 questionnaires were delivered to 20 businesses of varying sizes (large, medium, and small). 355 questionnaires were completed by respondents from 16 different companies. The social identity theory studies how membership in a social group shapes an individual's perception of themselves (Shin et al., 2022). The concept deals with how a person's perspective varies according to where they are within a group. This relates to the presumption that workers have within their company, which varies according to the culture in which they operate. Data analysis was performed using SPSS, and this process included several statistical approaches, both descriptive and inferential. Specifically, reliability analysis was conducted to evaluate the internal consistency in the total output of performance of the employee in the questionnaire items. Cronbach's alpha was calculated to assess the reliability, with a predetermined threshold for acceptable reliability (e.g., a Cronbach's alpha of 0.70 or higher). The study's participant demographics reflected a diverse sample, with 69.6% identified as male and 30.4% as female. The occupational distribution indicates a balanced representation across sectors, with 33.0% of participants hailing from the food sector, 33.8% from the pharmaceutical sector, and 33.2% from the clothing sector. In terms of prior professional experience, the respondents exhibited varied tenure lengths. A notable of 12.4% reported having worked for over a year, while 15.2% had experience shorter than a year. A substantial 27.3% had been in their respective roles for three years, and 16.3% for five years. The highest proportion, comprising 28.7%, boasted professional experience exceeding five years. These demographic variables form a comprehensive overview of the participant composition, laying the foundation for a nuanced exploration of the interplay of psychological distress, workplace incivility, and counterproductive work behavior within the manufacturing industries in Pakistan. Theorems of fuzzy logic rely on the degree of truth in their calculation. A fuzzy logic system generates a specific output based on the degree of input truth and linguistic factors. The status of this input influences the quality of the output. In addition, any value between 0 and 1, including values such as 0.17 or 0.54, can be a fuzzy logic membership degree. After a careful analysis of all relevant data, fuzzy logic aids in the selection of the optimal course of action, which aids in issue resolution. By examining the different possibilities of digital True and False values, the fuzzy logic technique simulates how people make judgments. Whether using fuzzy logic computing, the truth degree is important. A fuzzy logic system produces a predefined result based on linguistic characteristics and the input's degree of truth. The type of output depends on the status of this input. A fuzzy logic statistic can have values in the range of 0.17 and 0.54, or it can be 0 or 1. Fuzzy logic considers all potential outcomes of digital True and False values, simulating human decision-making. Structural equation modeling (SEM) with maximum likelihood estimation was employed to test the mediation hypothesis. The model specified workplace incivility as the independent variable, psychological distress as the mediator, and counterproductive work behavior as the dependent variable. Significance of the indirect effect was assessed through bias-corrected bootstrap confidence intervals based on 5,000 resamples. Additionally, fuzzy linear regression (Tanaka et al., 1982) was applied to model measurement uncertainty through triangular fuzzy numbers (h = 0.5)."

4. Results and Findings

This study aimed to investigate how workplace incivility and counterproductive work behavior in manufacturing organizations are influenced by psychological distress and assistance from colleagues. The study's goal was to assess the impact of psychological distress and co-worker support on the spread of workplace incivility among employees throughout working time and task completion. The study's 16 business units are involved in small, medium, and large-scale manufacturing organizations. The pharmaceutical industry had the most respondents (120) of the three industries. Most responders in the survey are master's-level qualified.

Table 1: Reliability

Cronbach's Alpha	Cronbach's Alpha Using Standardized Items as the Basis	Total Items
0.629	0.610	18

The reliability statistics reflect the study's dependability and its conclusions. The study addresses a novel aspect of workplace rudeness. Unlike Asian countries, especially Pakistan, the West has dedicated a significant amount of time and resources to the issue. This test's objective is to confirm the consistency and dependability of the data collection methods employed in the study. The various findings demonstrate that the data acquired is reliable and on which one may rely. Following the application of the reliability test, the Cronbach's Alpha result of 0.629 indicated a lower level of awareness of psychological distress as a cause of employee incivility among Pakistani manufacturing employees. 355 respondents representing 16 different companies indicated in their responses that there is a low level of knowledge in the industrial sector. The research is based on replies from human resources, production, and operations people in the food, pharmaceutical, and manufacturing industries. The 355 responses indicated limited awareness among organizations regarding psychological distress as a source of workplace incivility, suggesting a gap in knowledge and understanding of this topic.

Table 2: Coefficients of Level of Awareness

Variable	B	t-statistic	p-value
The organizational culture	-0.005	-0.093	0.926
strategy alignment with the environment	-0.083	-1.541	0.124
1Support from coworkers in harmony with the environment	0.118	2.228	0.027
Comprehending psychological stress detection	0.160	2.987	0.003
The value of assistance from colleagues	0.68	1.367	0.206

Because this is primarily exploratory research, in this study, we used linear regression to investigate the relationship between independent and dependent variables. On two dependent variables, we determined two regression models individually.

$$LA = \beta_1 + \beta_2 E + \beta_3 C + \beta_4 AS + \beta_5 GB + \beta_6 AH + u \tag{1}$$

$$GP = \beta_1 + \beta_2 E + \beta_3 C + \beta_4 AS + \beta_5 GB + \beta_6 AH + u \tag{2}$$

Where,
LA = Awareness of Psychological Distress Level
E = The Value of a Happy Environment

C = The organizational culture
AS = Alignment between fostering a nice environment and reducing workplace incivility
GB = Recognizing psychological discomfort
AH = Firm plans that are in line with the Environment
WI = Putting Practices in Place to Lessen Incivility at Work
Equation (1) for the estimated regression is:

$$LA = -0.005\,E + 2.421 + 0.130\,AS - 0.090\,C + 0.069\,AH + 0.155\,GB$$

$$t = (-.093)(6.723)(2.228)(-1.541)(1.267)(2.987)$$

Now let's examine the regression results for the dependent variable, Level of Awareness of Psychological Stress. The link between E and LA is not statistically significant, according to the equation. This demonstrates a link between the independent elements (i.e., the environment's importance is not substantial) and the dependent variable, awareness level. Given that it has a low value, it eventually affects workplace incivility inside the organization; this is indicated by the negative regression coefficient of 0.093. There is no correlation between the organizational culture and the degree of psychological stress awareness, as indicated by the t value of C, or the culture of the organization, which is -1.541. Conversely, the remaining independent variables exhibit positive values and show a significant correlation with LA. At t = 2.228, AS and LA are significantly associated. It evaluates the connection between environmental sustainability objectives and awareness level. Similarly significant and showing a positive regression coefficient is WI's t value of 2.987. When compared to GPH, the value of t for AS (alignment with environmental goals) shows a low t-value and a positive regression coefficient. AH and LA, however, show a close relationship. It demonstrates the necessity for support with GHRM awareness and the use of fuzzy logical scaling to workplace features. Equation (2), the calculated regression, is:

$$WI = 0.143\,E + 1.430 + 0.154\,AS + 0.090\,C + 0.080\,AH + 0.72\,WI + u$$

$$t = (2.686)(4.058)(2.692)(1.632)(1.398)(1.409)$$

Regression analysis results for the second dependent variable (WI), which measures workplace incivility using practices, are increasingly understood via numbers. This interprets a stronger relationship between WI and independent variables.

(i.e., $\beta_2 E + \beta_3 C + \beta_4 AS + \beta_5 WI + \beta_6 AH + u$).

The regression coefficients suggest a marginally significant relationship. On the other hand, 1.632 is a low t-value indicating a positive relationship with GP. The organizational culture's 1.632 t value shows a changeable sign when paired with GP. In comparison to GP, the value of t for AS in terms of sustainability goal alignment is 1.409, indicating a substantial positive coefficient. There is less of a significant correlation between this independent variable and GP, as indicated by the low value of AH (1.398). The obtained numbers were used to assess the results of "the regression application on the second dependent variable", GP, which is the adoption of workplace incivility practices. This translates to a stronger relationship between WI and independent variables.

(i.e. $\beta_2 E + \beta_3 C + \beta_4 AS + \beta_5 GB + \beta_6 AH + u$).

Regression coefficients point to a relationship that is just slightly significant. Although the t-value of 1.632 is small, it suggests a positive relationship with GP. The variable's relevance to GP is indicated by the 1.632 t value of the organization's environment. When compared to GP, the value of t for AS, or aligning sustainability goals, is 1.409, a positive and significant coefficient. The low value of AH (1.398) suggests that there is less of a meaningful link between this independent variable and GP. Now, the figures that are produced are employed to evaluate the regression application's outcomes concerning the second dependent variable, GP, or the utilization of techniques to lessen psychological stress. Thus, there is a greater correlation between WI and the independent factors.

(i.e. $\beta_2 E + \beta_3 C + \beta_4 AS + \beta_5 WI + \beta_6 AH + u$).

Regression coefficients point to a relationship that is just slightly significant. Despite a low t-value, 1.632 shows a positive correlation with WI. For AS, the t value of 1.409 when sustainability goals are aligned indicates a positive coefficient that is consistent when paired with WI. For AS , or the value of t is 1.409 When the sustainability goals are aligned, a positive coefficient is significant when paired with WI. There is less of a significant correlation between this independent variable and WI, as indicated by the low value of AH (1.398). The test's figures also demonstrate a strong correlation between the application of the practice and each of the independent variables: organizational culture, understanding of the benefits, and strategy alignment with sustainability and environmental goals. Building on the exploratory regression findings, structural equation modeling was conducted to test the hypothesized mediation mechanism. Specifically, we examined whether psychological distress mediates the relationship between workplace incivility and counterproductive work behavior.

Table 3: Descriptive Statistics and Correlations

Variable	M	SD	1	2	3
1. Workplace Incivility	3.44	0.92	—		
2. Psychological Distress	3.61	1.04	.49***	—	
3. Counterproductive Work Behavior	3.42	0.88	.37***	.37***	—

Note. N = 395. M = Mean; SD = Standard Deviation. ***p < .001.

All measurement scales demonstrated excellent internal consistency reliability, with Cronbach's alpha coefficients exceeding .94 for all constructs (workplace incivility: α = .97; psychological distress: α = .98; counterproductive work behavior: α = .98). Mean scores ranged from 3.42 to 3.61 on the five-point scale, indicating moderate levels across all variables. The correlation matrix revealed significant positive associations among all study variables. Workplace incivility correlated positively with both psychological distress (r = .49, p < .001) and counterproductive work behavior (r = .37, p < .001). Psychological distress also correlated significantly with counterproductive work

behavior (r = .37, p < .001), providing preliminary support for the proposed mediation model. The structural equation model tested whether psychological distress mediates the workplace incivility-counterproductive work behavior relationship. Results are presented in Table 4 and illustrated in Figure 2. The model demonstrated good explanatory power, with R^2 = .235 for psychological distress and R^2 = .194 for counterproductive work behavior.
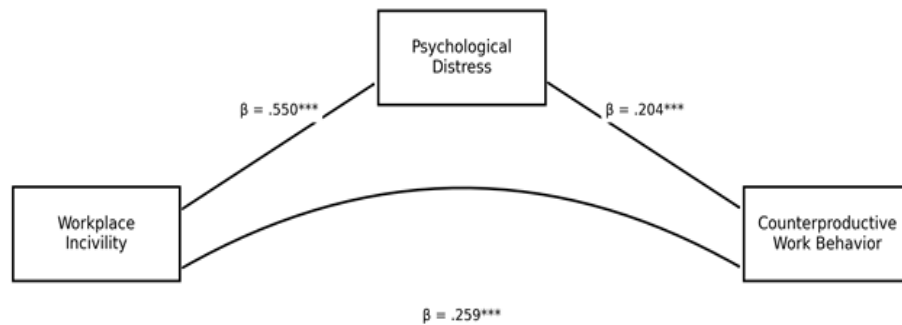

Fig. 3: Structural Equation Model Results.

Table 4: Structural Equation Modeling: Mediation Analysis Results

Path	β	t-statistic	p-value
Total effect (c)	.371	8.307	< .001
WI → PD (a)	.550	11.027	< .001
PD → CWB (b)	.204	4.661	< .001
Direct effect (c')	.259	5.220	< .001
Indirect effect (a×b)	.112	—	< .001

Note. N = 395. WI = Workplace Incivility; PD = Psychological Distress; CWB = Counterproductive Work Behavior. β = standardized path coefficient. Indirect effect tested using bias-corrected bootstrap confidence intervals (5,000 resamples): 95% CI [.056, .176]. R^2 = .235 for PD; R^2 = .194 for CWB. Proportion mediated = 30.2%.

Examination of individual paths revealed significant effects at each stage. First, workplace incivility significantly predicted psychological distress (β = .550, SE = .050, p < .001), indicating that greater exposure to uncivil workplace treatment was associated with elevated psychological strain. Second, psychological distress significantly predicted counterproductive work behavior when controlling for workplace incivility (β = .204, SE = .044, p < .001). Third, the direct effect of workplace incivility on counterproductive work behavior remained significant (β = .259, SE = .050, p < .001), though reduced from the total effect (β = .371, SE=.045, p<.001).

The indirect effect through psychological distress was significant (β = .112, 95% CI [.056, .176], p < .001), as confirmed by bias-corrected bootstrap confidence intervals based on 5,000 resamples. This indirect effect accounted for 30.2% of the total effect, indicating partial mediation. The pattern suggests that psychological distress represents an important mechanism linking workplace incivility to counterproductive behavior, while additional pathways (comprising approximately 70% of the effect) remain to be identified. Supplementary analyses examined whether this mediation pattern held across different types of counterproductive work behavior. Results in Table 5 demonstrate consistent mediation effects across all four CWB dimensions: production deviance (β = .098, 95% CI [.037, .169], 27.9% mediated), property deviance (β = .118, 95% CI [.057, .187], 32.2% mediated), political deviance (β = .123, 95% CI [.060, .194], 32.5% mediated), and personal aggression (β=.122, 95%CI[.058,.194], 29.8% mediated).

Table 5: Mediation Effects Across CWB Dimensions

CWB Dimension	Total Effect	Direct Effect	Indirect Effect	p-value
Production Deviance	.352	.253	.098	< .001
Property Deviance	.367	.249	.118	< .001
Political Deviance	.379	.256	.123	< .001
Personal Aggression	.410	.288	.122	< .001

Note. N = 395. CWB = Counterproductive Work Behavior. All indirect effects were tested using bias-corrected bootstrap confidence intervals (5,000 resamples). Proportion mediated: Production Deviance = 27.9%; Property Deviance = 32.2%; Political Deviance = 32.5%; Personal Aggression = 29.8%.

These findings indicate that psychological distress functions as a common mechanism across diverse forms of counterproductive behavior, rather than being specific to particular behavioral types.

4.1. System of simple fuzzy logical theorems

Applying fuzzy logic Theorems, I and II show how regulations can be put into place to lower workplace incivility while cutting expenses in manufacturing-related businesses when employees cooperate and engage in unproductive behavior. In 1938, Alomari and Darus (2010) [15] divided a differentiable function's absolute deviation by its integral mean to demonstrate the following inequality:

4.2. Fundamental fuzzy logic data equations for inequality

$$\left| \frac{1}{b-a} \int_a^b f(y)\, dy - f(x) \right| \le \left(\frac{1}{4} - \frac{\left(x - \frac{a+b}{2}\right)^2}{(b-a)^2} \right) (b-a)^2 \|f'\|_\infty$$

Where $f': (a, b) \to R$ is bounded on (a, b) and $f: I \to R$ is a differentiable function on (a, b).

Many mathematicians were working on this inequality at the time Ostrowski found it, and it was being used in a variety of contexts, including probability and numerical analysis. For Dragomir and Wang (1998) [16] and Alomari et al. (2010) applications of Ostrowski's inequality, as well as new results and generalizations relating to Ostrowski's inequality.

4.2.1. Definition

Considering I to be an interval in R, $f: I \to R$ is said to be convex if for all $x, y \in I$ and $t \in [0,1]$

$$f(tx + (1-t)y) \le tf(x) + (1-t)f(y)$$

This means that B is on or below the chord AB if A, B, and C Are the three distinct points on B's graph between A and C. Earlier, (Mihesan) provided the following explanation of (α, m) −convexity:

The function $f: [0, b] \to R, b > 0$, is said to be (α, m) −convex, where $(\alpha, m) \in [0,1]^2$. If one has

$$f(tx + m(1-t)y) \le t^\alpha f(x) + m(1-t)^\alpha f(y)$$

The function $f: [0, b] \to R$; $c, b > 0$ is said to be strongly convex, if one has [30]

$$f(tx + (1-t)y) \le tf(x) + (1-t)f(y) - ct(1-t)|x-y|^2$$

For all $x, y \in [0, b]$ and $t \in [0,1]$.

The function $f: [0, b] \to R$; $c, b > 0$ is said to be strongly m-convex where $m \in [0,1]$, if one has [30]

$$f(tx + m(1-t)y) \le tf(x) + m(1-t)f(y) - cmt(1-t)|x-y|^2$$

The function $f: [0, b] \to R, b > 0$, is said to be (s, m) −convex, where $(s, m) \in [0,1]^2$, if one has [30]

$$f(tx + m(1-t)y) \le t^s f(x) + m(1-t)^s f(y)$$

for all $x, y \in [0, b]$ and $t \in [0,1]$.

The function $f: [0, b] \to R$; $c, b > 0$ is said to be strongly (s, m) −convex in the second sense for $(s, m) \in [0,1]^2$ if one has [30]

$$f(tx + m(1-t)y) \le t^s f(x) + m(1-t)^s f(y) - cmt(1-t)|x-y|^2$$

For all $x, y \in [0, b]$ and $t \in [0,1]$.

If we take into account Kaleva (1987) formula [21]. A fuzzy number satisfies the following conditions if it is $u: R \to [0, 1]$.

Explanation:

u is normal (i.e., there exists an $x_0 \in R$ s.t $u(x_0) = 1$)

The set u is convex fuzzy, i.e., $(x\lambda + (1-\lambda)y) \ge \min\{u(x), u(y)\}$, for any $x, y \in R$, $\lambda \in [0, 1]$. where the term "convex fuzzy subset" refers to u.

On R, u is upper semicontinuous, i.e., $\forall x_0 \in R$ and $\forall \epsilon > 0, \exists$ neighborhood.

$$V(x_0): u(x) \le u(x_0) + {}^2, \forall x \in V(x_0).$$

The set $[u] = \{x \in R: u(x) > 0\}$ is compact in the sense that $\overline{A}$ represents A's closure.

Based on Kaleva (1987) assertion [21]. Assume $k \in R$ and $u, v \in RF$. Then, the equations define the addition and scalar multiplication, respectively.

$$[u \oplus v]\alpha = [u]\alpha + [v]\alpha$$

$$[k.u]\alpha = k[u]\alpha$$

for all $\alpha \in [0, 1]$ where $[u]\alpha + [v]\alpha$ is the typical product of a scalar and a subset of R, while $k[u]\alpha$ denotes the typical addition of two intervals (as subsets of R).

Proposition:

Let $k \in R$ and $u, v \in RF$. Then, the qualities listed below are true [14, 15].

1) $1.u = u$
2) $u \oplus v = v \oplus u$
3) $k.u = u.k$
4) $[u]\alpha_1 \subseteq [u]\alpha_2$, Whenever $0 \le \alpha_2 \le \alpha_1 \le 1$.

Let $D: RF \times RF \to R + \cup \{0\}$ be a function that the equation defines.

Fuzzy reasoning is employed, as defined by fuzzy logical inequalities, in the absence of raw data to validate the reasons for automating machine judgments.

Lemma.1

Assume that a mapping. $f: I \to R$ where $a, b \in I$ with $a < b$ is differentiable on $\dot{I}$,

Let $L_f[a, b]$ be the fuzzy space and $C_f[a, b]$ be the fuzzy continuous mapping space.

If $f'' \in C_f[a, b] \cap L_f[a, b]$, then

$$\frac{[(x-a)^2 - (b-x)^2]f'(x) + 2(b-x)f(b) + 2(x-a)f(a)}{2(b-a)}$$

$$= \frac{(x-a)^3}{2(b-a)}\left(\int_0^1 (1-t^2)f''(ta + (1-t)x)dt\right) + \frac{(b-x)^3}{2(b-a)}\left(\int_0^1 (1-t^2)f''(tb + (1-t)x)dt\right) + \frac{1}{b-a}\int_a^b f(t)dt$$

4.2.2. Theorem 01

Fuzzy logic's uniqueness in relation to Theorem 01

After reducing costs, investing in safety measures, and rotating counterproductive work behavior after helping staff members create a stress-free environment, the inquiry may provide new findings on the accuracy of exact judgments / accurate quantities of outputs in manufacturing companies. If the following lemma is taken into consideration with the intention of reducing the minimum time, increasing revenue, and demonstrating positive results under the following lemma, manufacturing companies' attitudes towards Co-Worker instrumental support variables can be changed, and policies to foster a peaceful workplace environment can be adopted. Automatic item production will also grow if the tools are implemented in accordance with the equation below.

Theorem 01: *Suppose a mapping* $f : I \subset R \to R_F$ *is differentiable on* I^o *such that* $f'' \in C_F[a,b] \cap L_F[a,b]$, *where* $a, b \in I^o$ *with* $a < b$. *If* $D(f'(x), o)$ *is* $(s, m) -convex$ *in the second sense on* $[a,b]$, *for some* $s \in [0,1], m \in [0,1], x \in [a,b]$, *then the following inequality holds*

$$D\left(\frac{[(x-a)^2-(b-x)^2]f'(x)+2(b-x)f(b)+2(x-a)f(a)}{2(b-a)}, \frac{1}{b-a}\int_a^b f(t)dt\right)$$

$$\leq \frac{m\left(\frac{1}{s+1}-B(3,s+1)\right)D\left(f''\left(\frac{x}{m},o\right)\right)}{2(b-a)} \times \{(x-a)^3-(b-x)^3\}$$

$$+\frac{(x-a)^3 D(f''(a),o)+(b-x)^3 D(f''(b),o)}{(b-a)(s+1)(s+3)}$$

Proof:
Utilising Lemma, we have,

$$D\left(\frac{[(x-a)^2-(b-x)^2]f'(x)+2(b-x)f(b)+2(x-a)f(a)}{2(b-a)}, \frac{1}{b-a}\int_a^b f(t)dt\right)$$

$$= D\frac{(x-a)^3}{2(b-a)}\int_0^1(1-t^2)f''(ta+(1-t)x)dt + \frac{(b-x)^3}{2(b-a)}\int_0^1(1-t^2)f''(tb+(1-t)x)dt$$

$$+\frac{1}{b-a}\int_a^b f(t)dt, \frac{1}{b-a}\int_a^b f(t)dt$$

$$= D\frac{(x-a)^3}{2(b-a)}\int_0^1(1-t^2)f''(ta+(1-t)x)dt + \frac{(b-x)^3}{2(b-a)}\int_0^1(1-t^2)f''(tb+(1-t)x)dt$$

$$+\frac{1}{b-a}\int_a^b f(t)dt, \tilde{o}$$

$$= D\left(\frac{(x-a)^3}{2(b-a)}\int_0^1(1-t^2)f''(ta+(1-t)x)dt, \tilde{o}\right) + D\left(\frac{(b-x)^3}{2(b-a)}\int_0^1(1-t^2)f''(tb+(1-t)x)dt, \tilde{o}\right)$$

$$= \frac{(x-a)^3}{2(b-a)}D\left(\int_0^1(1-t^2)f''(ta+(1-t)x)dt, \tilde{o}\right) + \frac{(b-x)^3}{2(b-a)}D\left(\int_0^1(1-t^2)f''(tb+(1-t)x)dt, \tilde{o}\right)$$

$$= \frac{(x-a)^3}{2(b-a)}\left(\int_0^1|1-t^2|D(f''(ta+(1-t)x), \tilde{o})dt\right) + \frac{(b-x)^3}{2(b-a)}\left(\int_0^1|1-t^2|D(f''(tb+(1-t)x), \tilde{o})dt\right)$$

$$= \frac{(x-a)^3}{2(b-a)}\left(\int_0^1|1-t^2|D(f''(ta+(1-t)x), \tilde{o})dt\right) + \frac{(b-x)^3}{2(b-a)}\left(\int_0^1|1-t^2|D(f''(tb+(1-t)x), \tilde{o})dt\right)$$

We use the $D(f''(x), \tilde{o})$ is $(s, m) -$convexity,

$$\leq \frac{(x-a)^3}{2(b-a)}\left(\int_0^1|1-t^2|\left\{t^s D(f''(a), \tilde{o}) + m(1-t)^s D\left(f''\left(\frac{x}{m}\right), \tilde{o}\right)\right\}dt\right)$$

$$+\frac{(b-x)^3}{2(b-a)}\left(\int_0^1|1-t^2|\left\{t^s D(f''(b), \tilde{o}) + m(1-t)^s D\left(f''\left(\frac{x}{m}\right), \tilde{o}\right)\right\}dt\right)$$

$$\leq \frac{m\left(\frac{1}{s+1}-B(3,s+1)\right)D\left(f''\left(\frac{x}{m},o\right)\right)}{2(b-a)} \times \{(x-a)^3-(b-x)^3\}$$

$$+\frac{(x-a)^3 D(f''(a),o)+(b-x)^3 D(f''(b),o)}{(b-a)(s+1)(s+3)}$$

As fuzzy logic is implemented, Theorem 02, its novelty
Mathematical algorithms, managerial economics, and management accounting can all be used to forecast lower manufacturing costs. We used the holder's uneven range system to facilitate labor and protect against potentially harmful infections such as COVID-19 and Colra, in addition to many other illnesses. Along with cultivating an understanding of psychological stress and providing support to colleagues. Using this technique reduced the number of raw materials needed to make items and increased the accuracy rate.

4.2.3. Theorem 02

Suppose a mapping $f: I \subset R \to R_F$ is differentiable on I^o such that $f'' \in C_F[a,b] \cap L_F[a,b]$, where $a,b \in I^o$ with $a < b$. If $D(f'(x), õ)^q$ is (s,m) −convex in the second sense on $[a,b]$, for some $s \in [0,1], m \in (0,1], x \in [a,b], q > 1, q^{-1} + p^{-1} = 1$, Then the following inequality holds

$$D\left(\frac{[(x-a)^2-(b-x)^2]f'(x)+2(b-x)f(b)+2(x-a)f(a)}{2(b-a)}, \frac{1}{b-a}\int_a^b f(t)dt\right)$$

$$\leq \left(\frac{B\left(\frac{1}{2},p+1\right)}{2}\right)^{\frac{1}{p}} \frac{1}{2(b-a)(s+1)^{\frac{1}{q}}}\left[(x-a)^3\left\{D(f''(a),õ)+mD\left(f''\left(\frac{x}{m}\right),õ\right)\right\}+(b-x)^3\left\{D(f''(b),õ)+mD\left(f''\left(\frac{x}{m}\right),õ\right)\right\}\right]$$

Where $B(.,.)$ Is the beta function?

Proof:

Utilizing Lemma, an $q > 1$, we have

$$D\left(\frac{[(x-a)^2-(b-x)^2]f'(x)+2(b-x)f(b)+2(x-a)f(a)}{2(b-a)}, \frac{1}{b-a}\int_a^b f(t)dt\right)$$

$$= D\frac{(x-a)^3}{2(b-a)}\int_0^1(1-t^2)f''(ta+(1-t)x)dt + \frac{(b-x)^3}{2(b-a)}\int_0^1(1-t^2)f''(tb+(1-t)x)dt$$

$$+ \frac{1}{b-a}\int_a^b f(t)dt, \frac{1}{b-a}\int_a^b f(t)dt$$

$$= D\frac{(x-a)^3}{2(b-a)}\int_0^1(1-t^2)f''(ta+(1-t)x)dt + \frac{(b-x)^3}{2(b-a)}\int_0^1(1-t^2)f''(tb+(1-t)x)dt$$

$$+ \frac{1}{b-a}\int_a^b f(t)dt, õ$$

$$= D\left(\frac{(x-a)^3}{2(b-a)}\int_0^1(1-t^2)f''(ta+(1-t)x)dt, õ\right) + D\left(\frac{(b-x)^3}{2(b-a)}\int_0^1(1-t^2)f''(tb+(1-t)x)dt, õ\right)$$

$$= \frac{(x-a)^3}{2(b-a)}D\left(\int_0^1(1-t^2)f''(ta+(1-t)x)dt, õ\right) + \frac{(b-x)^3}{2(b-a)}D\left(\int_0^1(1-t^2)f''(tb+(1-t)x)dt, õ\right)$$

$$= \frac{(x-a)^3}{2(b-a)}\left(\int_0^1|1-t^2|D(f''(ta+(1-t)x), õ)dt\right) + \frac{(b-x)^3}{2(b-a)}\left(\int_0^1|1-t^2|D(f''(tb+(1-t)x), õ)dt\right)$$

$$= \frac{(x-a)^3}{2(b-a)}\left(\int_0^1(|1-t^2|)^p dt\right)^{\frac{1}{p}}\left(\int_0^1 D(f''(ta+(1-t)x, õ)^q dt\right)^{\frac{1}{q}}$$

$$+ \frac{(b-x)^3}{2(b-a)}\left(\int_0^1(|1-t^2|)^p dt\right)^{\frac{1}{p}}\left(\int_0^1 D(f''(tb+(1-t)x, õ)^q dt\right)^{\frac{1}{q}}$$

By applying the definition of (s,m) −convexity, and simplification, we have

$$\leq \left(\frac{B\left(\frac{1}{2},p+1\right)}{2}\right)^{\frac{1}{p}} \frac{1}{2(b-a)(s+1)^{\frac{1}{q}}}\left[(x-a)^3\left\{D(f''(a),õ)+mD\left(f''\left(\frac{x}{m}\right),õ\right)\right\}+(b-x)^3\left\{D(f''(b),õ)+mD\left(f''\left(\frac{x}{m}\right),õ\right)\right\}\right]$$
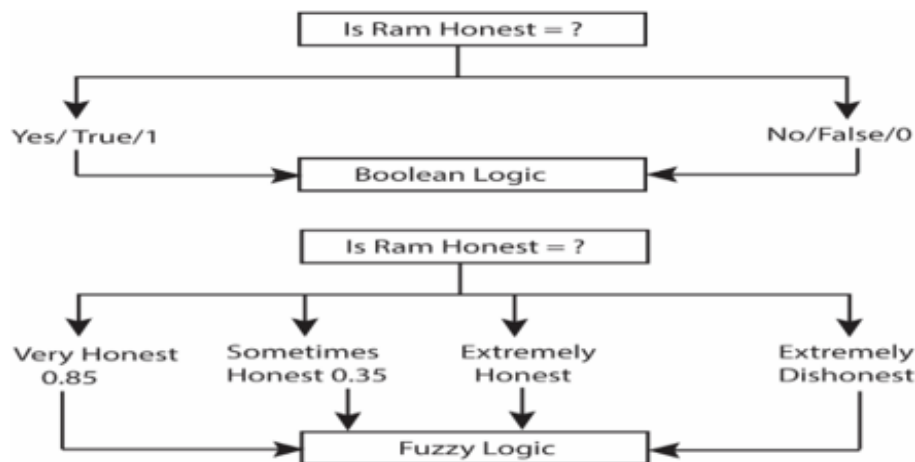

Fig. 4: Boolean and Fuzzy Logic.

Theorem 03: *Suppose a mapping* $f: I \subset R \to R_F$ *is differentiable on* I^o *such that* $f'' \in C_F[a,b] \cap L_F[a,b]$ *where* $[a,b] \in I^o$ *with* $a < b$. *if* $D(f'(x), o)$ *is strongly* (s,m) −*convex function in the second sense on* $[a,b]$, *for some* $s,m \in [0,1], x \in [a,b]$, *Then the following inequality holds*

$$D\left(\frac{[(x-a)^2-(b-x)^2]f'(x)+2(b-x)f(b)+2(x-a)f(a)}{2(b-a)},\frac{1}{b-a}\int_a^b f(t)dt\right)$$

$$\leq \frac{m\left(\frac{1}{s+1}-B(3,s+1)\right)D\left(f''\left(\frac{x}{m},o\right)\right)}{2(b-a)}[(x-a)^3-(b-x)^3] + \frac{(x-a)^3 D(f''(a),o)+(b-x)^3 D(f''(b),o)}{(b-a)(s+1)(s+3)} - \frac{7cm(a-b)^2}{60}\left[\frac{(b-x)^3+(x-a)^3}{2(b-a)}\right]$$

Proof:
By using Lemma, we have

$$D\left(\frac{[(x-a)^2-(b-x)^2]f'(x)+2(b-x)f(b)+2(x-a)f(a)}{2(b-a)},\frac{1}{b-a}\int_a^b f(t)dt\right)$$

$$= D\left(\frac{(x-a)^3}{2(b-a)}\int_0^1 (1-t^2)f''(ta+(1-t)x)dt + \frac{(b-x)^3}{2(b-a)}\int_0^1 (1-t^2)f''(tb+(1-t)x)dt\right)$$

$$+ \frac{1}{b-a}\int_a^b f(t)dt, \frac{1}{b-a}\int_a^b f(t)dt$$

$$= D\left(\frac{(x-a)^3}{2(b-a)}\int_0^1 (1-t^2)f''(ta+(1-t)x)dt + \frac{(b-x)^3}{2(b-a)}\int_0^1 (1-t^2)f''(tb+(1-t)x)dt\right)$$

$$+ \frac{1}{b-a}\int_a^b f(t)dt, o$$

$$= D\left(\frac{(x-a)^3}{2(b-a)}\int_0^1 (1-t^2)f''(ta+(1-t)x)dt, o\right)$$

$$+ D\left(\frac{(b-x)^3}{2(b-a)}\int_0^1 (1-t^2)f''(tb+(1-t)x)dt, o\right)$$

$$= \frac{(x-a)^3}{2(b-a)}D\left(\int_0^1 (1-t^2)f''(ta+(1-t)x)dt, o\right)$$

$$+ \frac{(b-x)^3}{2(b-a)}D\left(\int_0^1 (1-t^2)f''(tb+(1-t)x)dt, o\right)$$

$$= \frac{(x-a)^3}{2(b-a)}\left(\int_0^1 |(1-t^2)|D\big(f''(ta+(1-t)x)\big)dt, o\right)$$

$$+ \frac{(b-x)^3}{2(b-a)}\left(\int_0^1 |(1-t^2)|D\big(f''(tb+(1-t)x)\big)dt, o\right)$$

We use the $D(f''(x),o)$ is strongly $(s,m)-$convex

$$\leq \frac{(x-a)^3}{2(b-a)}\left(\int_0^1 |(1-t^2)|\left[t^s D(f''(a),0)+m(1-t)^s D\left(f''\left(\frac{x}{m},o\right)\right)-cmt(1-t)|a-x|^2\right]dt\right)$$

$$+ \frac{(b-x)^3}{2(b-a)}\left(\int_0^1 |(1-t^2)|\left[t^s D(f''(b),0)+m(1-t)^s D\left(f''\left(\frac{x}{m},o\right)\right)-cmt(1-t)|b-x|^2\right]dt\right)$$

$$\leq \frac{m\left(\frac{1}{s+1}-B(3,s+1)\right)D\left(f''\left(\frac{x}{m},o\right)\right)}{2(b-a)}[(x-a)^3-(b-x)^3]$$

$$+ \frac{(x-a)^3 D(f''(a),o)+(b-x)^3 D(f''(b),o)}{(b-a)(s+1)(s+3)} - \frac{7cm(a-b)^2}{60}\left[\frac{(b-x)^3+(x-a)^3}{2(b-a)}\right].$$

Theorem 04: *Suppose a mapping $f: I \subset R \to R_F$ is differentiable on I^o such that $f'' \in C_F[a,b] \cap L_F[a,b]$, where $[a,b] \in I^o$ with $a < b$. if $D(f'(x),o)^q$ is strongly $(s,m)-$convex in the second sense on $[a,b]$, for some $s,m \in [0,1]$, $x \in [a,b]$, $q > 1$, $q^{-1}+p^{-1}=1$, Then the following inequality holds*

$$D\left(\frac{[(x-a)^2-(b-x)^2]f'(x)+2(b-x)f(b)+2(x-a)f(a)}{2(b-a)},\frac{1}{b-a}\int_a^b f(t)dt\right)$$

$$\leq \left(\frac{B\left(\frac{1}{2},p+1\right)}{2}\right)^{\frac{1}{p}}\cdot\frac{1}{2(b-a)(s+1)^{\frac{1}{q}}}\left[(x-a)^3\left\{D(f''(a),o)+mD\left(f''\left(\frac{x}{m}\right),o\right)-\frac{cm|a-x|^2}{6}\right\}\right]$$

Proof:
Utilizing Lemma and $q > 1$, we have

$$D\left(\frac{[(x-a)^2-(b-x)^2]f'(x)+2(b-x)f(b)+2(x-a)f(a)}{2(b-a)},\frac{1}{b-a}\int_a^b f(t)dt\right)$$
$$= D\left(\frac{(x-a)^3}{2(b-a)}\int_0^1 (1-t^2)f''(ta+(1-t)x)dt + \frac{(b-x)^3}{2(b-a)}\int_0^1 (1-t^2)f''(tb+(1-t)x)dt\right)$$

$$+ \frac{1}{b-a} \int_a^b f(t)dt, \frac{1}{b-a} \int_a^b f(t)dt$$

$$= D\left(\frac{(x-a)^3}{2(b-a)} \int_0^1 (1-t^2)f''(ta+(1-t)x)dt + \frac{(b-x)^3}{2(b-a)} \int_0^1 (1-t^2)f''(tb+(1-t)x)dt\right)$$

$$+ \frac{1}{b-a} \int_a^b f(t)dt, o$$

$$= D\left(\frac{(x-a)^3}{2(b-a)} \int_0^1 (1-t^2)f''(ta+(1-t)x)dt, o\right)$$

$$+ D\left(\frac{(b-x)^3}{2(b-a)} \int_0^1 (1-t^2)f''(tb+(1-t)x)dt, o\right)$$

$$= \frac{(x-a)^3}{2(b-a)} D\left(\int_0^1 (1-t^2)f''(ta+(1-t)x)dt, o\right)$$

$$+ \frac{(b-x)^3}{2(b-a)} D\left(\int_0^1 (1-t^2)f''(tb+(1-t)x)dt, o\right)$$

$$= \frac{(x-a)^3}{2(b-a)} \left(\left(\int_0^1 |(1-t^2)|^p \, dt\right)^{\frac{1}{p}} \left(\int_0^1 D\big(f''(ta+(1-t)x)\big), o\big)^q \, dt\right)^{\frac{1}{q}}\right)$$

$$+ \frac{(b-x)^3}{2(b-a)} \left(\left(\int_0^1 |(1-t^2)|^p \, dt\right)^{\frac{1}{p}} \left(\int_0^1 D\big(f''(tb+(1-t)x)\big)^q, o\big) \, dt\right)^{\frac{1}{q}}\right)$$

We use the $(s,m)-$convexity and simplifying

$$\leq \left(\frac{B\left(\frac{1}{2},p+1\right)}{2}\right)^{\frac{1}{p}} \cdot \frac{1}{2(b-a)(s+1)^{\frac{1}{q}}} \left[(x-a)^3 \left\{ D(f''(a), o) + mD\left(f''\left(\frac{x}{m}\right), o\right) - \frac{cm|a-x|^2}{6}\right\}\right]$$

$$+ (b-x)^3 \left\{ D(f''(b), o) + mD\left(f''\left(\frac{x}{m}\right), o\right) - \frac{cm|b-x|^2}{6}\right\}$$

To assess the accuracy of the data and target values presented in Figure-3, our attention can be directed towards the Boolean and fuzzy logic systems within the automation setup. When the values and timing align precisely with the provided logic, the Boolean fuzzy logic system demonstrates a favorable true outcome within the designated timeframe, making these Boolean logical systems suitable for integration into automated manufacturing machinery. Businesses that employ fingerprint and face scanners for attendance have an example of a biometric system. By studying how criminals who engage in criminal behavior, such as gamblers, killers, and thieves, use automated equipment in the second phase of the design, we may detect and distinguish the manifestations of extremely false claims and highly genuine claims.

4.3. Empirical application of fuzzy regression

Having established the theoretical fuzzy framework, we applied fuzzy linear regression to our empirical data (N=395) to demonstrate practical utility. Following Tanaka et al. (1982) possibilistic regression approach, coefficients were represented as triangular fuzzy numbers (L, C, U) with possibility level h = 0.5, explicitly modeling measurement uncertainty inherent in Likert scales. Fuzzy regression yielded bounded estimates that validate our SEM findings while revealing individual variation. Path coefficients ranged as follows: workplace incivility to psychological distress (0.398, 0.550, 0.701), psychological distress to counterproductive behavior (0.155, 0.210, 0.264), and direct effect (0.190, 0.257, 0.324). The fuzzy indirect effect was (0.062, 0.115, 0.185), with proportion mediated ranging from 12.1% to 73.6% (center: 31.0%), nearly identical to our SEM estimate of 30.2%. This convergence across methods strengthens confidence in findings, while the wide bounds reflect meaningful heterogeneity in how manufacturing employees experience workplace stressors. The fuzzy framework provides organizations with bounded estimates for intervention planning: conservative scenarios (12% mediation) warrant heavy investment in direct incivility prevention, while optimistic scenarios (74% mediation) justify comprehensive psychological support programs. The most likely scenario (31% mediation) suggests balanced resource allocation across both approaches (see Table 6).

Table 6: Fuzzy Linear Regression: Mediation Analysis Results

Effect	Lower	Center	Upper
WI → PD (a)	.398	.550	.701
PD → CWB (b)	.155	.210	.264
WI → CWB (direct, c')	.190	.257	.324
Indirect Effect (a×b)	.062	.115	.185
Total Effect	.252	.372	.509
Proportion Mediated	12.1%	31.0%	73.6%

Note. N = 395. WI = Workplace Incivility; PD = Psychological Distress; CWB = Counterproductive Work Behavior. Fuzzy coefficients represent triangular membership functions with possibility level h = 0.5.

4.3.1. Advantages of fuzzy regression for organizational cost forecasting

Traditional ordinary least squares (OLS) regression produces point estimates that, while statistically valid, present limitations for managerial decision-making. A coefficient estimate of $\beta = 0.257$ (SE = 0.042) provides a single value that forces binary resource allocation decisions without guidance on scenario planning or risk assessment. Fuzzy regression addresses three critical limitations. First, it enables scenario-based planning through bounded estimates rather than point predictions. Our results (lower: 0.190, center: 0.257, upper: 0.324) allow organizations to budget conservatively using lower bounds, plan for expected outcomes using center estimates, and maintain contingency reserves for upper-bound scenarios. Second, fuzzy approaches avoid parametric assumptions about error distributions that workplace behavior data frequently violate. Third, the methodology explicitly incorporates measurement uncertainty inherent in Likert-scale psychological assessments, where a score of 3.2 represents genuinely ambiguous rather than precise behavior. For resource-constrained Pakistani manufacturing enterprises, these bounded estimates provide actionable cost ranges suitable for three-tiered budgeting frameworks commonly employed in capital investment decisions. The approach transforms psychological research findings into financial planning tools by making uncertainty explicit rather than averaging it away through point estimates.

5. Discussion and Conclusion

In Pakistani industries other than manufacturing, psychological discomfort and peer support have a direct impact on employee behavior and attitudes. This study looks at the link between psychological anguish and peer support from co-workers in Pakistan's manufacturing industry, as well as any possible implications these characteristics may have on employees' psychological distress and counterproductive work behavior (CWB). Employee behavior can be greatly influenced by psychological discomfort, which includes despair, anxiety, and continuous emotional stress. In an industry where production anxiety and strict deadlines are common, like manufacturing, workers may experience increased psychological suffering. Incivility in the workplace, as well as disturbing, unpleasant, or irresponsible behavior among co-workers, can be symptoms of discomfort. Workers experiencing psychological discomfort have a higher tendency to act out, be dismissive, or adopt passive-aggressive tactics, all of which can lead to a hostile work environment. The manufacturing is involved in customary practices and businesses. These require substantial concepts, systems, and the fuzzy logical system's failure to comprehend the new automation system, all of which are the outcome of other causes. Our analysis shows that psychological distress plays an important role in connecting workplace incivility to counterproductive behavior. When employees experience rude or disrespectful treatment at work, they often develop psychological distress, which then leads them to engage in counterproductive behaviors. The data suggest this pathway accounts for 30-31% of the relationship, with fuzzy regression revealing this proportion could range from 12.1% to 73.6% depending on individual variation and measurement precision, meaning psychological distress explains about one-third of why incivility leads to bad behavior. However, this also means that 70% of the effect works through other means. Workers might respond to incivility through other channels; they might feel it's unfair, they might get angry, or they might simply care less about the organization. All of these could lead to counterproductive behavior without necessarily going through psychological distress first. Understanding these multiple pathways is important for organizations trying to address the problem. Unilever, for example, has built workplace training programs and implemented new automated HR systems to estimate employee total productivity daily. A new automated fuzzy logical system will be used to evaluate employee performance on environmental elements on a timely, weekly, and monthly basis. Workers should spread the word about new and existing organizations and encourage environmental education. The study investigates the intricate relationship between workplace incivility, counterproductive work behavior, psychological distress, and colleague support in manufacturing organizations. The reliability analysis reasonably provides a foundation for the theory, while emphasizing the novel exploration of workplace rudeness in a context where understanding and awareness are lacking. What's particularly interesting is that this pattern holds across different types of counterproductive behavior. Whether workers slow down production, damage property, play politics, or act aggressively toward others, psychological distress seems to be involved in roughly the same way, accounting for between 28% and 33% of each relationship. This consistency tells us that psychological distress doesn't just affect one kind of bad behavior; it affects many different kinds in similar ways. The regression analysis, conducted through two models, reveals interesting insights. The Level of Awareness regarding psychological distress is influenced significantly by support from co-workers and recognizing psychological discomfort. The organizational culture and environmental alignment show less statistical significance in shaping awareness. On the other hand, Workplace incivility practices are positively associated with a happy environment, organizational culture, and assistance from colleagues. This suggests that fostering a positive work environment, including help on the role of psychological distress, colleague support, and organizational culture logic theorems introduces a unique perspective, offering a mathematical foundation for understanding workplace dynamics. The theorems demonstrating how fuzzy logic can be implemented to lower workplace incivility while reducing costs in manufacturing organizations, such as convexity, to model workplace dynamics accurately. The implementation of fuzzy logic, leveraging mathematical concepts as outlined in Theorem 02, presents a method to forecast lower manufacturing costs and improve accuracy rates through fuzzy reasoning. The study suggests that automated mathematical applications only work if there is a low level of knowledge in the industrial sector. The theorem capabilities for manufacturing companies provide substantial contributions. The theorem only provides a structured approach to understanding these mechanisms. These findings fit well with established theories in organizational psychology. When negative events happen at work, like someone treating you rudely, it triggers emotional reactions. Those emotional reactions then shape how you behave afterward. In this case, rudeness triggers distress, and distress leads to counterproductive actions. This sequence makes intuitive sense and matches what researchers have found in other settings. It also aligns with the idea that workplace stressors create psychological strain, and that strain has behavioral consequences beyond just affecting health. These findings have direct implications for organizational resource allocation and financial planning. The fuzzy regression bounds enable risk-adjusted intervention planning whereby organizations can design tiered programs aligned with different budget scenarios rather than binary decisions based on point estimates. Conservative managers may fund core interventions that demonstrate positive returns under lower-bound assumptions, while risk-tolerant organizations can pursue more comprehensive programs targeting center or upper-bound scenarios. This portfolio approach mirrors standard capital budgeting practices but requires explicit uncertainty quantification through bounded estimation. Additionally, behavioral economics principles suggest that mental accounting biases contribute to systematic underinvestment in workplace climate interventions. Incivility costs disperse across departmental budgets (turnover in human resources, productivity losses in operations, quality defects in manufacturing) while intervention costs consolidate in training budgets, creating asymmetric cost perceptions. Reframing interventions as preventing aggregated losses rather than generating uncertain benefits may increase adoption rates through loss aversion mechanisms.

6. Implications, Limitations, and Future Research Directions

6.1. Practical implications

First, employers should prioritize their workers' mental health by implementing programs that lessen psychological distress, such as counselling services, stress management workshops, and mindfulness exercises. Given that roughly 30% of the link between workplace incivility and counterproductive behavior operates through psychological distress, these mental health initiatives become critically important for reducing about one-third of problematic behaviors. Second, since a healthy work environment ought to be a fundamental aspect of corporate culture, encouragement of cooperation, mutual aid, and teamwork may strengthen ties among co-workers. Third, managers and leaders have an important influence in molding workplace behavior, and employees' interpersonal and conflict resolution skills should be improved through training programs. However, since 70% of the effect operates through other pathways, organizations cannot rely solely on stress reduction and need comprehensive approaches addressing incivility directly while supporting employee well-being. Fourth, recognizing Pakistan's cultural values that naturally inhibit undesirable behaviors by emphasizing cooperation, group cohesiveness, and balanced purpose can enhance interventions. What's particularly encouraging is that the psychological distress pathway works consistently across all types of counterproductive behavior, production problems, property damage, political maneuvering, and personal aggression, meaning a single intervention can improve multiple outcomes simultaneously. Fifth, frequent focus groups and communication are required to get accurate information about the prevalence of counterproductive work behavior and workplace rudeness. Organizations should recognize that addressing workplace incivility delivers dual benefits: it directly reduces bad behavior and prevents the psychological distress that leads to additional problems, making civility training and clear behavioral expectations not just ethical obligations but economically sound investments with measurable returns. Fuzzy bounds suggest organizations should adopt varying training and clear behavioral expectations, not just as clinical obligations but as economically sound psychological support, depending on workforce characteristics.

6.2. Limitations and future research directions

The study relies on a cross-sectional design and a specific sample of participants from the food, pharmaceutical, and apparel manufacturing industries. This design may introduce sampling bias and limit the generalizability of the findings to other sectors within the manufacturing industry. The data collection method primarily involves self-reported responses through questionnaires. This method may be subject to respondent bias, as participants may provide socially desirable answers or may not accurately represent their experiences. Future studies could incorporate multiple data sources or objective measures to enhance data validity. Moreover, the research focuses exclusively on manufacturing industries in Pakistan. The findings may not be directly applicable to different cultural or industrial contexts. Future research could expand the geographical scope to enhance the study's external validity. Furthermore, while fuzzy logic provides a nuanced understanding of decision-making processes, its generalization to real-world scenarios may be limited. The study acknowledges the complexity of fuzzy logic, but this application may not fully capture the intricacies of human behavior in the workplace. Longitudinal studies could provide a more comprehensive understanding of the dynamics between psychological distress, workplace incivility, and counterproductive work behavior. Our findings indicate that psychological distress mediates approximately 30% of the relationship between workplace incivility and counterproductive behavior, with consistency across all four dimensions of counterproductive behavior. This suggests psychological distress operates as a general mechanism rather than affecting only specific behavioral types. However, the substantial direct effect (70%) indicates additional mechanisms warrant investigation. Utilizing physiological measures such as cortisol levels or heart rate variability would enable a more in-depth analysis of causal relationships and the potential for interventions to mitigate outcomes. Moreover, future research complementing quantitative findings with qualitative approaches, such as interviews or focus groups, could provide a richer understanding of individuals' experiences in the workplace. Qualitative data could help uncover nuanced factors contributing to psychological distress and counterproductive work behavior. Additionally, integrating objective measures alongside self-reported data could enhance the robustness of the study. Future research should explore alternative mediating pathways accounting for the remaining 70% of the effect, including perceived organizational injustice, anger, reduced organizational commitment, or direct retaliation motives. Examining these competing pathways simultaneously would clarify which mechanisms matter most. Future research could also investigate potential moderators and the implementation of well-being programs, conflict resolution strategies, or leadership training to create a positive work environment

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References

[1] Agarwal, U. A., & Vaghela, P. S. (2021). Work-life balance, well-being, and perceived organizational support during COVID-19: An empirical study. *International Journal of Organizational Analysis*, 30(4), 1027-1050. https://doi.org/10.1108/IJOA-06-2020-2267

[2] Alomari, M., & Darus, M. (2010). Some Ostrowski type inequalities for quasi-convex functions with applications to special means. *RGMIA Res. Rep. Coll.*, 13(2), 6.

[3] Alomari, M., Darus, M., Dragomir, S. S., & Cerone, P. (2010). Ostrowski type inequalities for functions whose derivatives are s-convex in the second sense. *Applied Mathematics Letters*, 23(9), 1071-1076. https://doi.org/10.1016/j.aml.2010.04.038.

[4] Alshurideh, M. T., Al Kurdi, B., Alzoubi, H M, Ghazal, T M, Said, R A, AlHamad, A Q, Hamadneh, A, Sahawneh, N and Al-kassem, A H. (2022). Fuzzy assisted human resource management for supply chain management issues. *Annals of Operations Research*, 1-19. https://doi.org/10.1007/s10479-021-04472-8.

[5] Bennett, R. J., & Robinson, S. L. (2000). Development of a measure of workplace deviance. *Journal of Applied Psychology*, 85(3), 349-360. https://doi.org/10.1037/0021-9010.85.3.349.

[6] Carpenter, N. C., Whitman, D. S., & Amrhein, R. (2020). Unit-Level Counterproductive Work Behavior (CWB): A Conceptual Review and Quantitative Summary. *Journal of Management*, 47(6), 1498-1527. https://doi.org/10.1177/0149206320978812

[7] Cong-Xin, W., & Ming, M. (1991). Embedding problem of fuzzy number space: Part I. *Fuzzy Sets and Systems*, 44(1), 33-38. https://doi.org/10.1016/0165-0114(91)90030-T.

[8] Cortina, L. M., Kabat-Farr, D., Magley, V. J., & Nelson, K. (2017). Researching rudeness: The past, present, and future of the science of incivility. *Journal of Occupational Health Psychology*, 22(3), 299-313. https://doi.org/10.1037/ocp0000089.

[9] Cortina, L. M., Magley, V. J., Williams, J. H., & Langhout, R. D. (2001). Incivility in the workplace: Incidence and impact. *Journal of Occupational Health Psychology*, 6(1), 64-80. https://doi.org/10.1037/1076-8998.6.1.64

[10] Dragomir, S. S., & Wang, S. (1998). Applications of Ostrowski's inequality to the estimation of error bounds for some special means and for some numerical quadrature rules. *Applied Mathematics Letters*, 11(1), 105-109. https://doi.org/10.1016/S0893-9659(97)00142-0.

[11] Fatima, A. (2016). Impact of workplace ostracism on counter productive work behaviors: Mediating role of job satisfaction. *Abasyn Journal of Social Sciences*, 9(2), 388-408.

[12] Giumetti, G. W., Saunders, L. A., Brunette, J. P., DiFrancesco, F. M., & Graham, P. G. (2022). Cyber incivility @ work: The new age of interpersonal deviance. *Cyberpsychology, Behavior, and Social Networking*, 25(6), 383-391.

[13] Hamberg-van Reenen, H. H., Proper, K. I., & van den Berg, M. (2012). Worksite mental health interventions: A systematic review of economic evaluations. *Occupational and Environmental Medicine*, 69(11), 837-845. https://doi.org/10.1136/oemed-2012-100668.

[14] Hershcovis, M. S., & Reich, T. C. (2013). Integrating workplace aggression research: Relational, contextual, and method considerations. *Journal of Organizational Behavior*, 34(S1), S26-S42. https://doi.org/10.1002/job.1886.

[15] Hom, P. W., Lee, T. W., Shaw, J. D., & Hausknecht, J. P. (2017). One hundred years of employee turnover theory and research. *Journal of Applied Psychology*, 102(3), 530-545. https://doi.org/10.1037/apl0000103.

[16] Huang, H., Lin, J., Wu, L., Fang, B., Wen, Z., & Sun, F. (2020). Machine learning-based multi-modal information perception for soft robotic hands. *Tsinghua Science and Technology*, 25(2), 255-269. https://doi.org/10.26599/TST.2019.9010009.

[17] Ipsen, C., van Veldhoven, M., Kirchner, K., & Hansen, J. P. (2021). Six key advantages and disadvantages of working from home in Europe during COVID-19. *International Journal of Environmental Research and Public Health*, 18(4), 1826. https://doi.org/10.3390/ijerph18041826

[18] Kahneman, D., & Tversky, A. (1979). Prospect theory: An analysis of decision under risk. Econometrica, 47(2), 263-291. https://doi.org/10.2307/1914185.

[19] Kaleva, O. (1987). Fuzzy differential equations. *Fuzzy Sets and Systems*, 24(3), 301-317. https://doi.org/10.1016/0165-0114(87)90029-7.

[20] Kirk, B. A., Schutte, N. S., & Hine, D. W. (2021). The effect of an expressive-writing intervention for employees on emotional self-efficacy, emotional intelligence, affect, and workplace incivility. *Journal of Applied Social Psychology*, 51(9), 879-891. https://doi.org/10.1111/jasp.12800.

[21] Kőszegi, B., & Rabin, M. (2006). A model of reference-dependent preferences. Quarterly Journal of Economics, 121(4), 1133-1165. https://doi.org/10.1162/qjec.121.4.1133

[22] Loh, J. M. I., & Loi, N. (2018). Tit for tat: burnout as a mediator between workplace incivility and instigated workplace incivility. *Asia-Pacific Journal of Business Administration*, 10(1), 100-111. https://doi.org/10.1108/APJBA-11-2017-0132.

[23] Mitchell, M. S., Baer, M. D., Ambrose, M. L., Folger, R., & Palmer, N. F. (2018). Cheating under pressure: A self-protection model of workplace cheating behavior. *Journal of Applied Psychology*, 103(1), 54-73. https://doi.org/10.1037/apl0000254.

[24] Pearson, C. M., Andersson, L. M., & Porath, C. L. (2005). Workplace incivility. In *Counterproductive work behavior: Investigations of actors and targets.* (pp. 177-200). American Psychological Association. https://doi.org/10.1037/10893-008.

[25] Pearson, C. M., Andersson, L. M., & Wegner, J. W. (2001). When workers flout convention: A study of workplace incivility. *Human Relations*, 54(11), 1387-1419. https://doi.org/10.1177/00187267015411001.

[26] Porath, C., & Pearson, C. (2013). The price of incivility. *Harvard Business Review*, 91(1-2), 114-121.

[27] Porath, C. L., & Erez, A. (2007). Does rudeness really matter? The effects of rudeness on task performance and helpfulness. *Academy of Management Journal*, 50(5), 1181-1197. https://doi.org/10.5465/amj.2007.20159919.

[28] Richardson, K. M., & Rothstein, H. R. (2008). Effects of occupational stress management intervention programs: A meta-analysis. *Journal of Occupational Health Psychology*, 13(1), 69-93. https://doi.org/10.1037/1076-8998.13.1.69.

[29] Scheepers, D., & Ellemers, N. (2019). Social Identity Theory. In K. Sassenberg & M. L. W. Vliek (Eds.), *Social Psychology in Action: Evidence-Based Interventions from Theory to Practice* (pp. 129-143). Springer International Publishing. https://doi.org/10.1007/978-3-030-13788-5_9.

[30] Schilpzand, P., De Pater, I. E., & Erez, A. (2016). Workplace incivility: A review of the literature and agenda for future research. *Journal of Organizational Behavior*, 37(S1), S57-S88. https://doi.org/10.1002/job.1976 .

[31] Shin, Y., Lee, E. J., & Hur, W.-M. (2022). Supervisor incivility, job insecurity, and service performance among flight attendants: the buffering role of co-worker support. *Current Issues in Tourism*, 25(6), 901-918. https://doi.org/10.1080/13683500.2021.1905618.

[32] Smith, S. L., Kindermans, P.-J., Ying, C., & Le, Q. V. (2017). Don't decay the learning rate, increase the batch size. *arXiv preprint arXiv:1711.00489*.

[33] Tanaka, H., Uejima, S., & Asai, K. (1982). Linear regression analysis with fuzzy model. IEEE Transactions on Systems, Man, and Cybernetics, 12(6), 903-907. https://doi.org/10.1109/TSMC.1982.4308925.

[34] Thaler, R. H. (1999). Mental accounting matters. Journal of Behavioral Decision Making, 12(3), 183-206. https://doi.org/10.1002/(SICI)1099-0771(199909)12:3<183::AID-BDM318>3.0.CO;2-F.

[35] Vranjes, I., Baillien, E., Vandebosch, H., Erreygers, S., & De Witte, H. (2021). The development and validation of the Inventory of Cyberbullying Acts at Work (ICA-W). *European Journal of Work and Organizational Psychology*, 30(2), 179-191.

[36] Welbourne, J. L., Gangadharan, A., & Sariol, A. M. (2023). Supervisor gender and workplace incivility: The costs of being female. *Journal of Leadership & Organizational Studies*, 30(1), 93-107.

[37] Wu, C., & Gong, Z. (2001). On Henstock integral of fuzzy-number-valued functions (I). *Fuzzy Sets and Systems*, 120(3), 523-532. https://doi.org/10.1016/S0165-0114(99)00057-3.

[38] Wu, L.-Z., Yim, F. H.-k., Kwan, H. K., & Zhang, X. (2012). Coping with Workplace Ostracism: The Roles of Ingratiation and Political Skill in Employee Psychological Distress. *Journal of Management Studies*, 49(1), 178-199. https://doi.org/10.1111/j.1467-6486.2011.01017.x.

[39] Yao, J., Lim, S., Guo, C. Y., Ou, A. Y., & Ng, J. W. X. (2022). Experienced incivility in the workplace: A meta-analytical review of its construct validity and nomological network. *Journal of Applied Psychology*, 107(2), 193-220. https://doi.org/10.1037/apl0000870.