

ASSESSMENT OF PROBATION PROGRAMS ON MANAGEMENT OF RECIDIVISM IN KENYA: A CASE STUDY OF GARISSA COUNTY

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Abstract: Probation programs are central to offender rehabilitation and the management of recidivism through supervision, rehabilitation, restorative justice, and community reintegration. This study examined the influence of probation programs on the management of recidivism in Kenya, focusing on Garissa County. Specifically, it assessed the effects of supervision intensity, rehabilitation programs, victim-offender mediation and restorative practices, and community support on recidivism management. The study was guided by Social Learning Theory, Strain Theory, Control Theory, and the Risk-Need-Responsivity (RNR) Model. A descriptive survey research design employing a quantitative approach was adopted. Stratified random sampling was used to select probation officers, offenders on probation, and recidivists. Data were collected using structured questionnaires and analyzed through descriptive statistics and multiple linear regression. The findings revealed skepticism regarding the effectiveness of supervision intensity in reducing re-offending and limited confidence in existing rehabilitation programs. Victim-offender mediation and restorative justice practices were found to be infrequently implemented during probation. However, respondents strongly acknowledged the importance of community and family support, particularly community awareness initiatives, in facilitating offender rehabilitation and reintegration. Overall, there was confidence in the probation system's potential to manage recidivism when supported by competent probation officers and coordinated stakeholder involvement. The study concludes that strengthening probation programs requires improved supervision, comprehensive rehabilitation interventions, greater integration of restorative justice practices, and stronger community partnerships. It recommends enhancing supervision through counseling, skills training, and behavioral assessments; restructuring rehabilitation programs to address offenders' psychological, social, and economic needs; institutionalizing victim-offender mediation within probation procedures; and expanding collaboration with community-based organizations to improve offender reintegration and reduce recidivism.

Keywords: Rehabilitation programs, Community support Restorative, justice Recidivism management, Kenya.

1. INTRODUCTION

Recidivism, defined as the tendency of previously convicted offenders to reoffend after release or completion of a sentence, remains one of the most persistent challenges confronting criminal justice systems worldwide. High recidivism rates undermine public safety, increase correctional costs, and signal weaknesses in offender rehabilitation and reintegration programs. Consequently, many countries have increasingly embraced probation as a community-based correctional strategy that emphasizes offender supervision, rehabilitation, and social reintegration rather than incarceration. Probation programs seek to address criminogenic needs through structured supervision, behavioral interventions, vocational training, counseling, restorative justice practices, and community support, thereby reducing the likelihood of repeat offending.

Evidence from developed and developing countries demonstrates that effective probation programs can significantly reduce recidivism when implemented through evidence-based approaches. Studies conducted in the United States, the United Kingdom, Japan, and South Africa indicate that appropriate supervision intensity, individualized rehabilitation programs, restorative justice interventions, and strong community support enhance offender reintegration and improve compliance with probation conditions (Taxman & Pattavina, 2021; Dominey et al., 2022; Hirano, 2022; Maseko & Dube, 2022). These findings suggest that successful probation outcomes depend not only on legal supervision but also on addressing offenders' social, psychological, and economic needs through coordinated community-based interventions.

Despite these global advances, recidivism continues to pose a significant challenge in many developing countries, particularly within Sub-Saharan Africa, where probation services often operate under limited institutional capacity and resource constraints. Factors such as inadequate rehabilitation services, excessive probation officer caseloads, unemployment, social stigma, and weak community reintegration mechanisms continue to undermine the effectiveness of community corrections. Consequently, many offenders fail to successfully reintegrate into society and eventually relapse into criminal behaviour.

In Kenya, probation services constitute an integral component of the criminal justice system and are intended to promote offender rehabilitation while reducing prison overcrowding through non-custodial sentencing. Probation officers supervise offenders, facilitate behavioural change programmes, provide counselling, and link offenders to educational, vocational, and psychosocial support services. Nevertheless, national reports indicate that recidivism remains a persistent concern, with more than one-third of offenders reportedly reoffending within a few years of completing probation (Kenya Probation and Aftercare Service, 2021). These trends raise concerns regarding the effectiveness of existing probation programmes in achieving their rehabilitative objectives and highlight the need to evaluate the factors influencing successful offender reintegration.

Existing empirical studies in Kenya have examined offender rehabilitation, juvenile correctional programmes, community reintegration, and determinants of recidivism in counties such as Nairobi, Mombasa, Kisumu, and Kakamega. However, these studies have largely focused on custodial rehabilitation, juvenile justice, or offender characteristics, with limited attention given to the effectiveness of probation programmes as community-based interventions. Furthermore, little empirical evidence exists on how probation programme components, including supervision intensity, rehabilitation programmes, restorative justice practices, and community support, influence the management of recidivism in marginalized and underserved regions such as Garissa County.

Garissa County presents a unique context for examining probation effectiveness because of its socio-economic challenges, security concerns, and limited access to rehabilitation and reintegration services. These contextual factors may influence offender behaviour and the successful implementation of probation programmes. Understanding how probation interventions operate within such an environment is essential for developing evidence-based policies aimed at strengthening community corrections and reducing repeat offending.

This study therefore examines the influence of probation programmes on the management of recidivism in Kenya using Garissa County as a case study. Specifically, the study evaluates the influence of supervision intensity, rehabilitation programmes, restorative justice practices, and community support on the management of recidivism. The findings are expected to contribute to the growing body of knowledge on community corrections while providing practical recommendations for strengthening probation services and informing criminal justice policy in Kenya and similar developing-country contexts.

2. REVIEW

Theoretical Review

Control Theory (Hirschi, 1969) argues that criminal behavior is more likely when individuals have weak social bonds with family, education, employment, and the wider community. The theory emphasizes that strengthening attachment, commitment, involvement, and adherence to societal norms can deter criminal behavior and reduce recidivism. In the context of Garissa County, where many offenders experience weak family and community support, the theory supports probation interventions that promote family counseling, vocational training, employment opportunities, and community engagement to facilitate successful reintegration. However, the theory is limited because it places primary emphasis on social bonds while giving less attention to factors such as mental health, substance abuse, personal choice, and other individual differences that also influence criminal behavior.

The Risk-Need-Responsivity (RNR) Model (Andrews & Bonta, late 1980s) provides an evidence-based framework for offender rehabilitation by matching intervention intensity to an offender's risk level, addressing criminogenic needs, and tailoring rehabilitation strategies to individual characteristics. The model is widely recognized for improving correctional outcomes by prioritizing high-risk offenders and focusing on key factors such as unemployment, substance abuse, and low educational attainment. Its application is particularly relevant in Garissa County, where individualized probation interventions can enhance offender rehabilitation and reduce reoffending. Nevertheless, implementing the RNR Model requires substantial resources, skilled personnel, and comprehensive offender assessments, which may be difficult to achieve in resource-constrained settings. Moreover, the model does not fully account for external systemic barriers and personal factors that may continue to influence recidivism despite appropriate interventions.

Together with Social Learning Theory and Strain Theory, these frameworks provide a comprehensive theoretical foundation for the study by explaining how social relationships, economic pressures, individual rehabilitation needs, and evidence-based probation practices influence the management of recidivism. Collectively, they justify the adoption of integrated probation programs that combine behavioral, social, and economic interventions to improve

Empirical Review

Evidence on supervision intensity shows that effective probation supervision contributes to recidivism reduction when it is individualized and integrated with evidence-based interventions. Studies indicate that supervision alone has limited impact on reducing reoffending unless combined with cognitive-behavioral approaches, offender risk assessment, and rehabilitative support (Bonta et al., 2019; Taxman & Pattavina, 2020; Lovins et al., 2020; Viglione, 2021; Wodahl et al., 2022; DeMichele et al., 2023). The literature further emphasizes that supervision aligned with the Risk-Need-Responsivity (RNR) model is more effective than surveillance-oriented approaches, which often increase technical violations without promoting meaningful behavioral change.

Research on rehabilitation programs consistently identifies rehabilitation as a key determinant of successful offender reintegration and recidivism reduction. Vocational training, cognitive-behavioral therapy, educational initiatives, healthcare interventions, employment support, diversion programs, and arts-based rehabilitation have all been shown to improve reintegration outcomes and lower reoffending rates (Ruto, 2018; Ogada, 2018; Kiptui, 2020; Visher et al., 2020; Binswanger et al., 2020; Rodriguez et al., 2020; Mwaniki, 2021; Waweru, 2022; Duwe, 2023; Howard et al., 2023). However, inadequate funding, unemployment, stigma, limited accessibility, and the lack of culturally responsive interventions continue to constrain rehabilitation outcomes, particularly in marginalized regions such as Garissa County.

Studies on justice victim-offender mediation and restorative practices demonstrate that restorative justice interventions significantly enhance offender accountability, empathy, reconciliation, and successful reintegration. Evidence from victim-offender mediation, restorative conferencing, and related restorative approaches indicates substantial reductions in recidivism compared to traditional punitive justice systems (Walters, 2020; Wilson et al., 2020; Gavrielides & Artinopoulou, 2020; Hayes & Daly, 2020; Hennessey Hayes et al., 2023). These findings suggest that integrating restorative justice into probation programs strengthens rehabilitation outcomes and promotes long-term behavioral change.

Evidence on community support highlights the importance of social and economic reintegration in reducing recidivism. Community-based interventions, including mentorship, family support, stable housing, employment assistance, peer counseling, mental health services, and community mobilization, have consistently been associated with lower reoffending rates and improved reintegration outcomes (Hagan et al., 2021; Miller & Smith, 2022; Johnson et al., 2022; Wilson & Beck, 2023; Patterson et al., 2023; Taylor et al., 2023). Despite these positive findings, limited empirical research has examined how structured community support can be effectively integrated into probation programs in Kenya, particularly in culturally diverse and resource-constrained counties such as Garissa, highlighting the need for context-specific studies to inform policy and practice.

The literature indicates that probation programs play a significant role in reducing recidivism when implemented as integrated interventions. Evidence shows that effective supervision, rehabilitation, restorative justice, and community support each contribute to successful offender reintegration and lower reoffending rates. However, the effectiveness of these interventions depends on adequate resources, individualized approaches, and strong community involvement. The reviewed studies further reveal a gap in context-specific evidence on the integration of these probation programs in Kenya, particularly in Garissa County, thereby justifying the need for the current study.

3. METHODOLOGY

This study adopted a quantitative research approach using a descriptive survey design to examine the influence of probation programs on the management of recidivism in Garissa County, Kenya. The design was considered appropriate because it enables the collection of standardized data from a relatively large population and facilitates statistical analysis of relationships between probation program components and recidivism outcomes (Saunders, Lewis, & Thornhill, 2019). Garissa County was purposively selected due to its active implementation of probation services and the persistent challenge of repeat offending despite the adoption of community-based correctional interventions.

The target population comprised 100 respondents, including 20 probation officers, 50 offenders serving probation orders, and 30 recidivated offenders. These categories were selected because they are directly involved in the implementation and outcomes of probation programs and therefore provide relevant information regarding offender supervision, rehabilitation, restorative justice practices, community support, and recidivism management. A sample of 80 respondents was determined using Yamane's (1967) sample size formula at a 95% confidence level and selected through stratified random sampling to ensure proportional representation of each respondent category. The final sample consisted of 16 probation officers, 40 offenders, and 24 recidivated offenders. Primary data were collected using structured questionnaires developed from the study objectives and existing empirical literature.

4. RESEARCH FINDINGS AND DISCUSSIONS

Correlation Analysis

A correlation analysis was conducted to determine the strength and direction of the relationships between key variables influencing Management of Recidivism in Garissa County.

Correlation between probation programs and Management of Recidivism in Garissa County, Kenya

		Supervision intensity	Community support	Justice victim-offender mediation and restorative practices	Rehabilitation Programs	Management of Recidivism
Supervision intensity	Pearson Correlation	1	.651**	.520**	.515**	.341**
	Sig. (2-tailed)		.000	.000	.000	.003
	N	73	73	73	73	73
Community support	Pearson Correlation	.651**	1	.618**	.617**	.422**
	Sig. (2-tailed)	.000		.000	.000	.000
	N	73	73	73	73	73
Justice victim-offender mediation and restorative practices	Pearson Correlation	.520**	.618**	1	.608**	.464**
	Sig. (2-tailed)	.000	.000		.000	.000
	N	73	73	73	73	73
Rehabilitation Programs	Pearson Correlation	.515**	.617**	.608**	1	.491**
	Sig. (2-tailed)	.000	.000	.000		.000
	N	73	73	73	73	73
Management of Recidivism	Pearson Correlation	.341**	.422**	.464**	.491**	1
	Sig. (2-tailed)	.003	.000	.000	.000	
	N	73	73	73	73	73

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

Source: Researcher (2025)

The correlation analysis revealed that all probation program components had positive and statistically significant relationships with the management of recidivism in Garissa County ($p < .01$). Rehabilitation programs exhibited the strongest relationship with recidivism management ($r = .491$), followed by justice victim-offender mediation and restorative practices ($r = .464$), community support ($r = .422$), and supervision intensity ($r = .341$). These findings indicate that although supervision contributes to reducing reoffending, its effectiveness is enhanced when integrated with rehabilitation, restorative justice, and community-based support. The results are consistent with previous empirical studies and are

supported by the Risk-Need-Responsivity (RNR) model, Social Learning Theory, Strain Theory, and Control Theory, which emphasize that effective offender rehabilitation requires interventions that address criminogenic needs, encourage positive behavioral change, and strengthen social reintegration.

The study further established strong and significant interrelationships among the probation program components. Supervision intensity was positively associated with community support ($r = .651$), restorative practices ($r = .520$), and rehabilitation programs ($r = .515$), while community support showed strong correlations with restorative practices ($r = .618$) and rehabilitation programs ($r = .617$). Restorative practices and rehabilitation programs were also strongly related ($r = .608$), demonstrating that these interventions reinforce one another in promoting offender reform. Overall, the findings suggest that probation programs are most effective when implemented as an integrated system rather than as isolated interventions. The study concludes that a coordinated approach combining supervision, rehabilitation, restorative justice, and community support offers the greatest potential for reducing recidivism and promoting sustainable offender reintegration in Kenya.

Regression Analysis

A multiple linear regression analysis was conducted to examine the influence of supervision intensity, community support, justice victim-offender mediation and restorative practices, and rehabilitation programs on the management of recidivism in Garissa County. The model produced a correlation coefficient of $R = 0.559$, indicating a moderate positive relationship between the combined probation program variables and the management of recidivism. The coefficient of determination ($R^2 = 0.312$) shows that the four predictors jointly explained 31.2% of the variation in the management of recidivism, while the adjusted R^2 of 0.307 demonstrates that the model retained substantial explanatory power after adjusting for the number of predictors. This implies that although probation interventions contribute significantly to recidivism management, approximately 68.8% of the variation is attributable to other factors not included in the model, such as socioeconomic conditions, employment opportunities, institutional capacity, offender characteristics, and family support.

The overall regression model was statistically significant ($F(4,68) = 64.374, p < .001$), confirming that supervision intensity, community support, justice victim-offender mediation and restorative practices, and rehabilitation programs jointly predict the management of recidivism. The significance of the model indicates that the observed relationships are unlikely to have occurred by chance and that probation program components collectively make a meaningful contribution to reducing recidivism in Garissa County.

The coefficient estimates further revealed that all four predictor variables had positive and statistically significant effects on the management of recidivism. Supervision intensity significantly influenced recidivism management ($\beta = 0.166, B = 0.103, t = 3.793, p < .001$), suggesting that enhanced offender monitoring and structured supervision improve compliance with probation conditions and reduce the likelihood of reoffending. Community support also demonstrated a significant positive effect ($\beta = 0.146, B = 0.101, t = 3.222, p = .001$), indicating that strong family involvement, community acceptance, and social support facilitate successful offender reintegration.

Justice victim-offender mediation and restorative practices emerged as the strongest predictor of recidivism management ($\beta = 0.207, B = 0.158, t = 4.917, p < .001$), highlighting the importance of restorative justice approaches in promoting offender accountability, victim participation, reconciliation, and behavioral change. Rehabilitation programs similarly exerted a significant positive influence ($\beta = 0.203, B = 0.136, t = 4.879, p < .001$), demonstrating that counselling, vocational training, educational opportunities, and psychosocial interventions substantially improve offenders' capacity for successful reintegration into society.

Overall, the regression findings indicate that all four probation program components significantly contribute to the management of recidivism in Garissa County. Based on the standardized beta coefficients, justice victim-offender mediation and restorative practices had the greatest influence, followed closely by rehabilitation programs, supervision intensity, and community support. These findings suggest that effective recidivism management requires an integrated probation framework that combines structured supervision, evidence-based rehabilitation, restorative justice mechanisms, and strong community reintegration initiatives. Nevertheless, the moderate explanatory power of the model indicates that additional contextual factors beyond probation interventions continue to influence recidivism outcomes and should be considered in future research and policy interventions.

5. SUMMARY OF FINDINGS

The study established that probation programs significantly influence the management of recidivism in Garissa County. Correlation analysis revealed that supervision intensity, rehabilitation programs, justice victim-offender mediation and restorative practices, and community support were all positively and significantly associated with the management of recidivism. Rehabilitation programs exhibited the strongest correlation ($r = .491$), followed by justice victim-offender mediation and restorative practices ($r = .464$), community support ($r = .422$), and supervision intensity ($r = .341$). Multiple regression analysis further confirmed that all four variables were significant predictors of the management of recidivism. Justice victim-offender mediation and restorative practices emerged as the strongest predictor ($\beta = .207$), followed by rehabilitation programs ($\beta = .203$), supervision intensity ($\beta = .166$), and community support ($\beta = .146$). The regression model was statistically significant ($F(4,68) = 64.374$, $p < .001$) and explained 31.2% of the variation in the management of recidivism ($R^2 = .312$), indicating that probation interventions make a meaningful contribution to reducing reoffending, although other contextual factors also influence recidivism outcomes.

6. CONCLUSION

The study concludes that probation programs play a significant role in the management of recidivism in Garissa County. Effective supervision, rehabilitation programs, justice victim-offender mediation and restorative practices, and community support each contribute positively to reducing reoffending among probationers. Among these interventions, restorative justice practices and rehabilitation programs demonstrated the greatest influence, highlighting the importance of interventions that promote offender accountability, behavioural change, and successful community reintegration. Although the combined probation interventions significantly predicted the management of recidivism, they explained only 31.2% of its variation, suggesting that broader socioeconomic, institutional, and community factors also shape recidivism outcomes. Therefore, strengthening probation services through integrated supervision, evidence-based rehabilitation, restorative justice approaches, and enhanced community participation is essential for improving the effectiveness of recidivism management in Garissa County.

7. RECOMMENDATIONS

The study recommends strengthening probation supervision through continuous training, adequate staffing, and offender-centered approaches that combine monitoring with guidance and behavioral support. Rehabilitation programs should be adequately resourced and expanded to include vocational training, counselling, and life skills to enhance offender reintegration. The study also recommends institutionalizing justice victim-offender mediation and restorative practices through stronger collaboration between probation services, the Judiciary, community leaders, and other stakeholders. In addition, community participation should be strengthened by engaging families, employers, and community-based organizations in offender reintegration while addressing stigma against former offenders. Overall, an integrated approach that combines effective supervision, rehabilitation, restorative justice, and community support should be adopted to improve the management of recidivism in Garissa County.

8. RECOMMENDATION FOR FURTHER RESEARCH

Future research should examine the influence of socioeconomic, cultural, and religious factors on recidivism and offender reintegration. Studies should also evaluate the effectiveness of probation supervision, rehabilitation, and restorative justice practices to identify evidence-based approaches that enhance offender rehabilitation and reduce reoffending.

REFERENCES

- [1] Afifa, Y. N., & Santoso, I. (2022). Proactive risk mitigation strategies and building strategic resilience in the food supply chain: A review. *Food Research*, 6(2), 9–17.
- [2] Amuah, J. (2023). Overcoming corporate disaster by leveraging the proactive power of enterprise risk management. Available at SSRN 4624088.
- [3] Amuah, J. (2023). Overcoming corporate disaster by leveraging the proactive power of enterprise risk management. Available at SSRN 4624088.

- [4] Awan, U., Shamim, S., Khan, Z., Zia, N. U., Shariq, S. M., & Khan, M. N. (2021). Big data analytics capability and decision-making: The role of data-driven insight on circular economy performance. *Technological Forecasting and Social Change*, 168, 120766.
- [5] Bag, S., Dhamija, P., Luthra, S., & Huisingh, D. (2023). How big data analytics can help manufacturing companies strengthen supply chain resilience in the context of the COVID-19 pandemic. *The International Journal of Logistics Management*, 34(4), 1141–1164.
- [6] Balogh, B. (2023). Adapting to change: Resilient management in a dynamic business. *Journal Dimensie Management and Public Sector*, 4(3), 22–28.
- [7] Bahrami, M., & Shokouhyar, S. (2022). The role of big data analytics capabilities in bolstering supply chain resilience and firm performance: A dynamic capability view. *Information Technology & People*, 35(5), 1621–1651.
- [8] Browder, R. E., Dwyer, S. M., & Koch, H. (2024). Upgrading adaptation: How digital transformation promotes organizational resilience. *Strategic Entrepreneurship Journal*, 18(1), 128–164.
- [9] Can Saglam, Y., Yildiz Çankaya, S., & Sezen, B. (2021). Proactive risk mitigation strategies and supply chain risk management performance: An empirical analysis for manufacturing firms in Turkey. *Journal of Manufacturing Technology Management*, 32(6), 1224–1244.
- [10] Can Saglam, Y., Yildiz Çankaya, S., & Sezen, B. (2021). Proactive risk mitigation strategies and supply chain risk management performance: An empirical analysis for manufacturing firms in Turkey. *Journal of Manufacturing Technology Management*, 32(6), 1224–1244.
- [11] Chatterjee, S., & Mariani, M. (2022). Exploring the influence of exploitative and explorative digital transformation on organization flexibility and competitiveness. *IEEE Transactions on Engineering Management*.
- [12] Cheng, D., & Pettigrew, R. N. (2023). Leveraging data-driven decisions: A framework for building intracompany capability for supply chain optimization and resilience. *Supply Chain Management*, 28(6), 1026–1039. <https://doi.org/10.1108/SCM-12-2022-0464>
- [13] Chi, M., Li, W., Li, Y. J., Zhou, M., & Huang, R. (2025). Unraveling the paradoxical effects of digital transformation on organizational resilience: The role of customer and supplier concentrations. *Journal of Business Research*, 191, 115268.
- [14] Ciacci, A., & Penco, L. (2024). Business model innovation: Harnessing big data analytics and digital transformation in hostile environments. *Journal of Small Business and Enterprise Development*, 31(8), 22–46.
- [15] El-Haddadeh, R. (2020). Digital innovation dynamics influence on organisational adoption: The case of cloud computing services. *Information Systems Frontiers*, 22(4), 985–999.
- [16] Gani, M. O., Yoshi, T., & Rahman, M. S. (2023). Optimizing firm's supply chain resilience in data-driven business environment. *Journal of Global Operations and Strategic Sourcing*, 16(2), 258–281. <https://doi.org/10.1108/JGOSS-02-2022-0013>
- [17] He, Z., Huang, H., Choi, H., & Bilgihan, A. (2023). Building organizational resilience with digital transformation. *Journal of Service Management*, 34(1), 147–171.
- [18] Ji, Z., Zhou, T., & Zhang, Q. (2023). The impact of digital transformation on corporate sustainability: Evidence from listed companies in China. *Sustainability*, 15(3), 2117.
- [19] Khan, M. Z. (2024). Building a resilient business: Strategies for risk management. *Center for Management Science Research*, 2(1), 13–26.
- [20] Khurana, I., Dutta, D. K., & Ghura, A. S. (2022). SMEs and digital transformation during a crisis: The emergence of resilience as a second-order dynamic capability in an entrepreneurial ecosystem. *Journal of Business Research*, 150, 623–641.

- [21] Lin, J., Wu, S., & Luo, X. (2025). How does big data analytics capability affect firm performance? Unveiling the role of organisational resilience and environmental dynamism. *European Journal of Information Systems*, 34(3), 502–528.
- [22] Lisdiono, P., Said, J., Yusoff, H., & Hermawan, A. A. (2022). Examining leadership capabilities, risk management practices, and organizational resilience: The case of state-owned enterprises in Indonesia. *Sustainability*, 14(10), 6268.
- [23] Mangalaraj, G., Nerur, S., & Dwivedi, R. (2023). Digital transformation for agility and resilience: An exploratory study. *Journal of Computer Information Systems*, 63(1), 11–23.
- [24] Mohamed, M. A., Chen, T., Su, W., & Jin, T. (2019). Proactive resilience of power systems against natural disasters: A literature review. *IEEE Access*, 7, 163778–163795.
- [25] Nosike, C. J., Ojorbor, O. S. N., & Nosike, C. U. (2024). Enhancing business resilience: Innovation and adaptation during and after the global pandemic. *International Journal of Financial, Accounting, and Management*, 6(2), 217–229.
- [26] Pertheban, T. R., Thurasamy, R., Marimuthu, A., Venkatachalam, K. R., Annamalah, S., Paraman, P., & Hoo, W. C. (2023). The impact of proactive resilience strategies on organizational performance: Role of ambidextrous and dynamic capabilities of SMEs in manufacturing sector. *Sustainability*, 15(16), 12665.
- [27] Putritamara, J. A., Hartono, B., Toiba, H., Utami, H. N., Rahman, M. S., & Masyithoh, D. (2023). Do dynamic capabilities and digital transformation improve business resilience during the COVID-19 pandemic? Insights from beekeeping MSMEs in Indonesia. *Sustainability*, 15(3), 1760.
- [28] Quansah, E., Hartz, D. E., & Salipante, P. (2022). Adaptive practices in SMEs: Leveraging dynamic capabilities for strategic adaptation. *Journal of Small Business and Enterprise Development*, 29(7), 1130–1148.
- [29] Saeed, S., et al. (2023). Digital transformation and cybersecurity challenges for businesses resilience: Issues and recommendations. *Sensors*, 23(15), 666.
- [30] Singh, N. P., & Singh, S. (2019). Building supply chain risk resilience: Role of big data analytics in supply chain disruption mitigation. *Benchmarking: An International Journal*, 26(7), 2318–2342.
- [31] Sinha, R., & Ola, A. (2021). Enhancing business community disaster resilience. A structured literature review of the role of dynamic capabilities. *Continuity & Resilience Review*, 3(2), 132–148.
- [32] Sugureddy, A. R. (n.d.). Proactive data governance: Using AI and ML to anticipate and mitigate risks. *Journal ID*, 9339, 1263.
- [33] Wang, D., & Chen, S. (2022). RETRACTED: Digital transformation and enterprise resilience: Evidence from China. *Sustainability*, 14(21), 14218.
- [34] Xu, M., Zhang, Y., Sun, H., Tang, Y., & Li, J. (2024). How digital transformation enhances corporate innovation performance: The mediating roles of big data capabilities and organizational agility. *Heliyon*, 10(14).
- [35] Yabe, T., Rao, P. S. C., Ukkusuri, S. V., & Cutter, S. L. (2022). Toward data-driven, dynamical complex systems approaches to disaster resilience. *Proceedings of the National Academy of Sciences*, 119(8), e2111997119.
- [36] Yang, Z., Dong, M., Guo, H., & Peng, W. (2025). Empowering resilience through digital transformation intentions: Synergizing knowledge sharing and transformational leadership amid COVID-19. *Journal of Organizational Change Management*, 38(1), 59–81.
- [37] Zhang, J., Long, J., & Von Schaewen, A. M. E. (2021). How does digital transformation improve organizational resilience? Findings from PLS-SEM and fsQCA. *Sustainability*, 13(20), 11487.