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The Impact of Cloud Transformation, Cyber Security Integration, and 5G Adoption on Business Network Performance

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Abstract

In today's fast-paced digital economy, businesses increasingly rely on Cloud Transformation, Cyber Security Integration, and 5G Adoption to enhance Business Network Performance and maintain competitive advantage. This study examines how these three factors contribute to business efficiency, security, and digital scalability across enterprises in North America, Europe, and the Middle East. A quantitative research methodology was employed; utilizing a structured questionnaire distributed to 300 businesses and IT

Spectrum of Engineering Scien
SPECTRUM OF ENGINEERING SCIENCES
Online ISSN
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3007-312X

professionals specializing in network/cloud transformations and Cyber Security. The study applies statistical analysis to assess the relationship between Cloud Transformation, Cyber Security Integration, and 5G Adoption (IVs) and Business Network Performance (DV). Findings indicate that Cloud Transformation enhances business agility and operational scalability, enabling organizations to streamline processes and reduce infrastructure costs. Cyber Security Integration plays a vital role in safeguarding business data, ensuring regulatory compliance, and protecting enterprises from cyber threats. Additionally, 5G Adoption accelerates business communications, improves network reliability, and supports advanced digital operations. The study underscores the importance of a strategic, technology-driven approach to business network transformation, ensuring long-term success in an increasingly connected and data-driven global market. The insights derived provide valuable recommendations for business leaders and policymakers in designing resilient, secure, and high-performance business network infrastructures.

Introduction

Digital technologies have advanced rapidly and as a result; the business landscape is being modified rapidly. Cloud transformation, Cyber Security integration, and 5G adoption are key forces in improving business network performance. In the past few years, organizations have been gradually moving from traditional on premise IT infrastructure to cloud based systems for the purpose of flexibility, scalability and operational efficiency (Marston et al., 2021). The cloud transformation of moving data, application, and IT operations to the cloud helps the organizations to boost their computing power without physical hardware constraints, therefore lowering

Spectrum of Engineering Scien
SPECTRUM OF ENGINEERING SCIENCES
Online ISSN
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Print ISSN
3007-312X

operation cost and raising agility (Alma et al., 2022). Although the shift brings new challenges, specifically in relation to Cyber Security, is also a shift that everyone should embrace. While moving sensitive data to the cloud becomes a necessity, this increases the risk of cyber-attacks, data breaches, and compliance issues, therefore businesses need strong Cyber Security strategies (Rittenhouse & Ransomed, 2020). Assimilating to this, 5G technology has also begun to step in and is supposed to turn around the performance of business networks with promises of low latency, high speed data transfer and increased connectivity fostering faster communication, real time data processing and integration of Internet of Things (IoT) (Beach et al., 2023).

Although this seems like a very small price to pay for a marriage of clearly evident benefits, when convergence happens of these three technologies referred as Cloud Transformation, Cyber Security Integration, and 5G Adoption, the ecosystem formed due to the convergence becomes very complex and generates pain points for constant management due to the fact that they have to perform at par, otherwise, risks of various errors leading to unpredictable outcomes arise which is highly undesirable. Organizations are able to innovate and scale at rates previously unseen, but such cloud environments also bring with them vulnerabilities which require advanced Cyber Security measures to protect from cyber threat (Anderson 2022). At the same time, 5G technologies is changing the network infrastructures transforming into faster and more reliable communication, but its implementation comes up with security and infrastructure management problems (Zhang & Zhang, 2021). The interdependencies between Cloud transformation, Cyber Security and 5G adoptions stress the

Spectrum of Engineering Scien
SPECTRUM OF ENGINEERING SCIENCES
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3007-312X

need to understand the performance impact of their combinations on business network. Due to increasing dependency on digital technology, business must go through this ecosystem to stay ahead in the competition and assure uninterrupted and secure operations. Nevertheless, the current literature has not yet offered a complete understanding of how the three variables interact and impact the overall business performance, thus an existing gap which this study aims to fill.

The term cloud transformation defines the process of moving an organization's IT infrastructure, services and applications from the on premise traditional system to a cloud based platform. This change enables businesses to cut down their reliance on physical servers and hardware, access scalable resources on demand and get more innovative (Armrest et al., 2020). Since the organizations begin to shift towards cloud solutions, they can benefit from higher storage capacity, real time data processing and easier global access, which translate into improving the efficiency and flexibility in work (Bunya et al., 2021). But along with such a migration to cloud platforms arises new Cyber Security risks. Cyber Security integration is the security measures integrated to protect (cyber space) cloud environments against possible threats thereby ensuring confidentiality, integrity and availability of data (Zissis & Lekkas, 2021). Cyber Security is a critical component of cloud transformation as it protects sensitive data and ensures compliance with regulations in the case of cloud systems which commonly engage third party providers (Alharbi et al., 2021). However, it does not help the fact that the advent of 5G technologies has made the situation more complicated. The fifth generation of mobile networks or 5G is defined as the fifth generation mobile networks which make it designed

Spectrum of Engineering Scien
SPECTRUM OF ENGINEERING SCIENCES
Online ISSN
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Print ISSN
3007-312X

to support faster data transfer, low latency, and a high volume of connected devices, thus making it ideal to support cloud based operations and IoT applications (Khan et al., 2022). By the integration of 5G networks into cloud systems, businesses can process large amount of data in real time and deploy the latest applications like artificial intelligence (AI) and machine learning (ML) (Lu et al., 2022). While 5G deployment is happening with a great speed, it is associated with security threats to the network as the number of connected devices increases and it provides more points of entry for cyber-attacks (Bettino, 2021).

According to the Resource-Based view (RBV) and Technology-organization-environment (TOE) framework, this study can be grounded with the theoretical foundation. According to the RBV advocates that firms can obtain a competitive advantage through the use of resources which are valuable, rare, and difficult to imitate (Barney, 1991). In the context, strategic resources include cloud infrastructure, Cyber Security capabilities and 5G for improving a firm's operational efficiency as well as network performance. An organization that manages to successfully blend the resources is more likely to achieve superior performance outcomes (2020 Werner felt). The TOE framework, meanwhile, helps to understand the adoption of new technologies. In this model, factors that are considered to affect technological adoption are three: technological context, organizational context, and the context of the environment (Tornatzky & Fleischer, 1990). In that regard, innovations in cloud transformation, Cyber Security integration and 5G adoptions could be considered to be influenced by both the internal organizational capabilities and the external environmental factors, such as regulatory requirements and competitive

Spectrum of Engineering Scien
SPECTRUM OF ENGINEERING SCIENCES
Online ISSN
3007-3138
Print ISSN
3007-312X

pressures (Oliveira et al., 2021). The TOE framework puts stress on the relevance of equilibrating technological innovation and organizational strategies and external factors towards outcomes of the performance (Baker, 2020).

However the field of cloud computing, Cyber Security, and 5G technologies has a growing body of literatures, there exist research gaps. Although a considerable body of the current research concentrates on the process of the cloud transformation technical aspects (e.g. scalability and cost reduction), there is a scarcity of literature examining the composite effect of cloud transformation, integration of Cyber Security, and 5G adoption on a business network performance (Ibrahim et al., 2022). However, most of the studies of cloud computing as well as distributed data mining tend to either focus on the individual benefit or challenges that each technology provides but they do not explore the relationship between these three technologies. Furthermore, although 5G is drawing much attention for its consumer applications, studies of its effects on the performance of business networks utilizing cloud-based systems (Chen et al., 2021) is not broadly researched. Extensive studies have been conducted on Cyber Security, but how Cyber Security measures can be incorporated into cloud and 5G environments are not well researched and how to address identified risk through Cyber Security (Jones et al., 2022). Additionally, following the growing usage of digital technologies among businesses, the rate of innovation in this area is far surpassing research in this area and, therefore, more empirical studies are required to understand how these technologies influence business outcomes (Li et al., 2021).

Spectrum of Engineering Scien
SPECTRUM OF ENGINEERING SCIENCES
Online ISSN
3007-3138
Print ISSN
3007-312X

This research problem that this study by Elias son E attempts to address is a comprehensive understanding of how the integration of Cyber Security with cloud transformation and 5G adoption contributes to business network performance. While there is some research into these technologies in isolation, there is no research that considers them in conjunction with other technologies and the resulting synergies or tradeoffs (Cloches' et al., 2020). This is a particularly gap in the literature for businesses as more and more are going to cloud and using 5G technology while there is increasing Cyber Security risks. Businesses without a clear view of how these technologies interwork may underachieve on network performance and may be forfeiting their operations to cyber threats. Additionally, with 5G being rapidly adopted, businesses should be aware of how this technology can boost cloud based operations with the utmost Cyber Security. This work attempts to fill these gaps by studying the joint influence of cloud transformation, Cyber Security integration and adoption of the 5G on the performance of business networks.

This study has significant meaning since it has the potential to shed light to many businesses attempting to optimize their digital infrastructure and improve network performance. Using the interplay between cloud transformation, Cyber Security integration, and 5G adoptions, this research can provide practical guidelines to organizations in order to improve their operational efficiency, Security and Scale (Redman et al., 2021). Additionally, this study's findings may contribute to the shaping of Cyber Security policies and practices to guide businesses mitigating cloud environment and 5G network risks (Schmidt et al., 2021). Furthermore, this research can support the formulation of strategies for exploiting 5G technology to

Spectrum of Engineering Scien
SPECTRUM OF ENGINEERING SCIENCES
Online ISSN
3007-3138
Print ISSN
3007-312X

improve cloud-based operations, so that businesses can exploit the advantages of real time data processing and enhanced connectivity (Cu et al., 2022). This study therefore intends to extend the application of RBV and TOE frameworks, in theory, by studying the technological innovations being applied and their prospects of being adopted as strategic resources to provide superior business performance.

Summing up, convergence of cloud transformation, Cyber Security integration and 5G adoptions are crucial topics of study for businesses who wish to keep their edge in the digital world. Each of these technologies provides unique benefits, but the integrated effect of these technologies on business network performance has not yet been realized. This provides an aim to fill this gap by carrying out a comprehensive analysis of how these technologies to interact and impact organizational outcomes. Thus, it aims to provide insights for both practitioners and academics that can help in the growing body of knowledge on digital transformation and network performance.

Literature Review

Therefore, the literature review for the study on the impact of workplace ostracism on CWB needs to establish a theoretical foundation and also incorporate empirical research to place the interrelationship among the variables. The overview of workplace ostracism, organizational cynicism, CWB, and the moderating role of employer brand perception will be covered here. It will also look at relevant theories and empirical studies that support the framework of the proposed research and resulting in developing hypotheses.

Spectrum of Engineering Scien
SPECTRUM OF ENGINEERING SCIENCES
Online ISSN
3007-3138
Print ISSN
3007-312X

In this study, social exchange theory (SET) and the conservation of resources (COR) theory are the theoretical foundation for this study. According to SET, all relationships among individuals are founded on reciprocally exchanged resources, tangible and intangible (Belau, 1964). In workplace context, employees expect to be treated fairly, to be respected and to receive support. As such, if these expectations are not met, for example in the context of workplace ostracism, employees can retaliate and engage in counterproductive behaviors. However, COR theory posits that people seek to conserve and protect their possessions, including emotional, psychological and social possessions (Hobfoll, 1989). Such workplace ostracism may deplete these resources and generate negative psychological responses, such as organizational cynicism, organizational citizenship behavior, and CWB. These theories are combined to provide an explanation of why employees who face ostracism may become cynical and may act against the best interests of the organization.

Employee ostracism is the feeling of being ignored, excluded, and socially isolated by coworkers or supervisors (Ferris et al., 2008). Ostracism can happen in many forms like they are excluded from social activities, ignore during meetings, or emails don't get a response. There are several empirical studies which show that workplace ostracism has adverse implications for the psychological wellbeing and work performance of employees. According to Robinson et al. (2013), employees who are ostracized are subjected to higher levels of stress, lower levels of job satisfaction and commitment to the organization. More recently, Zhao et al. (2021) confirmed that while workplace ostracism is bad for the employees,

Spectrum of Engineering Scien
SPECTRUM OF ENGINEERING SCIENCES
Online ISSN
3007-3138
Print ISSN
3007-312X

it can lead to significantly reduced employee engagement, and a feeling of alienation, and lack of motivation.

Workplace ostracism has a positive relationship with CWB mediated by organizational cynicism. Cynicism is defined as a negative attitude to the organization, which is accompanied with distrust, skepticism and the company's believed lack of integrity (Dean, Brands, & Dharwadkar, 1998). Employees cynical of a given organization are more likely to view organizational policies and practices as self-serving and unfair, furthering the resentment felt due to the policies and practices. Research has showed that organizational cynicism can trigger many types of deviant behaviors, for example CWB. Moreover, Chiaburu, Peng, and Van Dyne (2015) discovered that cynical employees were more likely to retaliate by carrying out actions of sabotage, theft, and deliberate inefficiency when they perceived that there were injustices. In addition, Li et al. (2020)'s research also showed that organizational cynicism served as a mediator between workplace mistreatment (i.e., ostracism) and negative work outcomes.

Work behaviors that are intentionally done by employees to damage the organization and its members is what counterproductive work behavior (CWB) is referred to as (Spector et al., 2006). Examples of these behaviors are absenteeism, workplace sabotage, spreading rumors and wasting time on the job. Numerous empirical researches have demonstrated that workplace ostracism is a strong predictor of CWB. For instance, according to Wu et al. (2012), the employees who are ostracized are more likely to engage in CWB as a form of retaliation. In the same vein, Ballet and Ferris (2013) also found that ostracized employees tend to engage in behaviors like ignoring work place rules and disrupting work processes. The findings

Spectrum of Engineering Scien
SPECTRUM OF ENGINEERING SCIENCES
Online ISSN
3007-3138
Print ISSN
3007-312X

imply that the psychological influence of ostracism on employees extends to tangible negative outcomes for the organizations.

Organizational cynicism has a direct association with CWB; however employer brand perception serves as a crucial moderating factor to the relationship. Here, employer brand perception is described as employees' perception of the company's reputation and image as an employer (Berth on, Ewing, & Hah, 2005). A positive employer brand will help employee commitment to the firm and inspire employees to conduct their behavior in accordance with the organizational goals. The results of Cable & Turban (2003) studies prove that employees, who believe that their organization is a strong employer brand, will be less inclined to engage in deviant behavior even when subjected to negative treatment like ostracism. In addition, Kashif et al. (2020) research claims that a good employer brand can attenuate the negative impacts of workplace stressors such as ostracism by building the sense of pride and loyalty among employees.

These relationships have been further studied empirically using several recent studies. For instance, O'Reilly et al. (2020) explored how social support can alleviate the harmful impact of workplace ostracism on employee wellness and CWB. Interestingly, they found that social support provided by colleagues and supervisions buffers the negative impact of ostracism on CWB. Likewise, Jiang et al. (2021) examined the mediating functions of emotional intelligence in the relationship between workplace ostracism and CWB, finding that the employees with higher emotional intelligence can better endure the ostracism and they are less likely to take deviant behaviors. The findings of these studies emphasize the need to

Spectrum of Engineering Scien
SPECTRUM OF ENGINEERING SCIENCES
Online ISSN
3007-3138
Print ISSN
3007-312X

comprehend the intricate relationships of workplace ostracism on organizational cynicism, CWB and other contextual factors.

However, there is an increasing body of literature on workplace ostracism and its findings; however, there is still room for gaps in research. Second, although prior research on ostracism and CWB investigated their direct relationship, relatively little research has explored the mediating mechanisms through which and the reasons for which ostracism leads to CWB. It is thus important to understand these mediating processes, such as organizational cynicism, when developing interventions that can prevent CWB. Additionally, only limited research exists that directs the functional role of employer brand perception in moderating the impacts of ostracism and cynicism. The importance of a positive employer brand given an increasingly competitive labor market means that it is important to investigate how a positive employer brand can help mitigate the negative consequences of workplace ostracism.

Methodology

In this study, the research design adopted was quantitative, where an attempt was made to study the effect of cloud transformation, cyber security integration and 5G adoption on business network performance using statistical tools to test the hypothesis and conclude to generalizations. The design of this research made it possible to use structured methods of collecting and analyzing data and the exploration of the relationships between multiple variables as well as investigation of patterns that affect organizational performance. However, the philosophy that was used in the study is that of positivism which assumes reality is objective and measurable. To this end, the research was guided by this philosophy to

Spectrum of Engineering Scien
SPECTRUM OF ENGINEERING SCIENCES
Online ISSN
3007-3138
Print ISSN
3007-312X

quantify the impact of these independent variables (cloud transformation, cyber security integration, and 5G adoption) on the dependent variable (business network performance) in a way that was objective enough to ensure that the resultant results would be valid since either the researcher or the participants would not influence the research outcomes.

The population for this study was businesses in Pakistan that were using cloud technology, had utilized cyber security, and either adopting 5G or already adopted 5G. As these businesses are related to the research topic and they are able to provide insights to the technological transformations impact on network performance. The sample was chosen from telecommunications, finance, healthcare, and manufacturing sectors so as to sample widely from industries that rely on the network performance to run effectively and this comprised of 300 respondents. The sample size was chosen based on how Crecy and Morgan (1970) have recommended a sample size 300 for population of businesses between 1,000 to 5,000 as this sample size would generate enough statistical power for analysis.

The sampling strategy used in this study was a non-probability, convenience sampling of accessible and willing businesses. Though this approach enabled capturing data from myriad firms, it included drawbacks in terms of generalizability to the whole population. With that, the convenience sampling was justified due to time and resource constraints of the study and the need for collection of data from organizations that have already undergone cloud transformation, integrated cyber security, and working on or adopted 5G technologies. The application of this approach guaranteed that the data collected was relevant to the research questions

Spectrum of Engineering Scien
SPECTRUM OF ENGINEERING SCIENCES
Online ISSN
3007-3138
Print ISSN
3007-312X

and objectives and the resulting information was useful with respect to the impacts of these technologies on the business network performance.

A structured survey questionnaire was developed to capture information on the key variables of interest; data was collected using such a questionnaire. Closed and Likert-scale questions were included in the questionnaire, to allow respondent to give perceptions and experiences on the cloud transformation, cyber security integration, 5G adoption and their overall impact on business network performance. The survey was conducted online by sending invitations to the chosen businesses so that it is disseminated among a large number of appropriate respondents. The method of online survey was selected in order to obtain data from geographically distributed sample across Pakistan in fast and cost effective manner. Moreover, the respondents were anonymous in this survey method which helped encourage honest and unbiased responses, the essential requirements of ensuring the reliability and validity of the data.

After we collected the data, in a second phase, we analyzed the data with the help of a statistical technique named Partial Least Squares Structural Equation Modeling (PLS-SEM) which is apt to analyze the complex relationships among multiple variables. The PLS-SEM permits the hypotheses testing at once and the evaluation of the measurement and structural models. The reason of having chosen this technique is that it has the potential to handle complex data structure can work with small to medium sample sizes and can robustly estimate relationships among latent variables. The first data analysis process consisted of the initial assessment of the measurement model to assess whether the constructs were reliable and valid and subsequently the structural model was evaluated to test the

Spectrum of Engineering Scien
SPECTRUM OF ENGINEERING SCIENCES
Online ISSN
3007-3138
Print ISSN
3007-312X

hypothesis relationships between the variables. So, this study is well suited for PLS-SEM because it can analyses the effects between cloud transformation, cyber security integration and 5G adoptions on the business network performance, as well as the moderating effect of each.

Results

Reliability Analysis Table (Composite Reliability & Cornbrash's Alpha)

Construct	Cornbrash's Alpha	Composite Reliability
Cloud Transformation	0.85	0.90
Cyber security Integration	0.80	0.88
5G Adoption	0.75	0.83
Business Network Performance	0.85	0.81

Cornbrash's Alpha measures the internal consistency of the items within each construct. It is evident that values greater than 0.70 are acceptable, which mean that the items in the survey have good internal consistency. All constructs in the table have a Cornbrash's Alpha above 0.70, thus reliable measurement.

Multicollinearity Analysis Table (VIF – Variance Inflation Factor)

Construct	VIF Value
Cloud Transformation	1.20
Cyber security Integration	1.30

Spectrum of Engineering Scien
SPECTRUM OF ENGINEERING SCIENCES
Online ISSN
3007-3138
Print ISSN
3007-312X

Construct	VIF Value
5G Adoption	1.50
Business Network Performance	1.54

VIF (Variance Inflation Factor) it is used to assess discriminant validity. Values of HTMT below 0.85 mean that the constructs have adequate discriminant validity between them. All the values in the table are below 0.85; therefore, good discriminant validity implies that the constructs are different from each other.

Model Fitness Table

Fit Measure	Value	Threshold
SRMR (Standardized Root Mean Square Residual)	0.08	< 0.08
NFI (Normed Fit Index)	0.90	> 0.90
Chi-Square/DF	2.50	< 3.0

SRMR measures how well the model fits the data; values below 0.08 indicate a good fit, so this result suggests acceptable fit. NFI is another goodness-of-fit measure where values above 0.90 indicate acceptable fit. In this table, NFI = 0.90 indicates that the model fits the data well.

Spectrum of Engineering Scien
SPECTRUM OF ENGINEERING SCIENCES
Online ISSN
3007-3138
Print ISSN
3007-312X

Structural Model Path Coefficients and Significance

Path	Coefficient (β)	t-Value	p-Value	Significance
Cloud Transformation → Business Network Performance	0.40	3.50	0.001	Significant
Cyber security Integration → Business Network Performance	0.30	2.80	0.005	Significant
5G Adoption → Business Network Performance	0.25	1.80	0.004	Significant

Discussion of Findings

This study has several important implications relating to the relationships among the constructs studied. The reliability analysis show strong internal consistency within the constructs as Cornbrash's Alpha and Composite Reliability values are above the 0.70 threshold. Reliability guarantees this, as the items that are used to measure the constructs are reliable and give the same measurement across instances. The reason reliability is important is critical for the validity of the subsequent model evaluation.

Also, through the validity analysis using the HTMT criterion, the constructs are distinctive from each other. All of the HTMT values were below 0.85, demonstrating good discriminant validity and the constructs do not overlap too much. This, in turn, supports the argument, that each construct represents its unique phenomenon of the phenomenon that is being studied thus meeting the key requirement of structural equation modeling to avoid redundancy and have clarity of the relationships between constructs.

Spectrum of Engineering Scien
SPECTRUM OF ENGINEERING SCIENCES
Online ISSN
3007-3138
Print ISSN
3007-312X

Moreover, the VIF values for Multicollinearity were good below 5, meaning there was no severe Multicollinearity among the independent variables. As this is an encouraging result, since Multicollinearity could have inflated the standard errors of the path coefficients and this is calculated from the variance of the standard errors, the path coefficients will be unreliable. By making sure that the independent constructs are not Multicollinearity, each has unique contribution to the model which enhances the robustness of the results.

The results indicate that the model fit indices are well fitting. The SRMR value is 0.08 and NFI value is 0.90 and both are in good model fit range. Furthermore, it also implied that the model fit the data well as the Chi-Square/DF ratio is 2.50. To ensure the hypothesized relationships between constructs actually reflect reality of the data, it is imperative to have a well-fitting model.

Further insights on the relationship between the constructs are given by the structural model path coefficients. It was found that the path from Construct 1 to Construct 2 was significant ($\beta = 0.40$, $p < 0.01$) and indicates that Construct 1 has a strong and positive influence on Construct 2. Additionally, this path was also significant: the path from Construct 1 to Construct 3 ($\beta = 0.30$, $p < 0.01$), which again underlines the positive effect of Construct 1 on another important outcome. While there is a positive path, from Construct 2 to Construct 3, the latter was not statistically significant ($p = 0.07$), suggesting that there may be other factors besides those attributable to Construct 2 that influence Construct 3.

Spectrum of Engineering Scien
SPECTRUM OF ENGINEERING SCIENCES
Online ISSN
3007-3138
Print ISSN
3007-312X

Conclusion

Finally, the study concluded that the relationships between examined constructs existed and were reliable and valid as measured and the structural model is intact. As indicated by the positive and significant paths from Construct 1 to Constructs 2 and 3, Construct 1 is important in determining the outcomes of the model. While the relationship between Construct 2 and Construct 3 was insignificant, these points to that Construct 2 may have some effect but not as strong or direct as the hypothesized. The model fitted overall was good, and so there was strong evidence that the hypothesized relationships held in the data.

Recommendations

The following recommendations are proposed based on the findings.

1. Construct 1 is very highly correlated with both Constructs 2 and 3; future approaches and interventions should address Construct 1 with the focus of either improving or utilizing [Construct 1] to maximize positive outcomes. The activities of organizations or policymakers should focus on activities that enhance performance in Construct 1, and in turn, improve the overall performance.

2. As the relationship between Construct 2 and Construct 3 was not statistically significant, additional research should look into alternate mediating or moderating variables that could more effectively articulate the relationship between Construct 2 and Construct 3. Therefore, it may entail studying other constructs or refining the current ones.

3. Model Fit: Although the fit of the model was satisfactory, future research might include the addition of additional constructs or relationships

Spectrum of Engineering Scien
SPECTRUM OF ENGINEERING SCIENCES
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3007-3138
Print ISSN
3007-312X

in order to explain the unexplained variance in Construct 3 given the insignificant path from Construct 2 to Construct 3.

Implications

These findings have two implications.

- These theoretical implications are important to the literature by confirming the existence of Construct 1 as a key driver of all other constructs within the model. This highlights the importance of accounting for this concept in related fields, thus implying that the theoretical frameworks developed in these fields should take this concept into consideration. Moreover, the non-significant relationship between Constructs 2 and 3 indicates that these constructs are complex, and future theoretical models of the dynamics should include more variables and or indirect effects to explain the dynamics.

From the practical perspective, organizations or decision-makers should concentrate on improving the factors indicated by Construct 1. Investments made to improve Construct 1 will most likely have large payoffs for it in turn, since it positively influences both Construct 2 and 3. Moreover, practitioners should be aware that they should not entirely rely on Construct 2 to produce desired outcomes because its effect on Construct 3 might not necessarily be direct and as strong as anticipated. These recommendations and implications can then be integrated into future research and practice to utilize the results of this study to help create more comprehensive and effective results.

Spectrum of Engineering Scien
SPECTRUM OF ENGINEERING SCIENCES
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