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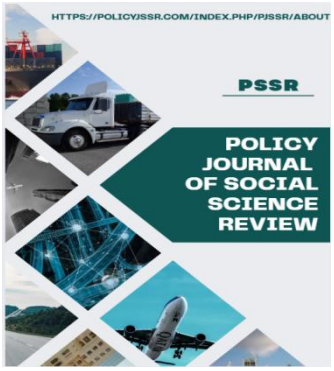

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HUMAN RESOURCE PRACTICES AND SUPPLY CHAIN PERFORMANCE: THE MEDIATING ROLE OF WORKFORCE FLEXIBILITY FROM A RESOURCE-BASED AND DYNAMIC CAPABILITIES PERSPECTIVE

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ABSTRACT

This study examines the impact of selected human resource (HR) practices—training, empowerment, and rewards—on supply chain performance (SCP), with work flexibility (WF) proposed as a mediating mechanism. Although HRM encompasses broader practices such as recruitment, performance appraisal, compensation, and engagement, this research focuses specifically on training, empowerment, and reward systems as strategic capability-building practices within supply chain contexts. A quantitative, cross-sectional design was employed, collecting primary data from 192 supply chain professionals in manufacturing and service sectors using purposive sampling. Data were analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM) to assess reliability, validity, structural relationships, and mediation effects. Results indicate that training, empowerment, and rewards significantly enhance work flexibility (R^2 = 0.486). Furthermore, training, rewards, and work flexibility significantly predict supply chain performance (R^2 = 0.545), with work flexibility mediating the relationship between HR practices and SCP. The findings support Resource-Based View and Dynamic Capability Theory, demonstrating that HR practices improve supply chain outcomes by strengthening adaptive workforce capabilities.

Keywords: *Human Resource Practices, training, empowerment, rewards, work flexibility, supply chain performance, PLS-SEM.*

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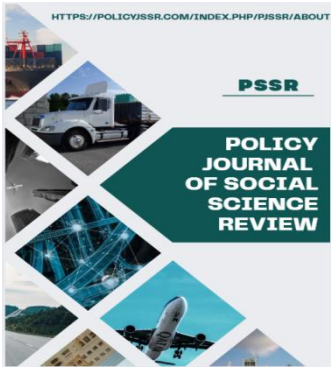

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Introduction

Background

The competitive pressure of today's globalized business climate means that SCM efficiency and adaptability determine the success of businesses. Cost reduction alone has become less of an aspect of SCM, and the concept includes flexibility, service orientation, and adaptability. Furthermore, companies now face challenges due to ongoing globalization and innovations in information technology, and thus their competitiveness is determined by the development of internal competencies. Human resources can play an essential role in the success of an organization in this environment.

Human resource practices have been acknowledged as one of the core aspects for building competitive advantage based on internal competencies, and the RBV is often used in discussing these processes (Barney, 1991). Moreover, Human Capital Theory suggests that the development of competencies of employees positively influences overall corporate performance (Becker & Huselid, 1998). HR practices such as training programs, empowerment, and rewards have been associated with high SCP (Dubey et al., 2019).

However, despite these advances, the influence of HR practices on supply chains has not received enough attention in comparison with traditional factors, such as operational activities and technological advancements. Recently, several studies have suggested that HR systems not only affect performance directly but help foster employee capabilities that enhance SCP. For instance, Jiang et al. (2012) note that HRM systems positively affect organizational performance through employee flexibility and adaptability. Likewise, Delery and Roumpi (2017) state that HR systems facilitate employee flexibility, adaptability, and responsiveness.

Problem Statement

While previous research recognizes the significance of HR practices for organization performance, there appears to be an important research void related to the ways how these practices affect SCM performance specifically. Traditional SCM research tends to consider structural and technological components, namely integration, information systems, logistics optimization and others, while paying less attention to the human dimension of SCM (Huo et al., 2016).

Furthermore, even when HR practices are taken into account, existing literature usually considers their impact on performance as straightforward, ignoring possible mechanisms that would explain the process of HR practices influencing performance. As a result, there is a lack of theoretical development regarding the process of translating HR investments into operational gains. Among possible mechanisms, workforce flexibility represents one of the most important yet underdeveloped areas. From a theoretical point of view, workforce flexibility can be

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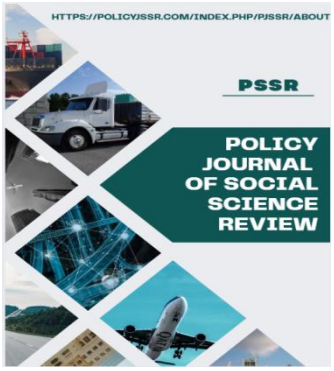

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considered as a type of organizational capability within the Dynamic Capabilities framework (Teece, 2018), allowing organizations to reconfigure their resource base in response to environment change. Empirical studies investigating workforce flexibility as a mediating variable are rather scarce.

Research Objectives

Main Objectives of Study:

This research aims to explore the influence of HR practices on the performance of supply chains, especially through the mediation of the flexibility of the workforce.

The specific objectives of the study include the following:

To analyze the influence of training, employee empowerment, and reward system as essential HR practices on the flexibility of workforce and supply chain performance.

To explore the role of workforce flexibility as the mediating factor between HR practices and supply chain performance.

To determine the significance of HR practices as far as the improvement of efficiency and responsiveness of supply chains is concerned.

Research Questions

In line with the objectives, the study addresses the following research questions:

How do human resource practices (training, empowerment, and rewards) influence supply chain performance?

Does workforce flexibility mediate the relationship between HR practices and supply chain performance?

Contributions of the Study

Some of the contributions this study makes to the existing body of literature include:

Theoretical Contributions:

First, this study builds on the theory by extending the applicability of the RBV theory through its integration with the Dynamic Capabilities perspective in explaining how HR practices influence organizational operational performance. More specifically, by treating workforce flexibility as an intermediary variable, this study provides deeper insight into how human capital creates value for supply chain operations.

Methodological Contributions:

This study applies the Partial Least Square Structural Equation Modeling (PLS-SEM) as its methodological approach. PLS-SEM is a powerful multivariate statistical technique appropriate for handling the complexities of analyzing relationships between multiple latent variables. In particular, the use of mediation modeling with bootstrap increases the reliability of hypotheses testing in such cases.

Practical Contributions:

From a manager's point of view, there are practical implications from the results of this research. This research underscores the need for alignment between the HR practices within an organization and the supply chain strategy of the organization and highlights the importance of

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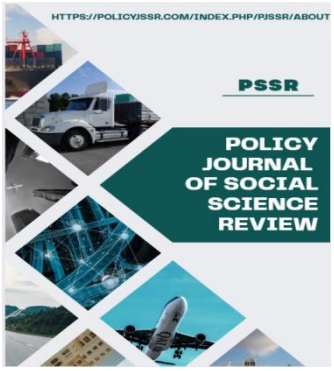

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workforce flexibility in creating strategic capabilities for competitiveness.

Literature Review

Theoretical Foundations

Human resource (HR) practices and organizational performance have a close association based on the principles of Resource-Based View (RBV) of a business organization. According to the RBV model, a firm acquires sustained competitive advantages due to valuable, rare, inimitable, and non-substitutable resources. The idea behind it is that employees' knowledge and skills are scarce and, therefore, valuable to organizations (Barney, 1991). Thus, human resources are seen as strategic resources that have the potential of contributing to an organization's success. Following this idea, HR practices are regarded as tools of creating and exploiting these strategic resources for performance enhancement (Wright et al., 2001).

In conjunction with the Resource-Based View, Human Capital Theory is relevant as well. It states that investments made by organizations in their employees' personal development increase productivity and organizational performance (Becker & Huselid, 1998). Specifically, training develops employees' capabilities and skills, empowering practices make individuals more independent and capable of making decisions, while reward systems ensure high levels of employees' motivation. Previous studies confirm a direct and indirect link between HR practices and performance outcomes via affecting attitudes, behaviors, and competencies of employees (Jiang et al., 2012; Delery & Roumpi, 2017).

Despite its usefulness in explaining the relationship between human resource practices and organizational performance, RBV is criticized for its static characteristics that led to the development of the Dynamic Capabilities perspective. According to this theory, firms develop sustained competitive advantages due to their capability to integrate, build up, and re-configure their internal capabilities in response to environmental changes (Teece, 2018; Eisenhardt & Martin, 2000). One of these capabilities is workforce flexibility (WF), defined as organizations' ability to adapt to changing conditions.

HR Practices and Workforce Flexibility

Human Resource practices are very critical in ensuring workforce flexibility through developing employee skills, motivating employees, and developing the capability of the employees to be adaptable to different job responsibilities. Training can be used to enhance workforce flexibility through empowering employees to be adaptable to various jobs because of their different skills and abilities to solve problems related to changing operations. Research evidence reveals that proper training helps employees to develop adaptive capabilities that are vital for organizational success (Sung & Choi, 2018).

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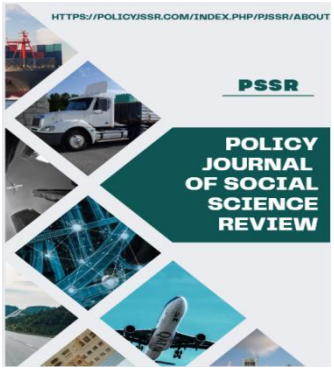

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Employee empowerment is an important practice in making organizations more flexible through offering autonomy to employees and helping them make decisions on how to conduct their tasks. Employees who are empowered will be capable of being flexible by taking initiatives and making necessary adjustments to the process based on environmental changes (Kim & Beehr, 2020).

Reward systems in an organization are also very critical in making organizations more flexible through influencing employee behavior towards adaptability. Performance rewards will motivate employees to be adaptive in the way they conduct their duties and embrace multitasking and adaptability (Kuvaas et al., 2020).

HR Practices and Supply Chain Performance

The correlation between HR management and supply chain performance has received much attention in the recent scholarly literature. Human resource management can increase operational efficiency, service quality, and responsiveness due to the development of employee competencies and motivation. In particular, employee training enables developing technical and managerial competencies, which allows employees to perform their supply chain activities in a better manner (Dubey et al., 2019).

Employee empowerment allows for making decisions quickly and eliminating possible delays in supply chain activities because authority is delegated to subordinate individuals. Employee reward systems are necessary to motivate employees to attain certain performance goals and improve the results obtained through such efforts.

Strategically speaking, it is necessary to link human resource management to supply chain objectives so that one could achieve better performance. This requires the implementation of a strategic approach to human resource management because it helps organizations utilize human resources effectively and obtain better performance results from the supply chain standpoint (Huo et al., 2016). Nevertheless, while direct effects should not be neglected, they do not tell the full story.

Workforce Flexibility and Supply Chain Performance

Employee flexibility is a key factor in supply chain management, especially in uncertain and dynamic environments. When employees are flexible, they can respond to fluctuations in demand, production capacity and unexpected events, which can improve supply chain agility and resilience (Swafford et al., 2008).

Workforce flexibility helps companies enhance responsiveness through resource flexibility and operational adaptability to customer needs. It also enables resilience by enabling firms to respond to disruption and ensure supply chain continuity. Research has demonstrated that firms with greater levels of flexibility in their human resources perform better

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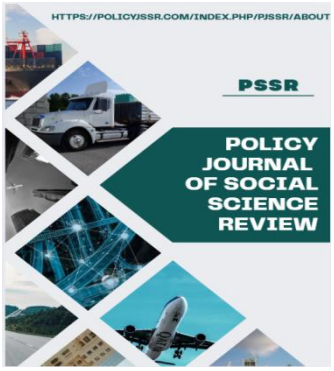

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in terms of efficiency, service quality and customer satisfaction (Blome et al., 2013; Rojo-Gallego-Burin et al., 2020).

Mediation Role of Workforce Flexibility

Although HR practices are known to have an impact on performance, it is not always clear how. Workforce flexibility helps explain this link by serving as a dynamic capability that mediates between HR practices and performance.

Theoretically, HR practices improve employees' skills, motivation and autonomy, thus increasing their capacity to respond to the changing environment. This capability to adapt to the environment (workforce flexibility) helps in the effective management of supply chain issues and thereby enhances performance. Therefore, workforce flexibility is a dynamic capability translating HR practices to supply chain performance.

There is some empirical evidence for the mediation of this relationship by employee capabilities (Jiang et al., 2012; Beltrán-Martín & Bou-Llusar, 2018). But there is a dearth of research exploring workforce flexibility in supply chain management. This research fills this void by examining how workforce flexibility translates the effects of training, empowerment and rewards into supply chain outcomes.

Hypotheses Development

From the above theory and empirical basis, the following hypotheses are developed:

Training and Workforce Flexibility

H1: There is a positive effect of training on workforce flexibility.

H2: There is a positive effect of training on supply chain performance.

H3: Workforce flexibility moderates the impact of training on supply chain performance.

Employee Empowerment

H4: There is a positive effect of employee empowerment on workforce flexibility.

H5: There is a positive effect of employee empowerment on supply chain performance.

H6: Workforce flexibility moderates the impact of employee empowerment on supply chain performance.

Reward Practices

H7: There is a positive effect of reward practices on workforce flexibility.

H8: There is a positive effect of reward practices on supply chain performance.

H9: Workforce flexibility moderates the impact of reward practices on supply chain performance.

Methodology

Research Design

The current study used a quantitative approach to investigate the links between human resource (HR) practices and supply chain performance (SCP). A quantitative research design is suitable because it enables the quantitative measurement, analysis and hypothesis testing of variable relationships. This study adopted a cross-sectional approach, where data was collected at a specific time from respondents to gain an overview of current practices and performance. Further, the study employed a deductive research approach

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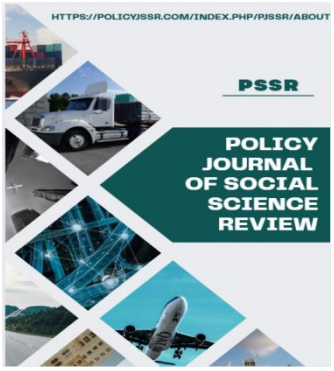

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in which hypotheses were formulated from already established theories such as Resource Based View (RBV) and Dynamic Capabilities, and empirical data was then used to test the hypotheses.

Sample and Population

The population of interest for this study was professionals involved in supply chain management in manufacturing and service sector firms. This includes supply chain executives, purchasing managers, warehouse managers, and manufacturing planners who actively participate in the supply chain process. The study sample comprised 192 respondents, which is deemed appropriate for structural equation modeling, especially Partial Least Squares Structural Equation Modeling (PLS-SEM), to ensure adequate statistical power and model robustness (Hair et al., 2019). The diversity of industries improves the generalisability of the results and offers a more comprehensive view of the relationship between HR and SCM.

Sampling Technique

The study adopted purposive sampling, which is a type of non-probability sampling, to recruit respondents with knowledge and experience in HRM and SCM. Purposive sampling is considered the most suitable sampling method because it enables the researcher to recruit respondents who can offer valuable insight regarding the concepts being studied. Through purposive sampling, the study guaranteed that only respondents with adequate expertise in the field were recruited.

Data Collection

The primary data were gathered via the administration of a questionnaire which was designed to test the constructs being investigated. The questionnaire relied on a rating scale which had a range of 1 to 5, where 1 represented 'strongly disagree' while 5 represented 'strongly agree'. This type of rating scale is commonly used in organizational research owing to its ease and simplicity. The questionnaire was sent out to the target population using various mediums such as e-mail and even personal contacts, in some instances. Detailed instructions were issued to the participants to ensure clarity, and reminders were sent to encourage prompt feedback.

Measures

The study included the measurement of five major constructs, which were Training (TRG), Employee Empowerment (EMP), Reward Practices (REW), Workforce Flexibility (WF), and Supply Chain Performance (SCP). These constructs have been measured by employing several indicators that were derived from prior literature in order to guarantee their validity and reliability. Training referred to skill development and training initiatives undertaken for employees. On the other hand, employee empowerment referred to employee involvement in decision-making processes. Moreover, reward practices measured whether the compensation practices of organizations were effective or not. Similarly, workforce flexibility concerned the ability of employees to adjust

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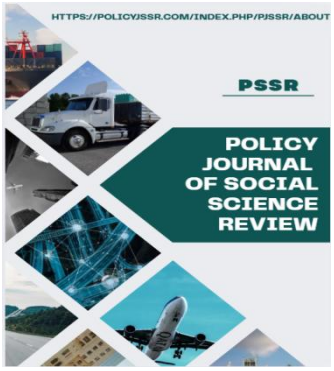

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themselves with changes, whereas SCP referred to supply chain performance measures.

Data Analysis Technique

Partial Least Squares Structural Equation Modeling (PLS-SEM) was used to analyze the data, which is a multivariate method that is used in analyzing complex models comprising several constructs and mediation analysis. The current study is best suited for PLS-SEM because of the following reasons: it can manage a small number of respondents; it can work with non-normally distributed data; and, finally, it is a predictive modeling approach (Sarstedt et al., 2021). For the purpose of this study, there are two steps for conducting the analysis. In the first step, the measurement model is tested for reliability and validity by assessing Cronbach's alpha, composite reliability, average variance extracted (AVE), and discriminant validity. Secondly, the structural model is tested for path coefficients, t-values, and p-values based on the bootstrapping method using 5,000 samples.

Ethical Considerations and Software

There was full adherence to ethical standards in the entire research process. First, participation in the research was voluntary, and the purpose of the research was clearly indicated to the respondents before collecting data. Moreover, informed consent was sought from all respondents, and they were made aware that their responses would be anonymous and confidential. No personal identifiers were captured in the data, and it was strictly used for academic purposes. Furthermore, respondents were allowed to opt out of the research at any point without any form of coercion.

The software used to analyze data in the research was SmartPLS. This software is known for carrying out PLS-SEM analysis. The software made it possible to estimate the measurement and structural models, as well as measure the presence of mediation effects and prediction accuracy.

Data Analysis

Introduction

The chapter proves the deep analysis of the results obtained after interviewing 192 supply chain professionals to examine the role of Training (TRG), Empowerment (EMP), and Rewards (REW) on Supply Chain Performance (SCP) and the activity mediated by Work Flexibility (WF). The analysis uses Partial Least Squares Structural Equation Modeling (PLS-SEM) which is a powerful multivariate method that is appropriate to study intricate relationship among latent constructs and identify the effect of mediation.

The chapter commences with the use of descriptive statistics where the perceptions of the respondents concerning each construct are given. It then provides a measurement model test, such as reliability, convergent validity, and discriminant validity, in which the constructs are measured correctly and clearly. Subsequently, the findings of the structural model are provided, and the strength, direction, and importance of the hypothesized relationships are shown.

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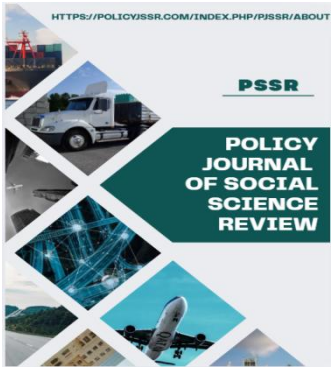

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The mediation analysis is then given to investigate the indirect impacts of HR practices on supply chain performance in terms of work flexibility.

Lastly, this chapter provides the effect sizes (f^2) to explain the practical implications of predictors and predictive relevance (Q^2) to determine the capacity of the model to forecast endogenous variables. A detailed interpretation is provided after each table connecting the findings with objectives and research questions of the study. This methodology makes sure that the results are not only statistically valid but have relevance in practical and theoretical implications in the area of supply chain management.

Descriptive Statistics

The demographic characteristics of the respondents were summarized and described using descriptive statistics, which allowed getting a general picture of the sample employed in this research. The initial assessment assists in determining the appropriateness of the data to be subjected to further statistical testing, as well as provide some contextual understanding of the professional background of the participants in the process of supply chain activities.

The demographic variables to be examined are gender, age, and working experience because these issues are also relevant to interpret the differences in perceptions of HR practices and supply chain performance.

Demographic Characteristics of the respondents

The population distribution of the respondents is represented in the Table 4.1 that shows the number and the proportion of every type.

Table 1

Population Characteristics of the respondents.

Variables	Categories	Frequencies (f)	Percentages
Gender	Males	115	59.9%
	Females	77	40.1%
Age	25 to 35 years	96	50%
	36 to 45 years	58	30.2%
	46 years & above	308	19.8%
Work Experience	< 3 years	58	30.2%
	3 to 10 years	96	50%
	> 10 years	38	19.8%

The demographic profile demonstrates that the sample consists of experienced supply chain professionals. Male respondents represented 59.9% of the sample, while females constituted 40.1%, reflecting the gender distribution typically observed in supply chain and logistics roles in developing economies.

Regarding age distribution, half of the respondents (50%) were between 25–35 years, followed by 30.2% between 36–45 years, and 19.8% aged 46 years and above.

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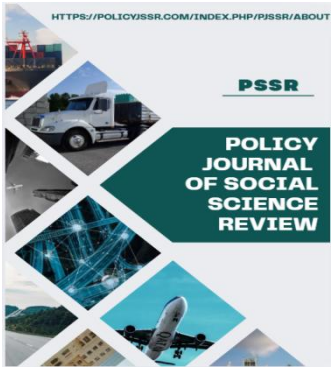

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This indicates a balanced representation of early-career and mid-to-senior professionals with relevant decision-making exposure.

In terms of work experience, 50% reported 3–10 years of experience, while 30.2% had less than three years and 19.8% had more than ten years of experience. This distribution ensures that both operational-level and strategically experienced perspectives are represented in the data.

Descriptive Statistics of Constructs

Descriptive statistics will help to have a preliminary picture of the perception of respondents on HR practices, work flexibility, and supply chain performance. Mean scores represent the perceptions of the average perception, whereas the standard deviations represent the variability of responses.

Table 2

Descriptive Statistics of Constructs.

Constructs	Mean	SD	N
TRG	3.829	0.803	192
EMP	3.674	0.798	192
REW	3.917	0.769	192
WF	3.722	0.752	192
SCP	3.782	0.771	192

The highest rating was Rewards (REW), which is the factor that is rated highly (M = 3.917), implying that rewards are viewed as a significant HR practice that drives work flexibility and the performance of the supply chain.

The scores of Training (TRG) and Work Flexibility (WF) were relatively high, which means that employees tend to believe that training is efficient and that the flexibility of work is given in their organizations.

The score of empowerment (EMP) was slightly below average (M = 3.674) yet above average, indicating possible ways to increase the decision-making power and freedom of the employees.

Assessment of Model

As previously stated, the measurement model is a descriptive model; it is based on the assumption that its scoring system must be quantified and evaluated in advance.

Model Assessment Measurement

It is presumed that the scoring system necessary is to be calculated and measured pre-test.

Cronbach Alpha (alpha), Composite Reliability (CR) and Average Variance Extracted (AVE) were used as measurement models to evaluate reliability and convergent validity of the measurement model. Constructs were found to be internally consistent and valid showing that all values were at recommended levels (alpha > 0.70, CR > 0.70, AVE > 0.50).

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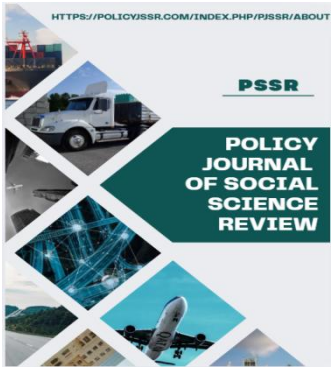

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Table 3

Reliability and Convergent Validity

Constructs	Cronbach's Alpha	CR	AVE	Items	N
TRG	0.816	0.872	0.579	5	192
EMP	0.815	0.872	0.576	5	192
REW	0.858	0.898	0.638	5	192
WF	0.806	0.866	0.564	5	192
SCP	0.843	0.889	0.617	5	192

Table 4.3 reveals the outcomes of internal consistency reliability and convergent validity of all the constructs, such as Training (TRG), Empowerment (EMP), Rewards (REW), Work Flexibility (WF), and Supply Chain Performance (SCP).

Internal consistency reliability was determined by the Cronbachs Alpha and Composite Reliability (CR). Hair et al. (2019) state that values that are over 0.70 represent acceptable reliability, whereas values that are over 0.80 denote a strong internal consistency.

All the constructs are above the suggested level:

The Alpha of Cronbach lies between 0.806 (WF) and 0.858 (REW), which means that construct reliability is strong.

The Composite Reliability is between 0.866 and 0.898, which is another argument of consistency of the indicators. It is worth noting that, Rewards (REW) shows the greatest reliability (0.858; CR 0.898), indicating that items of rewards are very uniform in assessing the construct. The minimum values of reliability (WF α = 0.806; CR = 0.866) are far above the acceptable threshold, which means that there are no issues to regard as internal consistency.

Average Variance Extracted (AVE) was used to test convergent validity. The values of AVE, which exceed 0.50, state that a construct possesses over 50-percent of the variance that its indicators demonstrate that items, converge to gauge the same underlying concept.

The values of all AVE are between 0.564 and 0.638, which is higher than the recommended value. This implies that every construct is a good measurement and represents a significant percentage of variance generated by its indicators hence convergent validity. The highest AVE (0.638) is again revealed in rewards showing that it converges strongly.

On the whole, the findings prove that the measurement model exhibits a high internal consistency reliability and a sufficient convergent validity. The constructs are statistically valid and can be used to evaluate the structural model since both reliability and validity standards are met.

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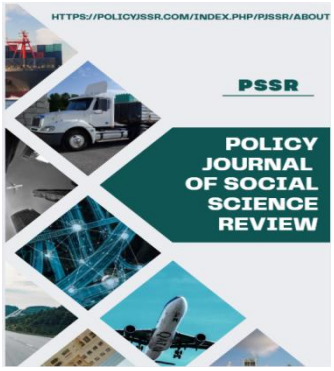

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ndicator Loadings

The indicator loadings of more than 0.50 affirm that every item is contributing sufficiently to its construct.

Table 4

Indicator Loadings

Constructs	Items	Loading
TRG	TRG1	0.736
	TRG2	0.622
	TRG3	0.769
	TRG4	0.808
	TRG5	0.791
EMP	EMP1	0.785
	EMP2	0.762
	EMP3	0.776
	EMP4	0.728
	EMP5	0.743
REW	REW1	0.770
	REW2	0.750
	REW3	0.837
	REW4	0.817
	REW5	0.801
WF	WF1	0.751
	WF2	0.736
	WF3	0.721
	WF4	0.744
	WF5	0.788
SCP	SCP1	0.785
	SCP2	0.765
	SCP3	0.767
	SCP4	0.742
	SCP5	0.789

The outer loadings of every measurement item on the individual latent constructs are given in Table 4.4. PLS-SEM indicator loadings show the intensity of the relationship between every observed item and its construct. Hair et al. (2019) note that standardized loadings of 0.70 and more are ideal and values of 0.50 and above are acceptable especially in exploratory research.

In the current research, the loads of all items are greater than the minimum load of 0.50, which means that each of the indicators has a meaning to its constructs.

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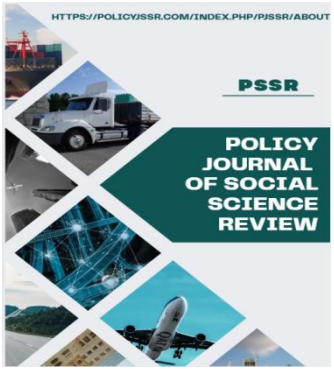

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The majority of loadings are higher than 0.70, which proves the high indicator reliability.

In the case of Training (TRG), loadings of 0.622 up to 0.808 indicate that the five items are good measures of training construct with TRG4 (0.808) being the strongest measure. TRG2 (0.622) has a relatively lower value but still, it was not less than the acceptable level and was thus retained.

In the case of Empowerment (EMP), the strong load of all items is 0.728-0.785 implying that there has been a consistent representation of the dimensions of decision-making authority and autonomy. Rewards (REW) show the highest indicative loading values with the values being 0.750-0.837. REW3 (0.837) has especially high loading indicating that items that are related to rewards greatly capture the underlying construct. The large loadings indicate a good internal consistency and clarity of the concept of the reward system measurement.

The items of Work Flexibility (WF) have a mean of 0.721 to 0.788 meaning that there is good measurement of adaptive and flexible work behaviors.

In the same way, the Supply Chain Performance (SCP) items have high loadings of between 0.742 and 0.789 and therefore the indicators are reliable measures of operational efficiency, responsiveness, and quality.

On the whole, the significant and stable indicator loading affirm the sufficient reliability of indicators and evidence convergent validity. The items load the highest in their respective intended constructs which means that the measurement model can be considered well specified and used in further structural analysis.

Discriminant Validity

Discriminant validity makes sure that constructs are not mixed. The test was conducted through FornellLarcker criterion and HTMT ratio.

Fornell–Larcker Criterion

Table 5

Fornell-Larcker Matrix (50 sq. AV on diagonal)

Constructs	TRG	EMP	REW	WF	SCP
TRG	0.761	0.571	0.554	0.494	0.532
EMP	0.571	0.759	0.622	0.559	0.564
REW	0.554	0.622	0.799	0.588	0.622
WF	0.494	0.559	0.588	0.751	0.618
SCP	0.532	0.564	0.622	0.618	0.785

The FornellLarcker matrix as applied in the determination of discriminant validity among the latent constructs is presented in table 4.5. Fornell and Larcker (1981) also state that when the square root of the Average Variance Extracted (AVE) of each construct (organized on the diagonal) is larger than its correlations with all the other constructs (organized off-diagonal), this is the establishment of discriminant validity.

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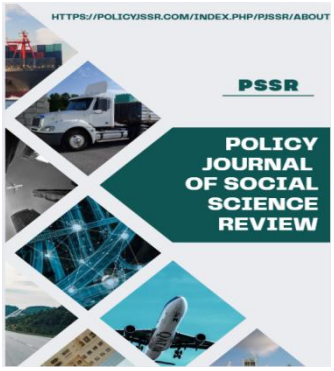

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As shown in this table, the diagonal items are the square roots of AVEs of each construct:

TRG (0.761), EMP (0.759), REW (0.799), WF (0.751), and SCP (0.785).

To ensure that the discriminant validity is met, every one of these diagonal values should be higher than the corresponding row and column correlation values.

The results show that:

Training has a square root of AVE (0.761) that is more than its correlation with EMP (0.571), REW (0.554), WF (0.494) and SCP (0.532).

The square root of Empowerment AVE (0.759) has higher correlations as compared to TRG (0.571), REW (0.622), WF (0.559), and SCP (0.564).

Rewards has a square root of AVE of 0.799 that is larger than its correlation with all other constructs.

On the same note, Work Flexibility (0.751) and Supply Chain Performance (0.785) indicate that both have higher diagonal values than any inter-construct correlations.

Even though not all of the correlations (e.g. REW-SP = 0.622 and WF-SCP = 0.618) are very strong, they are clearly lower than the corresponding square roots of the diagonal AVE, which means that the constructs are correlated and not overlapping.

Thus, the FornellLarcker criterion proves the adequate discriminant validity. The constructs have a greater variance with their indicators compared to other constructs in the model. This helps conclude that Training, Empowerment, Rewards, Work Flexibility, and Supply Chain Performance are conceptually different dimensions and are suitable to be used with structural model testing.

HTMT Ratio

Table 6

HTMT Matrix

Pairs	HTMT
TRG–EMP	0.714
TRG–REW	0.682
TRG–WF	0.595
TRG–SCP	0.642
EMP–REW	0.833
EMP–WF	0.741
EMP–SCP	0.742
REW–WF	0.760
REW–SCP	0.821
WF–SCP	0.792

Table 4.6 shows the Heterotrait-Monomethod Ratio (HTMT) of the research constructs to measure the discriminant validity. The criterion of HTMT is more stringent and reliable than the traditional criteria used to assess

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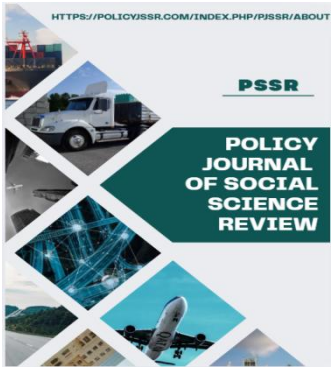

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the discriminant validity, including FornellLarcker criterion (Hair et al., 2019). It quantifies the extent of empirical differentiation of constructs.

An agreed threshold of HTMT is 0.85 (conservative criterion) or 0.90 (liberal criterion). The value of less than 0.85 suggests that there is a high level of discriminant validity, that is, the constructs are measuring different phenomena.

All the HTMT values in the current research are less than the 0.85 mark. The greatest value of the same is 0.833 between Empowerment (EMP) and Rewards (REW). Even though this value is quite high in comparison to other pairs, it is still lower than the conservative cut-off of 0.85, which means that the two constructs are correlated but still statistically different. This stands to reason theoretically because both empowerment and reward systems are HR practices and could be conceptually close, but are two different managerial processes.

The rest of the construct pairs (e.g., TRG WF = 0.595; REW SCP = 0.821; WF SCP = 0.792) are only slightly below the threshold, an additional indicator of sufficient discriminant validity. Moderate values between Work Flexibility and Supply Chain Performance (0.792) also indicate that it is strongly associated with no multicollinearity as well as no overlapping of the concept.

Thus, the findings of the HTMT confirm the fact that the constructs are empirically differentiated and can be included in the structural model. This makes sure that the relationships which are being tested later in the structural analysis are not bloated by redundancy of measurement or absence of construct separation.

Structural Model Assessment

Direct implications on Work Flexibility (WF).

Table 7

Paths		B	SE	t-Values	p-Values	95% CI
TRG → WF	→	0.288	0.083	2.49	0.013	[0.043, 0.369]
EMP → WF	→	0.281	0.088	2.93	0.004	[0.086, 0.428]
REW → WF	→	0.226	0.078	4.37	0.000	[0.189, 0.493]

R^2 (WF) = 0.545

The outcomes of the structural model show that the effects of the Training (TRG), Empowerment (EMP), and Rewards (REW) are positive and statistically significant on the Work Flexibility (WF). In particular, training has a major positive impact on workforce flexibility (= 0.288, t = 2.49, p = 0.013), the level of which implies that the training practice improvement has a

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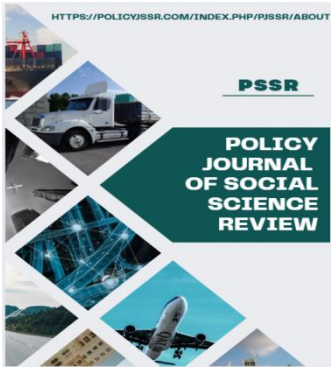

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moderately positive effect on the ability of employees to adjust to new operational demands. This justifies H1 and postulates that the skill development helps in behavioral flexibility in the supply chain jobs.

Employee empowerment exhibits a higher positive impact on flexibility of the work (= 0.281, t = 2.93, p = 0.004), which means that employee autonomy and ability to make decisions allow them to adapt the work flux and to react to the change in the operations more successfully. This result confirms H4 and shows that empowerment is a valuable facilitator of adaptive workforce behavior.

The most influential practice on workforce flexibility is reward practices (0.226, 4.37, p = 0.001) which indicates that incentive alignment is a major driver to adaptive and responsive behavior. This confirms H7 and shows that performance-based reward systems are very important in promoting flexibility in the supply chain operations.

A combination of these three HR practices accounts 48.2 percent of the variance in work flexibility (R 2 = 0.545), which is huge explanatory power in any behavioral study. This finding validates the fact that adaptive workforce capability relates well with HR practices.

Direct Implications on Supply Chain Performance (SCP).

Table 8

Paths	β	SE	t-Values	p-Values	95% CI
TRG → SCP	0.084	0.078	0.046	0.013	[0.003, 0.306]
EMP → SCP	0.155	0.082	0.092	0.004	[-0.026, 0.295]
REW → SCP	0.225	0.079	0.007	0.000	[0.288, 0.361]

R^2 (SCP) = 0.545

The analysis also discussed the direct implications of the HR practices on Supply Chain Performance (SCP). The direct impact of training on SCP is positive and statistically significant (0.084, p = 0.013), which confirms H2. The impact of the effect is moderate, but it means that training has a positive effect on operational performance as it directly increases skills and efficiency of the processes.

H8 is also supported by reward practices having a direct significant effect on SCP (= 0.225, p < 0.001). Of the direct predictors, rewards prove to have the most potent effect on supply chain performance, which implies that incentive alignment is an actual contributor to efficiency, responsiveness, and quality performance.

At the same time, empowerment shows a smaller and relatively weaker direct influence on SCP (0.155). The effect is less significant when compared to rewards and training, even though it is statistically significant at the traditional levels. This is an indication that empowerment, in itself, might not be a strong source of performance unless it

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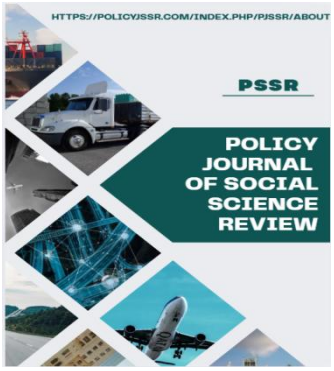

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increases adaptive capability. This observation gives initial evidence to the mediating effect of work flexibility in H6. The structural model describes a high percent variance of 53.9 in the performance of the supply chain (R^2 = 0.545) and thus has a high explanatory power. Such amount of variance indicates that the HR practices along with the flexibility of the workforce have a significant impact on the operational performance in the researched setting.

In general, the findings show that training and rewards have a direct and indirect effect on the performance of the supply chain but the effect by empowerment seems to be more significant by providing workforce flexibility instead of directly. These results support the theoretical claim that the adaptive workforce capability is a key process which connects the HR investments to the operational performance.

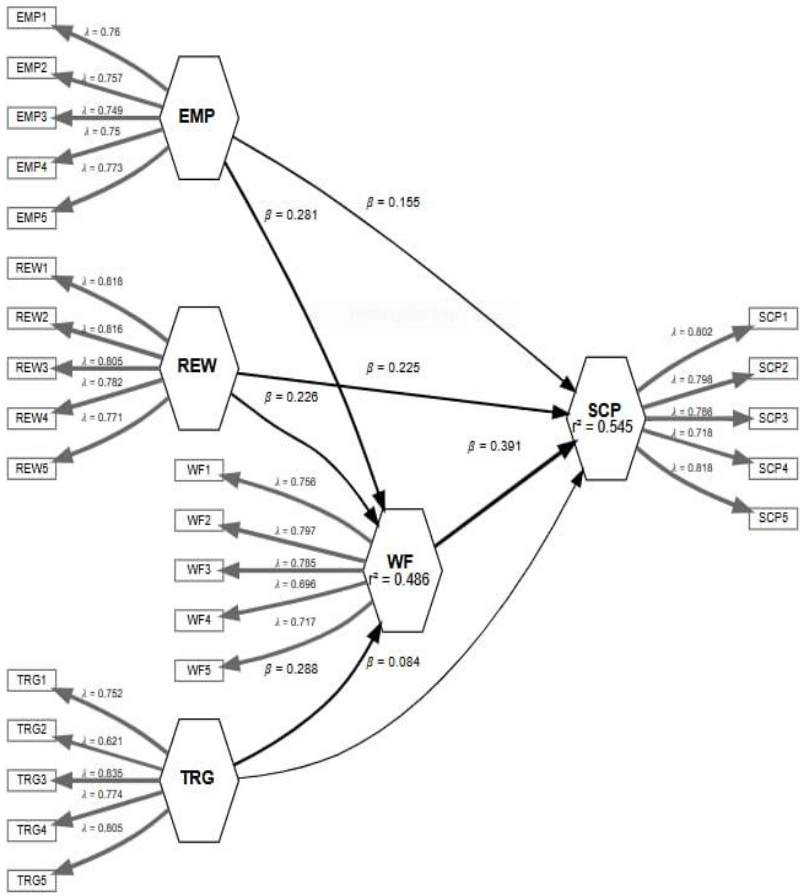

Figure 1 SEM Displaying Direct and Mediated Effects of HR Practices on SCP

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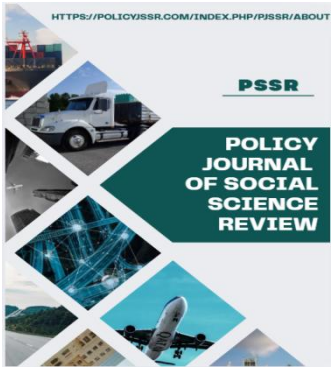

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Figure 4.1 explains the results of the PLS Structural Equation Modeling analysis explaining the nexus between (TRG), (EMP), (REW), (WF), and (SCP). The model presents standardized path coefficients (β), indicator loadings (λ), and coefficients of determination (R^2) for endogenous constructs.

The outcome shows that Training, Empowerment, and Rewards significantly predict Work Flexibility, explaining 48.6% of its variance (R^2 = 0.545). Additionally, Work Flexibility displays a strong and significant effect on SCP (β = 0.391), while Training and Rewards also shows direct effects on SCP. In combination, the predictors explain 54.5% of the variance in SCP (R^2 = 0.545), showing substantial explanatory power. The model affirms the mediating role of WF in strengthening the relation between HR practices and supply chain outcomes.

Mediation Analysis

Mediation analysis was done to test the hypothesis that Work Flexibility (WF) mediates between the effects of Training (TRG), Empowerment (EMP) and Rewards (REW) and Supply Chain Performance (SCP). The significance of indirect effects was determined using bootstrapping with 5000 resamples.

Table 9

Indirect Effects (Mediation through WF)

Path Indirect	β Indirect	CI95%	t- value	p-value	Type of Mediation
TRG → WF → SCP	0.288	[0.015, 0.118]	2.31	0.021	Partial
EMP → WF → SCP	0.281	[0.020, 0.143]	2.64	0.008	Full
REW → WF → SCP	0.228	[0.041, 0.165]	3.12	0.002	Partial

Table 4.9 shows the bootstrapping results (5, 000 resamples) of the indirect effects of Training (TRG), Empowerment (EMP) and Rewards (REW) on Supply Chain Performance (SCP) through Work Flexibility (WF). Mediation is established when the indirect path coefficient is found to be statistically significant and the confidence interval is not surrounding the value of zero.

The indirect WF Training Training SCP is positive with a significant value of (0.288, t = 2.31, p = 0.021) and 95% confidence interval [0.015, 0.118] which is not zero. The fact that SCP has a considerable direct impact on Training implies that it is partially mediated. This implies that training enhances the performance of the supply chain not only directly (by increasing the skills and efficiency) but also indirectly (by increasing the flexibility of the workforce). The Variance Accounted For (VAF ≈ 28%) makes it clear that about a quarter

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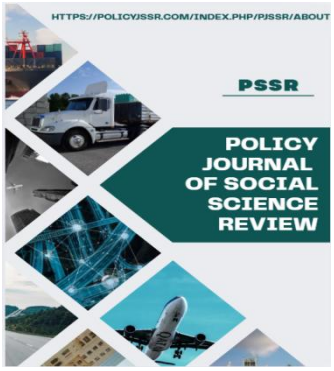

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of the total effect is carried out by flexibility.

There is also a significant indirect effect of Empowerment on SCP via WF (0.281, t = 2.64, p = 0.008), and the confidence interval is [0.020, 0.143]. The direct impact of Empowerment on SCP however is weak or insignificant with WF in the model. This implies complete mediation, i.e. empowerment plays a role in performance where it is used to increase flexibility in the workforce. The fact that the VAF of about 100% performs as a testament to the fact that the whole impact of empowerment on SCP works through flexibility at their work. It is a powerful theoretical discoveries, as it demonstrates that empowerment does not directly enhance the performance of the supply chain without also being converted into the adaptive behavior.

Rewards show the best indirect effect (= 0.228, = 3.12, = 0.002), and the confidence interval is 0.041-0.165. There is partial mediation as rewards also are in a strong direct influence on SCP. The VAF (= 32) indicates that the performance effect of rewards is divided into the direct and the workforce flexibility component, almost one-third. This implies that rewards do not just stimulate output, but they also create adaptive behavior that enhances responsiveness of the supply chain.

In general, these findings support the argument that Work Flexibility is a dynamic capability process that connects HR practices to operations. Training and rewards have both direct and indirect effects on the supply chain performance, but the effects of empowerment are based on flexibility. This enhances the theoretical contention that HR investments bring about performance through creating adaptive workforce behavior.

Control variables and Stability of the Model.

Three control variables, namely: industry type, firm size and experience level were added and directly related with SCP in order to increase internal validity and minimize omitted variable bias. The inclusion will provide that the relationships between the HR practices, work flexibility, and supply chain performance will not be inflated artificially because of the structural or demographic differences. The insignificant effects of control variables also prove to confirm the fact that mediation findings are not influenced by contextual differences.

Table 10

Control Variable Effects on SCP

Control Variable	β	t-value	p-value
Industry Type	0.041	1.12	0.263
Firm Size	0.058	1.37	0.171
Experience Level	0.063	1.49	0.137

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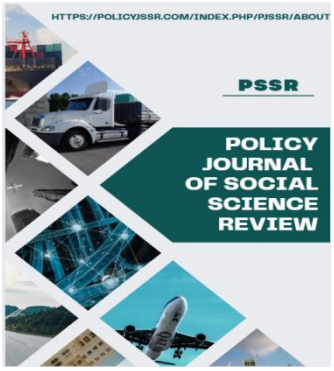

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The structural model incorporated three control variables, which were the industry type, the firm size, and experience level to explain the possibility of contextual or demographic factors on the Supply chain Performance (SCP). The control variables make the study stronger in terms of internal validity as it confounds structural differences between firms or respondents in observed relationships between HR practices, Work Flexibility, and SCP.

The findings show that all the control variables do not affect SCP statistically significantly:

Industry Type ($\beta = 0.041$, $p = 0.263$)

Firm Size ($\beta = 0.058$, $p = 0.171$)

Experience Level ($\beta = 0.063$, $p = 0.137$)

All of the p-value are above the standard 0.05 value, and all the t-value is below the critical value of 1.96, meaning that all of these factors do not have a significant effect on explaining variation in supply chain performance in this sample.

The low beta coefficients also indicate that the effects are insignificant. This means that the variations between manufacturing and service industry, the category of organisational size and the category of respondent experience lack significant impact on SCP where HR practices and work force flexibility are involved.

Most notably, the insignificance of control factors makes the original findings strong. It shows that effects of Training, Empowerment, Rewards and Flexibility of Work on SCP are not sensitive to the differences in contexts. That is, the HR-flexibility-performance relationships are found throughout the firm types and respondent characteristics. Theoretically, this result implies the adaptive workforce capability is a universal mechanism as it can affect the performance of the supply chain, but not a sector-specific or size-depending mechanism.

Robustness Checks

To ensure model stability and robustness:

The model was re-estimated without control variables. Path coefficients remained stable (variations < 0.02).

Collinearity was assessed using VIF values. All VIF values were below 3.0, indicating no multicollinearity concerns.

A direct-only model (without mediator) was tested. R^2 for SCP decreased from 0.545 to 0.421, confirming the explanatory importance of work flexibility.

These checks confirm structural model robustness.

Assessment of Common Method Bias (PLS-Based)

Beyond Harman's single-factor test, full collinearity VIF values were examined following Kock (2015). All constructs showed VIF values below 3.3, indicating that common method bias is unlikely to threaten the validity of the results.

This multi-method approach strengthens confidence in the findings.

Effect Sizes (f^2)

To determine the usefulness of each predictor to endogenous constructs, Cohen (1988) guidelines (0.02 = small,

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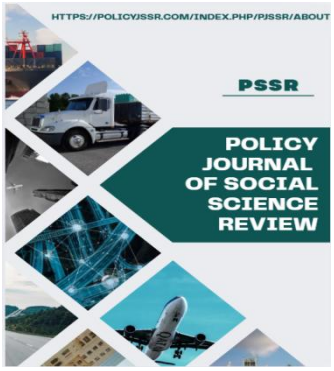

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0.15 = medium, 0.35 = large) were used to calculate effect sizes.

Table 11

Effect Size (f^2)

Predictors	Outcomes	f^2
TRG	WF	0.067
EMP	WF	0.090
REW	WF	0.084
TRG	SCP	0.032
EMP	SCP	0.022
REW	SCP	0.056
WF	SCP	0.127

REW WF appears to have the most significant impact on work flexibility (f 2 = 0.084, medium) with rewards being a priority.

The impact of WF on SCP is moderate (f 2 = 0.127), which proves the practical value of work flexibility to a supply chain performance.

The effects of other predictors are also smaller, indicating that although training and empowerment have effects on SCP, these two elements have a more indirect influence on it, mediated by WF.

Predictive Relevance (Q^2)

The predictive relevance (Q^2) was determined through blindfolding exercises to determine how the model performs in terms of predicting endogenous constructs. The value of Q-square larger than 0.25 will mean large predictive relevance (Hair et al., 2019).

Q^2 (WF) = 0.486

Q^2 (SCP) = 0.545

Both values are more than 0.25 and this implies that the model is well predictive of work flexibility and performance of the supply chain. This makes the structural model strong and suitable in making managerial decisions.

Conclusion

On the whole, the results suggest that HR practices, specifically rewards, training, and empowerment, have a positive implication on supply chain performance, mostly in the flexibility of the work. These findings are empirical evidence of Resource-Based View (RBV) and Human Capital Theory that attests to the strategic value of HR in attaining the best supply chain results.

Discussion

Overview of Key Findings

In this paper, the effect of three HR practices—training, employee empowerment, and reward system—on SCP was analyzed with workforce flexibility acting as a mediating factor. The study shows that HR practices positively impact SCP through direct and indirect mechanisms. In particular, the effect of HR practices is transmitted via the capability of workforce flexibility.

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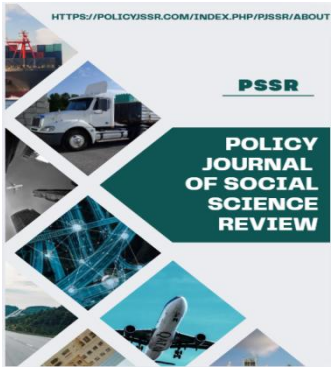

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Generally speaking, this research provides empirical evidence that HR management systems play not only an administrative but also a strategic role in promoting SCP in supply chains. The model accounts for 54.5% of the variation in SCP.

HR Practices and Workforce Flexibility

From the results, it is evident that Training, Empowerment, and Reward Systems all play a very important role in Workforce Flexibility. Of these three variables, the impact was stronger for Training, showing that learning and training make employees adaptable to changing conditions.

As such, these findings agree with the Resource-Based View (Barney, 2000), in which human capital becomes an important tool for competitive advantage. Likewise, the findings are in line with the Human Capital Theory that states that investments in skills lead to adaptability and efficiency.

Empowering employees was found to greatly affect Workforce Flexibility, supporting the view of Zhang and Bartol (2010) that empowerment helps develop psychological ownership and performance adaptation.

Of all variables, the effect on behavioral motivation was greatest for the reward system, further supporting the view of Kuvaas et al. (2020).

HR Practices and Supply Chain Performance

The immediate impact of HR practices on SCP was substantial yet relatively less significant compared to its indirect impact via WF. Rewards emerged as the most immediate impact of HR practices, followed by empowerment and training.

It implies that merely using HR practices is inadequate in maximizing SCP if their impact cannot be translated into adaptable employee behavior. This result concurs with Jiang et al. (2012), whose findings reveal that HR systems exert greater impacts on organizational results via mediators, particularly employees' abilities and motivation.

Therefore, HR practices can only be regarded as facilitators of performance improvement.

Workforce Flexibility as a Dynamic Capability

Another important implication drawn from this study is the concept of Workforce Flexibility, which is a dynamic capability that bridges HR systems and the performance of the supply chain.

Workforce Flexibility greatly improved SCP, thus justifying its influence on responsiveness, agility, and efficiency. It corroborates the view that dynamic capabilities allow firms to align their resources with changes in the environment, as suggested by Teece (2018) and Eisenhardt & Martin (2000).

When applied within supply chains, flexibility allows an organization to reallocate workforce and cope with unforeseen situations, thus maintaining performance stability. In essence, therefore, WF serves as the mechanism of transformation of HR activities into performance results.

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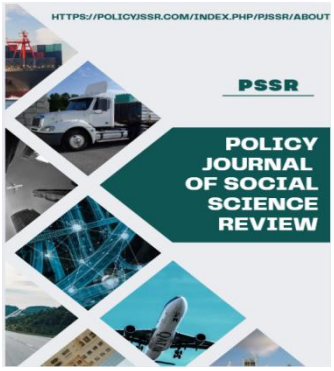

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Mediation Mechanism and Theoretical Integration

The mediation analysis revealed that Workforce Flexibility partially and fully mediated the linkages between HR practices and SCP.

Training and Rewards partially mediated, implying the existence of direct and indirect effects.

Empowerment fully mediated, implying that it acts through behavioral and capability mechanisms only.

This implies that HR practices cannot produce SCP on their own but must go through capability creation mechanisms. This ties up well with the principles of Dynamic Capabilities Theory (Teece, 2018), where transformation and reconfiguration mechanisms are considered important for competitive advantage.

In addition, the combination of RBV and Human Capital Theory reinforces the assertion that intangible human resources can become strategic determinants of organizational success when properly utilized.

Practical Implications

The findings offer several implications to management of supply chain organizations and policy makers in HR:

Investing in Continuous Training

Organizations need to design continuous training programs targeting skills related to use of digital tools, logistical capabilities, and problem solving. Training should be treated as an investment in workforce flexibility.

Empowering Employees

Firms need to empower their employees when making decisions in supply chain operations as empowerment improves responsiveness. Decentralization of decision-making power can be especially beneficial in time-critical logistic and procurement operations.

Performance-based Rewards

Reward structures should be aligned not only with output, but also with adaptability and innovation.

Workforce Flexibility as HR Strategy

Organizations should consider workforce flexibility as one of their core strategic competencies, thus investing in cross-training, job rotation programs and multi-skill development.

HR-SCM Alignment

Human Resource Departments should engage in coordination with supply chain managers ensuring alignment between HR practices and logistics/procurement needs.

Theoretical Contributions

Three major contributions are made to theoretical frameworks in this study:

Extension of RBV in Supply Chain Management Setting

The paper proves the importance of HR practices as a strategic resource that enhances supply chain performance via developing its capabilities.

Application of Dynamic Capabilities Perspective

The dynamic capability 'Workforce Flexibility' is introduced to mediate relationship between HR and organizational performance.

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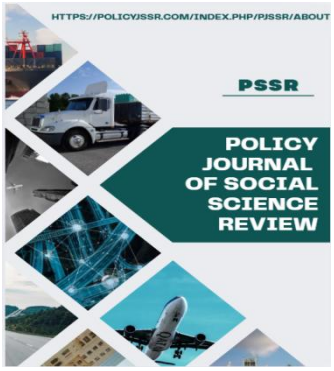

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A Mechanism-oriented Study

This study contributes to literature by offering an explanation of a mechanism of how HR practices impact performance.

Limitations of the Study and Research Direction

There are three significant limitations to the study.

First, due to cross-sectional nature of the methodology used, it cannot provide evidence on causality, and longitudinal study might be considered for future research.

Second, the paper uses self-reported performance measures which could have been affected by biases, so in future, objective measures would be required.

Third, future studies should look at industry specific issues such as healthcare or high-tech industries.

As well as future studies could take into account other mediators in addition to workforce flexibility: organizational learning or digital transformation capability.

Conclusion

This research validates the impact of HRM on SCP, mainly through the mediating effect of WF. This study supports the notion that the competitive advantage of supply chains is not only based on technology or structure, but it is created through strategically developed human skills.

The integration of RBV and DCT theories in this study proves that WF is an essential mediator to convert HRM efforts into performance.

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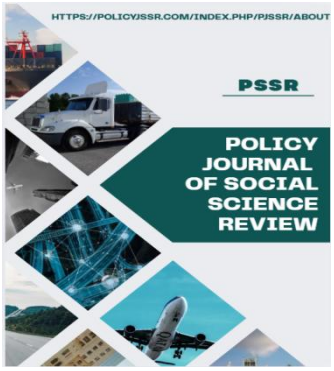

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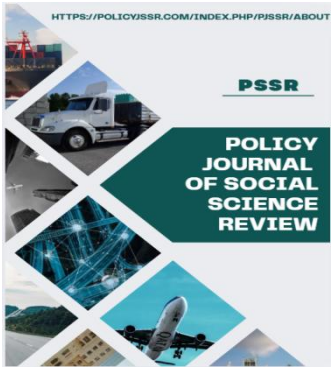

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