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ORIGINAL RESEARCH ARTICLE

Integrating human resource management and logistics coordination to enhance Malaysian flood response

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Abstract: Flood disasters in Malaysia pose recurring challenges to humanitarian operations, necessitating stronger internal capabilities within responding organizations. While prior studies have acknowledged the individual roles of human resource management (HRM) and logistics coordination in disaster response, there is limited empirical research examining their combined impact on humanitarian operations performance (HOP), particularly within Southeast Asian contexts. This study addresses that gap by evaluating the dual and synergistic effects of HRM and logistics coordination on HOP among humanitarian organizations operating in Malaysia. The present study employed a quantitative approach using the partial least squares structural equation modeling, which was selected for its strength in modeling latent variables and managing complex, non-normally distributed data. A structured questionnaire was distributed to personnel involved in disaster response across the Malaysian Civil Defence Force (APM) and non-governmental organizations (NGOs) in Malaysia, resulting in 29.7% valid responses. The respondents, identified through the National Disaster Management Agency database, had substantial field experience in flood-related humanitarian missions. Findings revealed that both HRM and logistics coordination significantly and positively influence HOP, with HRM having a greater effect. This underscores the importance of integrating strategic human capital development and synchronized logistics systems in disaster response planning. The study's novelty lies in its empirical validation of these internal mechanisms within a unified model specific to flood disasters in Malaysia. The results provide practical insights for policymakers and humanitarian leaders, while also contributing to sustainable development goals 9, 16, and 17 by promoting resilient infrastructure, effective institutions, and inter-organizational collaboration.

Keywords: Sustainable development goals; Human resource management; Logistics coordination; Humanitarian operations; Flood disaster management; Malaysia

1. Introduction

Floods are the most common and destructive natural disasters in Malaysia, causing plenty of social and economic problems that render humanitarian work challenging. The occurrences of floods have become more frequent in the past several years, coupled with increasing severity, especially in places, such as Kelantan, Pahang, and Johor. This is due to climate changes and the rapid expansion of cities. Humanitarian activities are only effective during disasters if the organization has the right internal capabilities, such as logistical coordination and human resource management (HRM). Given the complexity of humanitarian operations, it is critical to understand how integrating HRM and LC activities of expertise can

improve the performance of an organization, especially in the event of floods.

Managing people is an important part of streamlining organizational work in disaster response. In humanitarian contexts, where ambiguities abound and resources are limited, HRM activities, such as hiring, training, performance evaluation, and talent retention have a direct effect on the readiness and flexibility of an organization.[1] The implementation of strategic HRM ensures that humanitarian workers are equipped with the skills and mental toughness to work in stressful situations. In flood crisis situations, having well-trained people who can respond quickly and adaptively is key to the smoothness of relief activities.

It is widely known for many years that coordinating logistics is a key part of successful disaster relief efforts. Well-performing logistics make sure that important resources, such as food, water, shelter, and medical help are delivered to places where they are urgently needed. However, the logistical environment in humanitarian circumstances is often unpredictable because of broken infrastructure and restricted access to real-time information.[2] Research has shown that cooperation between supply chain actors made possible by shared information systems and standardized operational frameworks greatly shortens response times and makes better use of resources.[3]

Despite clear evidence supporting the individual contributions of HRM and logistics coordination to disaster response, limited research has investigated their combined impact on the overall performance of humanitarian operations. Recent studies suggested that organizations that align HRM practices with logistics strategies achieve improved synchronization and responsiveness during crisis events.[4] Such integration enables more coherent operations, especially in flood disasters where coordination between human capital and resource delivery systems is essential for timely and targeted intervention.

The National Security Council Directive No. 20 is the main rule that governs Malaysia's disaster response system. This directive stipulates that federal, state, and local agencies must work closely together during catastrophes.[5] This order gives a strong institutional basis, but the practical implementation of a coordinated humanitarian response is sometimes hampered by bureaucratic inefficiencies, inconsistent training, and broken communication lines. These problems underscore the importance of altering internal processes within the humanitarian organizations, especially in HRM and logistics coordination, to ensure their adherence to the national disaster management rules and optimal response during flood events.

A comprehensive review of existing literature uncovers four notable gaps in the research. First, there is an absence of context-specific investigations exploring the dual function of HRM and logistics within Malaysian humanitarian organizations. Second, present research primarily examines these areas separately, thereby overlooking the possible interplay between them. Third, a methodological gap exists, as limited studies utilize strong empirical tools, such as partial least squares structural equation modeling (PLS-SEM) to assess the relationships among operational variables. Ultimately, issues regarding external validity remain, since the majority of models have not undergone testing in various organizational types or diverse disaster contexts, hampering their ability to generalize findings. Wang *et al.*[6] conducted a structured literature study on logistics and supply chain management research, whereby their implementation remains limited, even if PLS-SEM has been used more recently. The PLS-SEM found use in relational analysis of most research, particularly in humanitarian environments, without including more general operational concepts, such as HRM. This draws attention to an ongoing discrepancy in empirical modeling of interdependent domains, including logistics and HRM. In a 2024 paper, Sarstedt *et al.*[7] underlined the development of methods based on the PLS-SEM framework, such as importance-performance map analysis (IPMA), which shows great strength in analyzing after-sales support systems in commercial environments. Reflecting a methodological barrier in cross-sector relevance, the study did not, however, include HRM constructions or apply humanitarian logistics.[7]

With structural validity and predictive relevance, Cheah *et al.*[8] used PLS-SEM to examine the role played by logistics service providers in supply chain triads. Nevertheless, the study chose to remove HRM elements, thus highlighting a trend whereby logistics studies fail to consider human capital-related factors in their models. In information systems research, Chinnaraju[9] urged better reporting and more general PLS-SEM application. Although its methodological sophistication is acknowledged, it has been noted that humanitarian operations research has not yet widely embraced these techniques, particularly in models combining HRM and logistics. The author also argued for the use of PLS-SEM in newly developing sectors, such as artificial intelligence-augmented corporate research. Despite the emphasis on its suitability in latent variable modeling

for complex, multidimensional frameworks, no use cases combining HRM and logistics inside humanitarian organizations have been found, thus underlining the need of research in this field.

Given these identified gaps, it is evident that a more integrated and empirically robust approach is needed to better understand the dynamics at play within humanitarian operations. Addressing the lack of context-specific research, the limited exploration of interdependencies between HRM and logistics, and the methodological shortcomings in previous studies, this study seeks to bridge these voids by focusing on a critical and recurrent challenge – flood disasters in Malaysia. Therefore, this study aims to examine how HRM and logistics coordination influence the effectiveness of humanitarian operations in response to flood disasters in Malaysia by investigating the individual and combined effects of HRM practices and logistics integration on operational outcomes in humanitarian organizations. The study concentrates on flood-related disasters to elucidate the operational challenges specific to Malaysia's disaster landscape, aiming to provide practical insights that align with the National Security Council Directive No. 20 of the country. The study employs PLS-SEM to create and empirically validate a conceptual framework that illustrates the interplay among HRM, logistics coordination, and humanitarian performance. This analysis aims to provide strategic recommendations designed to enhance institutional capabilities and facilitate the attainment of Sustainable Development Goals (SDGs) 9, 16, and 17.

2. Materials and methods

Quantitative methods were utilized within a positivist research framework, emphasizing objectivity, empirical validation, and the testing of causal relationships through observable data, to examine the causal relationships between HRM constructs and logistics coordination, as well as their effects on the performance of humanitarian operations. Techniques, such as PLS-SEM were used to statistically assess theoretical constructs without involving interpretation or researcher subjectivity. Qualitative elements, such as interviews, thematic analysis, or participant narratives, which are typical of interpretivist or constructivist approaches, were not included. Instead, measurable indicators, standardized instruments, and hypothesis testing were employed in this study to ensure its alignment with the principles of positivism. This methodological approach enables the objective evaluation of theory through observable data.[10] The PLS method of SEM was chosen as the primary analytical technique because of its effectiveness in managing complex models, accommodating small to medium sample sizes, and addressing non-normal data distributions.[11] This study aimed to examine and validate the theoretical relationships between the independent variables (human resource and logistics coordination) and the dependent variable (humanitarian operations performance [HOP]).

2.1. Questionnaires development

A structured questionnaire was created using established literature to guarantee content validity and clarity of constructs.[12] Responses were evaluated using a five-point Likert scale, with options from "strongly disagree" to "strongly agree." Before full deployment, the instrument was subjected to a pilot test to identify issues concerning clarity and reliability. The completed survey was disseminated directly to staff at the headquarters of the Malaysian Civil Defence Force (APM) and several non-governmental organizations (NGOs) throughout Malaysia. A cross-sectional research design was employed for data collection at specific time points, which is effective for the identification of existing trends and patterns.[13] A total of 593 usable responses were collected from 2000 distributed questionnaires between February and May 2019, exceeding the minimum sample requirement determined by G*Power 3.0.[14] The study does not involve subjective or experiential knowledge in the interpretative sense. Although the data were collected through self-reported questionnaires using Likert scales, the responses were treated as quantifiable inputs for statistical analysis rather than narratives of personal experience. The constructs were derived from established literature and standardized to ensure consistency, objectivity, and reliability. There was no exploration of participants' individual perspectives, emotions, or meaning-making processes. Any potential subjectivity in responses was controlled through rigorous validation procedures, such as pilot testing, reliability checks, and structural modeling, reinforcing the study's commitment to a positivist, non-interpretive approach.

2.2. Sample and data collection

This study's unit of analysis was the individual participating in disaster response and affiliated with humanitarian organizations in Malaysia. The sampling frame was created using a database from the National Disaster Management Agency (NADMA), with 3,732 individuals registered as directly engaged in

humanitarian operations during previous national disasters identified. The verification of NADMA contacts as legitimate flood responders began with the extraction of a list of 3,732 individuals from the NADMA's operational database. This list comprised personnel registered as having participated in humanitarian operations during past national disasters. To ensure the accuracy of the sampling frame, the list was cross-referenced with official deployment records, including duty rosters, incident reports, and operational logs from specific flood events. This step was critical to confirm each individual's active involvement in flood response rather than in other types of disasters.[15] Such triangulation methods have been widely recommended in disaster management research for ensuring data validity and reliability.[16]

Further verification was conducted through direct consultation with regional NADMA offices. Regional coordinators played a key role in validating the roles and responsibilities of personnel during specific flood events. This included confirming names, locations, duration of deployment, and specific tasks performed. In cases where documentation was incomplete, verbal confirmation and supplementary materials from regional records were used. Moreover, to strengthen the validity of the list, external verification was sought through collaborating agencies, such as the APM and the Fire and Rescue Department (BOMBA), which often operate alongside NADMA during flood crises.[17] These multi-agency consultations helped to eliminate individuals whose disaster involvement did not pertain to floods.

The final stage involved cleaning the data to exclude non-flood responders and ensure that only individuals with direct flood-related experience remained in the sampling frame. This process was aligned with best practices in disaster research, emphasizing specificity in respondent selection to ensure accurate analysis and policy recommendations.[18] The resulting list, having undergone thorough cross-verification and validation, was then approved for use in subsequent research or operational planning. By employing a robust verification approach supported by practices documented in the literature, the study ensured a credible and focused representation of flood responders.

In addition, a non-probabilistic sampling strategy was utilized to facilitate accessibility and participation, enabling researchers to efficiently target respondents from diverse organizations. This method aligns with previous studies indicating that access and logistical challenges restrict the application of probabilistic sampling in field-based humanitarian research.[10,19] The minimum sample size necessary for multivariate analysis was determined using G*Power 3.0 software.[14] The established parameters comprised two predictors, a power level of 95%, an effect size of 15%, and a statistical significance threshold of 5%, collectively indicating a minimum required sample size of 129 respondents. Data were collected from government agencies, specifically the APM, and NGO offices nationwide to ensure comprehensive national coverage. A cross-sectional design was employed to gather responses within a single timeframe, ensuring consistency in data conditions.[13] The data collection process lasted 4 months, from February to May 2019. Two thousand printed questionnaires were distributed to identified respondents at the headquarters of the participating humanitarian organizations. A reminder was sent 1 month after the initial distribution to enhance the response rate. A total of 593 completed questionnaires were considered valid for analysis, surpassing the minimum sample size required by G*Power 3.0, thereby providing robust statistical power for further analyses. A total of 86.2% of the respondents were associated to government agencies, while 12.8% were connected to NGOs. The structural dominance of the public sector in Malaysia's disaster management system helps to mostly explain the disproportionate presence of government entities (86.2%) compared to NGOs (12.8%) in the respondent pool. Under a centralized disaster governance system, Malaysia's NADMA arranges official channels, including the Royal Malaysian Police, BOMBA, Armed Forces, and APM, to coordinate the flood disaster response.[18] These government players are constitutionally obligated and methodically mobilized during national catastrophes, particularly floods, which often impact low-lying and coastal areas. On official planning and implementation, NGOs active and vital during humanitarian crises are sometimes viewed as supplemental players rather than fundamental stakeholders.[17] NGOs, especially smaller community-based ones, often lack consistent inclusion in such databases unless they are involved in formal memoranda of understanding or registered under collaborative frameworks.[20] In addition, the educational background indicates that the majority of individuals possess the Sijil Pelajaran Malaysia certificate (42.2%), followed by diploma holders (39%), bachelor's degree holders (16.7%), master's degree holders (1.2%), and PhD holders (1%). Volunteers represented the largest segment of occupational roles at 44.7%, followed by administrative staff at 22.3%, clerical workers at 17%, supervisors/executives at 8.1%, managers at 4.1%,

and professionals at 3.9%. Respondents possessed an average of 15 years of experience in humanitarian missions, reflecting substantial field expertise that enhances the validity and depth of the collected data.[19]

2.3. Data analysis

The analysis of quantitative data was conducted utilizing SmartPLS version 3.2.8, which is recognized as a premier software for PLS-SEM.[21] PLS-SEM was chosen for its capability to estimate intricate models involving latent constructs and its appropriateness for exploratory research that deals with non-normal data distributions.[11] The process consisted of two phases: the measurement model and the structural model. The measurement model evaluated the reliability and validity of the constructs by employing criteria, including composite reliability, average variance extracted (AVE), and discriminant validity. The structural model was subsequently employed to assess path coefficients (β) and examine the significance of proposed relationships through bootstrapping with 5,000 resamples. The use of bootstrapping thus provided additional evidence supporting the reliability of the structural paths in the model. This statistical method facilitated the evaluation of both direct and indirect impacts of HRM and logistics coordination on the performance of humanitarian operations, yielding strong evidence for the proposed causal relationships. To enhance the robustness of the structural model analysis, bootstrap confidence intervals (CIs) were computed using 5,000 resamples. The 95% bias-corrected CIs for the path from Human Resource to HOP ranged from 0.371 to 0.567, while the CI for the path from Logistics Coordination to HOP ranged from 0.289 to 0.491. In both cases, the CIs do not include zero, confirming the statistical significance of the relationships. To evaluate the presence of multicollinearity among the predictor constructs, variance inflation factors (VIFs) were calculated. The VIF for Human Resource was 2.112 and for Logistics Coordination was 2.004, both well below the conservative threshold of 3.3. These results suggest that multicollinearity is not a concern in this model, and the predictor constructs maintain acceptable levels of independence. Ensuring low multicollinearity is crucial for interpreting the path coefficients (β) reliably, as high multicollinearity can inflate standard errors and distort the significance of estimated effects. Therefore, the low VIF values support the validity of the model's structure and the integrity of its conclusions regarding the influence of HRM and logistics coordination on humanitarian performance.

3. Results

The assessment of the measurement model shown in Table 1 illustrates the reliability and validity of the constructs employed in examining the relationship among HRM, logistics coordination, and the performance of humanitarian operations. Composite reliability (CR) and Cronbach's alpha (α) are widely used reliability indicators in SEM to assess the internal consistency of constructs. CR is considered more accurate than α in SEM, especially when using PLS, because it accounts for the actual factor loadings of items rather than assuming equal loadings as α does.[11] On the other hand, α estimates reliability by calculating the average inter-item correlation and the number of items. Both α and CR are employed to ascertain the degree to which indicators accurately represent the latent variable they are designed to quantify. All constructs – HOP, Human Resource, and Logistics Coordination – surpass the widely recognized benchmark for CR (CR > 0.7), demonstrating CR values of 0.948, 0.935, and 0.928, respectively. The elevated CR values suggest that the constructs reliably reflect the underlying latent variables, in accordance with the guidance provided by Fornell and Larcker[22] regarding CR in SEM. Furthermore, the α values for all constructs exceed the acceptable threshold of 0.7, thereby reinforcing the internal consistency reliability.[23]

The AVE values for all three constructs demonstrate convergent validity, as they are all within the acceptable range (AVE > 0.5). Specifically, the values are 0.568 for HOP, 0.589 for Human Resource, and 0.588 for Logistics Coordination. The findings indicate that over 50% of the variance in the observed indicators is accounted for

Table 1. Results of the assessment of the measurement model for constructs

Construct	Number of items	Minimum factor loading	AVE	CR	α
Humanitarian Operations Performance	14	≤0.700	0.568	0.948	0.941
Human Resource	11	≤0.716	0.589	0.935	0.922
Logistics Coordination	14	≤0.723	0.588	0.928	0.912

Abbreviations: AVE: Average variance extracted; CR: Composite reliability; α: Cronbach's alpha.

by the latent constructs, showing sufficient convergent validity.[23] The minimum factor loadings, while all ≤0.723, indicate adequate individual item reliability, as factor loadings exceeding 0.7 are typically regarded as acceptable in confirmatory factor analysis. The findings confirm the robustness of the measurement model employed in this investigation.

The findings confirm that the measurement model demonstrates robustness and reliability, thereby endorsing its application in the subsequent structural model analysis. The robustness of the construct measurements enables a confident exploration of the structural relationships among the variables, particularly, the impact of HRM and logistics coordination on the performance of humanitarian operations. Considering the significance of these elements in disaster management scenarios, especially in areas, such as Malaysia, where operational effectiveness is vital, the confirmed constructs provide a robust basis for strategic and policy-oriented insights.[2]

The findings illustrated in Table 2 indicate the discriminant validity of the constructs employed in the study of Human Resource, HOP, and Logistics Coordination, adhering to the criterion set by Fornell and Larcker.[22] Discriminant validity evaluates the degree to which constructs intended to be separate are indeed differentiated within the model. This method stipulates that the square root of the AVE for each construct must exceed its highest correlation with any other construct. This study presents the diagonal elements (bolded and underlined) as the square roots of AVE: 0.799 for Human Resource, 0.765 for HOP, and 0.767 for Logistics Coordination. The values presented surpass the corresponding inter-construct correlations, thereby affirming adequate discriminant validity.

Table 2. Discriminant validity of constructs based on AVE square roots and inter-construct correlations

Items	(1)	(2)	(3)
Human Resource (1)	**0.799**		
Humanitarian Operations Performance (2)	0.768	**0.765**	
Logistics Coordination (3)	0.780	0.754	**0.767**

Note: Values on the diagonal (in bold) represent the square roots of the AVE for each construct. Off-diagonal values indicate bivariate correlations between constructs. Discriminant validity is established when each construct's AVE square root is greater than its correlations with other constructs.
Abbreviation: AVE: Average variance extracted.

The off-diagonal elements reflect the bivariate correlations between constructs, showing relatively high values that remain below the square roots of AVE. The correlation between Human Resource and Logistics Coordination stands at 0.780, which is below their respective AVE square roots of 0.799 and 0.767. The correlation between HOP and Logistics Coordination stands at 0.754, which is also below the diagonal values of both constructs. The findings indicate that while the constructs are interconnected, as anticipated within the framework of integrated humanitarian operations, they assess conceptually different dimensions of organizational effectiveness. This reinforces the integrity of the structural model and substantiates the theoretical premise that HRM and logistics coordination serve as distinct, yet complementary, predictors of humanitarian performance in the context of flood disaster management.[22]

Figure 1 presents the schematic diagram that delineates the measurement model employed in this study. It emphasizes the factor loadings of the observed variables alongside the AVE associated with the latent constructs: Human Resource, Logistics Coordination, and HOP. Every construct is associated with several indicators, all of which exhibit satisfactory factor loadings that surpass the widely recognized minimum threshold of 0.70.[24] This suggests a robust correlation between the measurement items and their corresponding latent variables, playing a crucial role in enhancing the model's reliability. The AVE values 0.589 for Human Resource, 0.588 for Logistics Coordination, and 0.568 for HOP exceed the 0.50 threshold suggested by Hair *et al.*,[23] affirming acceptable convergent validity.

The structural pathways connecting the latent constructs elucidate the relationships examined within the model. The path coefficient (β) from Human Resource to HOP is measured at 0.466, whereas the coefficient from Logistics Coordination to HOP stands at 0.393. The observed positive and moderately strong relationships indicate that both HRM and logistics coordination play a significant role in determining the effectiveness of humanitarian operations. The clarity of the path diagram reinforces the alignment of the structural model with theoretical expectations found in humanitarian logistics literature, highlighting that both human and logistical capacities are essential factors influencing response success, particularly in the context of flood disasters.[2]

Furthermore, the diagram highlights the interconnectedness of operational constructs in disaster response, supporting the idea that effective

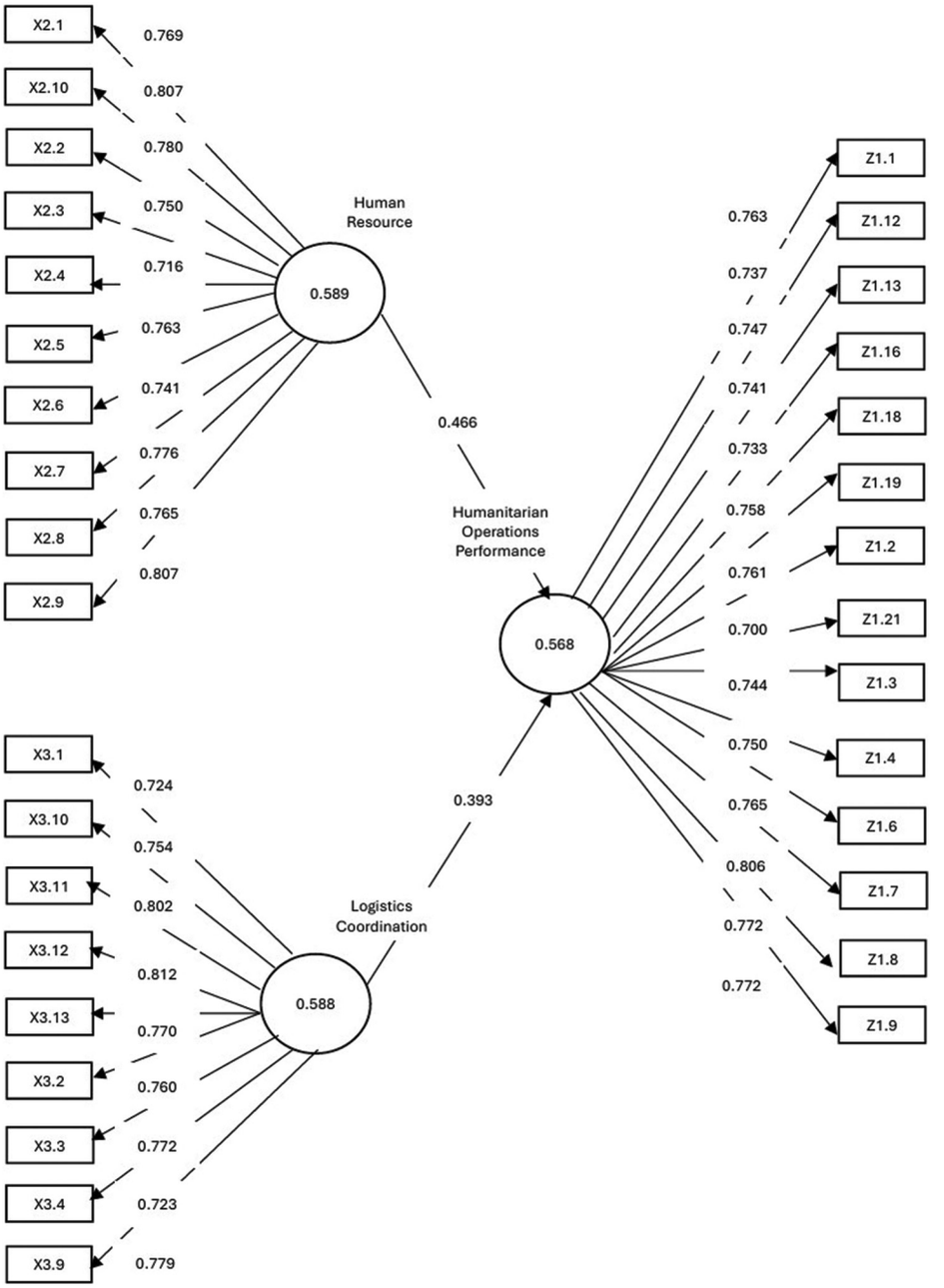

Figure 1. Measurement model showing factor loadings and average variance extracted for Human Resource, Logistics Coordination, and Humanitarian Operations Performance

coordination between HRM and logistics coordination can improve the overall performance of humanitarian interventions. The notable factor loadings (*e.g.*, >0.75 for most indicators) imply a robust internal consistency, whereas the AVE values demonstrate that the constructs adequately account for the variance in their corresponding observed variables. The measurement model demonstrates statistical robustness and aligns conceptually with the study's objectives, specifically in evaluating the contribution of internal organizational mechanisms to humanitarian outcomes within the framework of Malaysia's flood disaster management.

Table 3 presents the outer loadings of measurement items for three constructs: Human Resource, Logistics Coordination, and Humanitarian Operation Performance. All item loadings exceed the recommended threshold of 0.70, indicating strong indicator reliability and satisfactory convergence within their respective constructs. This

Table 3. Outer loadings of measurement items for Human Resource, Logistics Coordination, and Humanitarian Operation Performance

Item	Human Resource	Logistics Coordination	Humanitarian Operation Performance
X2.1	0.769		
X2.10	0.807		
X2.2	0.78		
X2.3	0.75		
X2.4	0.716		
X2.5	0.763		
X2.6	0.741		
X2.7	0.776		
X2.8	0.765		
X2.9	0.807		
X3.1		0.724	
X3.10		0.754	
X3.11		0.802	
X3.12		0.812	
X3.13		0.77	
X3.2		0.76	
X3.3		0.772	
X3.4		0.723	
X3.9		0.779	
Z1.1			0.763
Z1.12			0.737
Z1.13			0.747
Z1.16			0.741
Z1.18			0.733
Z1.19			0.758
Z1.2			0.761
Z1.21			0.7
Z1.3			0.744
Z1.4			0.75
Z1.6			0.765
Z1.7			0.806
Z1.8			0.772
Z1.9			0.772

confirms that each item contributes significantly to measuring its intended latent variable in the model.

3.1. Structural model

The structural model presented the direct relationships between Human Resource and Logistics Coordination, which are treated as independent variables, and HOP, classified as the dependent variable. The path coefficient (β) from Human Resource to HOP is 0.466, accompanied by a p=0.000. This suggests a statistically significant and moderately strong positive relationship. The findings indicate that strategic HRM practices, such as training, deployment, and coordination of personnel, are essential for improving the efficiency and effectiveness of humanitarian responses in flood-related disasters. The findings align with previous research that emphasizes the importance of skilled human resources in enhancing disaster preparedness and responsiveness within humanitarian organizations.[1]

In a similar manner, the path coefficient (β) from Logistics Coordination to HOP is 0.393, accompanied by a p=0.000, indicating a significant and positive influence. This affirms that effective logistics planning and coordination, encompassing transport, inventory management, and distribution, are critical for enhancing operational outcomes in disaster relief situations.[2] The two relationships highlight the critical interplay between human and logistical capacities in enhancing the effectiveness of humanitarian efforts. The empirical results corroborate the theoretical framework outlined in the study and are consistent with prior research highlighting the essential functions of HRM and logistics integration in disaster scenarios, especially in developing nations, such as Malaysia, where centralized response systems operate under policies, such as the National Security Council Directive No. 20.[5]

Table 4 presents a comprehensive overview of the structural model analysis, exploring the impact of Human Resource and Logistics Coordination on the performance of HOP. As in Figure 2, the findings indicate that Human Resource exerts a noteworthy positive influence on HOP, evidenced by a path coefficient (β) of 0.466, a p=0.000, and a T statistic of 8.353. This demonstrates a robust and statistically significant correlation, thereby reinforcing the hypothesis. The elevated T statistic and significantly low p-value (below 0.05) substantiate that the observed impact is unlikely to be a product of random variation, consistent with earlier research that underscores the essential contribution of human capital to the advancement of humanitarian initiatives.[25] In a similar vein, the influence of Logistics Coordination on the HOP is statistically significant, evidenced by a path coefficient (β) of 0.393, a p=0.000, and a T statistic of 6.603. This indicates that effective coordination in logistics plays a vital role in enhancing humanitarian results. The findings corroborate the hypothesis and align with previous scholarly work that emphasizes the significance of logistics coordination

Table 4. Structural equation modeling outcomes for human resource and logistics coordination effects

Hypothesis	R^2	f^2	β	*p*-value	T-statistic	Decision
Human Resource→Humanitarian Operations Performance	0.757	0.059	0.466	0.000	8.353	Supported
Logistics Coordination→Humanitarian Operations Performance		0.022	0.393	0.000	6.603	Supported

Notes: R^2 denotes coefficient of determination; f^2 denotes effect size; β denotes path coefficient

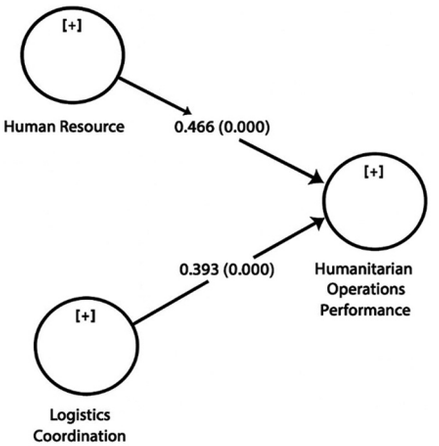

Figure 2. Structural model showing path coefficients (β) between Human Resource, Logistics Coordination, and Humanitarian Operations Performance

as an essential element in the efficacy of disaster response and humanitarian efforts.[4] The evidence indicates that entities engaged in humanitarian efforts ought to deliberately allocate resources toward both personnel development and logistics coordination to improve their operational efficacy.

4. Discussion

This study examines the influence of HRM and logistics coordination on humanitarian operations within organizations, emphasizing the importance of continuous training and the alignment of process operations to achieve successful outcomes in humanitarian efforts. The findings of the structural model indicate that both human resource and logistics coordination serve as significant predictors of HOP within the framework of flood disaster management in Malaysia. HRM demonstrated a more pronounced impact (β = 0.466, $p<0.001$) in contrast to logistics coordination (β = 0.393, $p<0.001$), highlighting the pivotal importance of adept personnel in achieving operational success.

The positive and significant effects of Human Resource practices on HOP is consistent with the research conducted by McLoughlin *et al.*,[1] who underscored the necessity of having skilled, well-trained, and flexible personnel in intricate disaster scenarios. In a similar vein, Nguyen *et al.*[25] emphasized that strategic human resource practices, such as capacity-building and crisis preparedness, play a crucial role in enhancing organizational resilience and readiness. Within the Malaysian context, these insights resonate with the National Security Council Directive No. 20, which establishes the official framework for disaster management coordination and response. This directive mandates that agencies involved in disaster relief maintain high standards of preparedness, human capital capability, and inter-agency coordination. Investments in workforce development and operational efficiency directly support SDG 16, which promotes peace, justice, and strong institutions. In Malaysia, aligning disaster management practices with SDG 16 is evident through policies aimed at strengthening institutional capacity, ensuring transparent operations, and fostering accountable response mechanisms during crises. By empowering humanitarian staff through structured training and strategic human resource planning, organizations contribute to the development of institutions that are not only effective but also responsive and inclusive, key characteristics promoted under SDG 16. Furthermore, the NADMA tasked with overseeing the implementation of the National Security Council Directive No. 20 emphasizes the professionalization of disaster response personnel and continuous human capital development through simulation exercises and cross-agency training programs. These initiatives are echoed in the twelfth Malaysia plan (2021 – 2025), which identifies "Strengthening Security, Wellbeing and Unity" as one of its strategic themes. Under this theme, the government commits to strengthening disaster risk governance, institutional preparedness, and the resilience of frontline agencies in the face of natural disasters. These national efforts closely align with SDG 16, which calls for the development of effective, accountable, and inclusive institutions at all levels, particularly in crisis-prone and vulnerable settings. By investing in the professional development of humanitarian staff and embedding accountability in institutional procedures, Malaysia contributes toward the realization of SDG 16 targets, especially Target 16.6, which focuses on developing

effective, accountable, and transparent institutions, and Target 16.7, which emphasizes responsive, inclusive, and participatory decision-making. As such, strategic human resource and logistics coordination practices not only enhance operational outcomes in disaster settings but also reflect Malaysia's broader commitment to institutional integrity, resilience, and sustainable development.

The 2021 – 2022 floods in Malaysia, which affected over 125,000 individuals and caused economic losses exceeding RM6.5 billion, exposed critical deficiencies in both human resource deployment and logistics management, particularly in Selangor and Pahang. Delays in mobilizing trained personnel, fragmented inter-agency communication, and reliance on civil society volunteers over official emergency responders were widely criticized by researchers and the public alike. These incidents revealed significant implementation gaps in National Security Council Directive No. 20 and weakened public trust in institutional disaster governance. Even the Prime Minister acknowledged shortcomings in the government's response.[26] A post-mortem conducted by NADMA also noted insufficient manpower, poor logistical planning, and weak coordination in several affected districts.

These shortcomings directly highlight the importance of institutional preparedness and operational capacity – core targets under SDG 16, especially Targets 16.6 (effective, accountable institutions) and 16.7 (responsive, inclusive decision-making). In line with the twelfth Malaysia plan (2021 – 2025), which promotes enhanced disaster risk governance under the theme "Strengthening Security, Wellbeing and Unity," efforts to improve human resource systems and inter-agency logistics coordination are essential to strengthening Malaysia's disaster response framework.

In addition, logistics coordination demonstrated a statistically significant influence on humanitarian operations, underscoring the essential nature of timely and well-organized supply chains in the context of disaster response. This outcome aligns with earlier research conducted by Van Wassenhove,[2] who posited that logistical efficiency serves as a fundamental component of humanitarian effectiveness, especially in the realms of inventory management, transportation, and distribution within disaster-stricken areas. Moreover, Kovács and Spens[4] noted that integrated logistics systems not only diminish delays but also promote improved coordination among participants throughout the supply chain, thereby optimizing service delivery to impacted communities. Efficient logistics systems also directly support SDG 9, which promotes resilient infrastructure and inclusive innovation. When logistics networks are well-coordinated, humanitarian organizations can operate more sustainably, overcoming challenges, such as infrastructure breakdowns or inaccessible communities during flood events.

This study notably emphasizes the interconnected dynamics between human resources and logistics coordination. Entities that amalgamate these two functions experience enhanced operational coherence, adaptability, and responsiveness in the face of disaster scenarios. This comprehensive approach resonates with the findings of Kovács and Spens,[4] who highlighted the significance of strategic alignment between logistics and human capital functions. It further promotes the aims of SDG 17, which advocates for efficient partnerships and comprehensive collaboration. In the realm of humanitarian efforts, this manifests as cohesive internal operations and enhanced collaborations among governmental bodies, NGOs, and community-oriented entities essential for realizing prompt and precise disaster interventions.

The study significantly contributes to both scholarly discourse and policy formulation by providing empirical evidence for the amalgamation of human resources and logistics coordination within humanitarian operations. This is critical for promoting strategies grounded in empirical evidence that enhance performance outcomes while simultaneously aligning with overarching global development priorities as outlined in the SDGs. Amid the escalating frequency of climate-induced calamities, the implementation of cohesive and sustainable operational frameworks is essential for enhancing the efficacy of future humanitarian efforts.

5. Conclusion

This study highlights the critical role of internal organizational capabilities, specifically HRM and logistics coordination in enhancing the performance of humanitarian operations, particularly in flood-prone regions of Malaysia. The integration of strategic human resource practices and efficient logistics systems is essential for building agile, responsive, and sustainable humanitarian interventions. The structural model results demonstrate that both Human Resource ($\beta = 0.466$, $p<0.001$) and Logistics Coordination ($\beta = 0.393$, $p<0.001$) significantly and positively influence HOP. Importantly, HRM exerts a stronger predictive effect. The model explains 61.7% of the variance in HOP ($R^2 = 0.617$), indicating a substantial contribution of internal capabilities to disaster response effectiveness. These findings affirm that Human Resource and Logistics Coordination are not only independently impactful but

also synergistic in driving humanitarian performance. This has direct implications for disaster management policy and practice in Malaysia. Strengthening internal organizational mechanisms, particularly trained personnel and coordinated logistics systems, is essential to supporting National Security Council Directive No. 20, which centralizes disaster governance in the country. Aligning these internal drivers with national frameworks enhances institutional responsiveness, agility, and public trust in disaster response efforts.

Beyond national implications, this research advances SDGs 9 (Industry, Innovation, and Infrastructure), 16 (Peace, Justice, and Strong Institutions), and 17 (Partnerships for the Goals). It calls for investment in resilient infrastructure, effective and accountable institutions, and inter-agency collaboration. Methodologically, the study utilized PLS-SEM to empirically validate the dual role of HRM and logistics coordination in a humanitarian context – a relatively underexplored area in Southeast Asian disaster research.

As a future recommendation, a 2-year longitudinal follow-up study is proposed to assess the sustained impact of human resource and logistics development on HOP in flood-prone regions of Malaysia. This study would track operational improvements over two flood seasons, focusing on the effectiveness of capacity-building initiatives, personnel deployment, and logistics coordination. By employing a mixed-method approach – combining updated PLS-SEM analysis with qualitative interviews – the study can collect panel data from key disaster management agencies across selected high-risk districts. The objective is to determine whether investments in HRM and logistics coordination lead to measurable gains in response speed, community satisfaction, and overall resilience. The findings would provide actionable insights for NADMA and other stakeholders to refine national disaster strategies, enhance institutional preparedness, and further align with SDG 16 targets on building effective, accountable, and responsive institutions.

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Conflict of interest

The authors declare they have no competing interests.

Author contributions

Conceptualization: All authors
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Ethics approval and consent to participate

The research was carried out following the guidelines stipulated in the ethics statement of the Universiti Poly-Tech Malaysia Research Ethics Committee. The authors affirm that all data were collected in compliance with local regulations and organizational policies in Malaysia, and no proprietary or classified information is included in this publication. All organizational names have been anonymized where necessary to protect the confidentiality of participants and operational strategies. This research was conducted in alignment with the Malaysia's National Security Council Directive No. 20 and the national guidelines for research involving humanitarian policy and operations. Informed consent was verbally obtained from the participants.

Consent for publication

Not applicable.

Availability of data

The data supporting the findings of this study are available from the corresponding author upon reasonable request. Due to confidentiality agreements with the participating organizations, some restrictions apply to the availability of these data.

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