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HRM Capabilities, Supply Chain Recovery, and Operational Resilience under Extreme Disruption in Iraq's Quick-Service Restaurant Sector: A PLS-SEM Approach

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ABSTRACT

This study examines how HRM capabilities, supply chain recovery, and extreme disruption intensity relate to operational resilience in Iraq's quick-service restaurant (QSR) sector, drawing on resource-based and dynamic capabilities perspectives. Using partial least squares structural equation modeling (PLS-SEM), data from 243 operational decision makers and knowledgeable employees were analyzed. The measurement model showed adequate reliability, convergent validity, and discriminant validity. HRM capabilities were positively associated with supply chain recovery and operational resilience, and supply chain recovery partially mediated the latter relationship. Extreme disruption intensity was negatively associated with supply chain recovery but did not significantly moderate the link between HRM capabilities and recovery. The findings suggest that workforce capabilities and recovery practices are interrelated in disruption-prone QSR contexts, while strong external pressure directly constrains recovery. The cross-sectional results are not causal evidence.

Key Words: PLS-SEM; HRM capabilities; supply chain recovery; operational resilience; extreme disruption intensity; quick-service restaurants; Iraq

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1. INTRODUCTION

Companies that work in disruption-prone environments are usually obliged to ensure service continuity and at the same time address the fluctuations in the availability of workforce, supplier reliability, logistics conditions, and customer demand. The literature on supply chain resilience typically considers disruption response and recovery as the key aspects of resilience, but also acknowledges that resilience is not merely a technical supply chain problem, but also an organizational resource, coordination, and adaptive capacity issue (Ambulkar et al., 2015; Brandon-Jones et al., 2014; Chowdhury and Quaddus, 2016). The empirical context of this study is the quick-service restaurant (QSR) industry in Iraq since the activities involved in the sample rely on the coordinated work patterns, availability of ingredients, responsiveness of procurement, and continuity of services in the face of unstable environments.

Despite the fact that the research on supply chain resilience has come up with valuable concepts of readiness, response, recovery, and robustness, the contribution of human resource management (HRM) capabilities to recovery-oriented supply chain outcomes is less explicit in most empirical models. According to the previous HRM studies, operating performance, absorptive capacity, responsiveness, and innovation-related outcomes can be linked to HR practices and flexibility-oriented HRM systems (Chang et al., 2013; Wright et al., 2003). The theoretical foundation of considering human and organizational capabilities as potentially valuable in situations where firms need to adjust to environmental change is also found in resource-based and dynamic capabilities perspectives (Barney, 1991; Teece, 2007; Teece et al., 1997). However, the empirical link between HRM capabilities, supply chain recovery, and operational resilience needs to be specified carefully, particularly when a study uses cross-sectional perceptual data.

This paper addresses that problem by estimating a PLS-SEM model where HRM Capabilities are related to Supply Chain Recovery and Operational Resilience, Supply Chain Recovery is modeled as a mediator, and Extreme Disruption Intensity is modeled as a direct predictor of Supply Chain Recovery and a moderator of the HRM Capabilities-Supply Chain Recovery relationship. This framework is compatible with the perspective that capabilities can act via particular recovery mechanisms, and also enables the intensity of disruption to be studied as a contextual pressure that can limit recovery. The research thus does not presume that HRM capabilities will automatically counteract external turbulence, but it is a test of whether the relationships observed are statistically supported in the sample.

The research adds to the applied SEM literature in three aspects. First, it develops and tests a parsimonious PLS-SEM model of four reflective latent constructs in a disruption-prone service operations setting. Second, it tests direct and indirect relationships between HRM Capabilities, Supply Chain Recovery, and Operational Resilience, which enables the research to determine whether supply chain recovery offers a statistical process that connects workforce-related capabilities to resilient operations. Third, it incorporates Extreme Disruption Intensity as a direct and conditional factor, which allows differentiating between direct contextual pressure and moderation. Since the data are cross-sectional, the paper does not interpret the results as conclusive evidence of causal effects, but as statistical associations that are theoretically consistent with the proposed model.

The rest of this paper is organized as follows. The related work section reviews the literature

and develops the hypotheses. The scope of the research is then stated, followed by the methodology, which describes the sample, measures, data screening, and PLS-SEM procedure. The results section presents the measurement and structural model results together with a discussion of the findings. The conclusions section presents the theoretical and managerial implications, the limitations, and directions for future research.

2. RELATED WORK

Resource-based, dynamic capabilities and supply chain resilience perspectives

The theoretical framework of this paper is a synthesis of resource-based and dynamic capabilities arguments and supply chain resilience studies. Resource-based view holds that firm resources may be a source of advantage when they are valuable, rare, hard to imitate, and embedded in organizational arrangements (Barney, 1991). The dynamic capabilities theory builds on this argument by highlighting the ability of firms to sense, seize, and reconfigure resources as the operating conditions vary (Teece, 2007; Teece et al., 1997). These views apply to disruption research since resilience is not just about the availability of resources but also the capacity to mobilize and reorganize them when needed.

HRM Capabilities are considered in the current model as workforce-related capabilities that can facilitate adaptation and coordination. Supply Chain Recovery is considered a recovery-based operational capability that indicates alternative sourcing, logistics recovery, distributor communication, and flexible operational reconfiguration. Operational Resilience is considered as the capability to persist and adjust operations in the face of disruption. This theoretical hierarchy is conservative: HRM Capabilities are not supposed to directly ensure resilience; rather, some of their relationship with resilience is supposed to work through supply chain recovery mechanisms.

Based on this, the conceptual model proposed is constructed on three interconnected assumptions. First, capabilities related to workforce can facilitate recovery since disruptions demand quick coordination and redeployment of individuals. Second, recovery-oriented supply chain practices can be linked to operational resilience since they assist firms to recover or adjust service routines. Third, the disruption intensity can play a direct constraining role and a possible conditional role in the HRM Capabilities-Supply Chain Recovery relationship. These assumptions are formulated below as testable hypotheses instead of being stated as known causal facts.

HRM Capabilities and Supply Chain Recovery

HRM Capabilities refer here to practices and routines that support workforce flexibility, rapid staff reallocation, supervisor empowerment, and crisis-related knowledge sharing. HRM research provides a basis for linking such capabilities to adaptive organizational outcomes. Wright et al. (2003) found that HR practices were related to business-unit operating performance in their empirical context, while Chang et al. (2013) developed and tested flexibility-oriented HRM systems and reported associations with absorptive capacity and responsiveness-related outcomes. These studies do not by themselves establish that HRM capabilities produce supply chain recovery in QSR organizations, but they support the narrower proposition that workforce-related systems may contribute to organizational responsiveness.

Supply chain recovery requires coordinated action after disruption, including restoring supply

flows, communicating with partners, adjusting logistics, and reconfiguring operations where needed. Prior supply chain resilience studies identify recovery, responsiveness, flexibility, and coordination as important elements of disruption management (Ambulkar et al., 2015; Brandon-Jones et al., 2014; Chowdhury & Quaddus, 2016). In a QSR setting, workforce flexibility and knowledge sharing may help managers and frontline employees adjust menus, staffing, procurement routines, and branch-level operating procedures when supply conditions change. Therefore, the first hypothesis is stated as follows:

H1. HRM Capabilities are positively associated with Supply Chain Recovery.

Supply Chain Recovery and Operational Resilience

Supply Chain Recovery is likely to have a positive relationship with Operational Resilience since recovery-focused capabilities enable organizations to recover or re-align operations following disruptions. Ambulkar et al. (2015) define and empirically investigate firm resilience to supply chain disruptions, highlighting the significance of capabilities that enable firms to react to and recover following disruption. Chowdhury and Quaddus (2016) also differentiate between readiness, response, and recovery as elements of supply chain resilience. Brandon-Jones et al. (2014) also demonstrate that information sharing and connectivity are also resources that are applicable to resilience and robustness, but the mechanisms are context-specific.

In the case of QSR organizations, operational resilience may be manifested in service continuity, quality sustainability, operational flexibility, and the capacity to persist in operations in the face of market or logistics disruption. A restaurant that is able to find other suppliers, communicate fast with distributors, and reorganize menus or bundles might be in a better position to continue operations. Since this assertion is tested with cross-sectional survey data, the hypothesis is stated as an anticipated positive correlation, but not a demonstrated causal impact:

H2. Supply Chain Recovery is positively associated with Operational Resilience.

HRM Capabilities and Operational Resilience

HRM Capabilities may also be directly associated with Operational Resilience. The capabilities associated with workforce can facilitate continuity in staffing, cross-functional support, local problem solving, and knowledge transfer in case of disruption. The resource-based and dynamic capabilities approaches substantiate the thesis that human and organizational capabilities can be useful in cases when companies need to change routines and organize responses in the context of environmental change (Barney, 1991; Teece, 2007; Teece et al., 1997). The narrower hypothesis that HR systems are related to operational and responsiveness-related outcomes is also supported by prior HRM research (Chang et al., 2013; Wright et al., 2003).

A direct route is added since HRM Capabilities can affect Operational Resilience in ways other than supply chain recovery. To illustrate, cross-trained workers can assist in ensuring continuity of services even when the supply conditions are not the sole limiting factor, and empowered managers can address operational issues at the branch level without having to wait until higher-level decisions are made. These mechanisms are not fully captured by the Supply Chain Recovery construct. Accordingly:

H3. HRM Capabilities are positively associated with Operational Resilience.

The mediating role of Supply Chain Recovery

Supply Chain Recovery may offer a statistical mechanism to relate workforce-related

capabilities to resilience outcomes, in the event that HRM Capabilities are related to Supply Chain Recovery, and Supply Chain Recovery is related to Operational Resilience. The use of mediation analysis in PLS path modeling is applicable when the scholars are interested in examining whether the data supports an indirect impact, even the results should be interpreted in the context of research design limitations (Nitzl et al., 2016). The mediation hypothesis in the current study does not mean that the cross-sectional data alone determine the temporal order. Instead, it checks the consistency of the indirect route with the theoretical model.

The suggested mediation is theoretically feasible since HRM Capabilities can empower employees and managers to organize recovery efforts, whereas recovery efforts can facilitate service continuity and flexibility. This gives the following hypothesis:

H4. Supply Chain Recovery mediates the relationship between HRM Capabilities and Operational Resilience.

Extreme Disruption Intensity and Supply Chain Recovery

Extreme Disruption Intensity is the perceived intensity of macroeconomic volatility, frequency of supply chain shock, and financial or operating pressure. Previous strategy studies have conceptualized market and environmental forces as situational factors that influence organizational learning and innovation performance (Zhou et al., 2005). The severity of disruption is also applicable in the context of supply chain resilience studies since recovery is more challenging in the presence of frequent, intense, or externally constrained shocks (Ambulkar et al., 2015; Chowdhury and Quaddus, 2016). The perceived high disruption intensity in the current QSR environment can be linked to reduced recovery ability since companies are exposed to more challenging supply, logistics, and cost environments.

The model has a direct relationship between Extreme Disruption Intensity and Supply Chain Recovery since extreme disruption can limit recovery despite internal capacity. This direct effect is significant as it does not overstate the capacity of HRM Capabilities to absorb external pressure. The hypothesis is therefore:

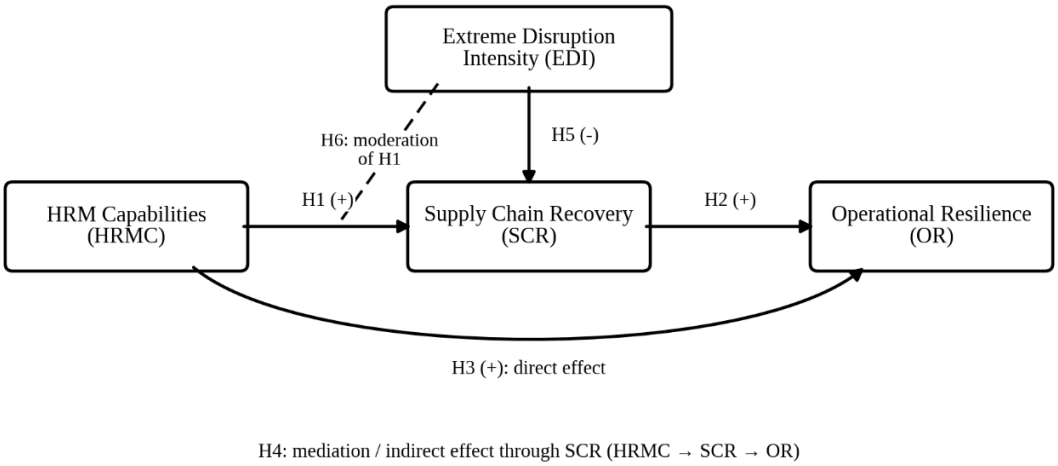
H5. Extreme Disruption Intensity is negatively associated with Supply Chain Recovery.

Moderating role of Extreme Disruption Intensity

Extreme Disruption Intensity may also condition the relationship between HRM Capabilities and Supply Chain Recovery. A possible assumption is that HRM Capabilities gain relevance in the face of greater disruption since workforce flexibility, empowerment, and knowledge sharing can assist firms to react when routines are disrupted. The other possible expectation is that extremely disruptive disruption may limit the advantages of HRM Capabilities when external supply, logistics, or cost pressures are beyond what internal workforce routines can counter. Since both interpretations are theoretically possible, the moderation hypothesis is formulated in a conservative way as a change in the strength of the relationship and not as a directional strengthening hypothesis:

H6. Extreme Disruption Intensity moderates the relationship between HRM Capabilities and Supply Chain Recovery, such that the strength of the relationship changes under higher levels of disruption intensity.

Figure 1. Proposed conceptual model.



Scope of Research

This study is concerned with the relationship between workforce-related capabilities and recovery-oriented supply chain outcomes in the quick-service restaurant (QSR) sector in Iraq, an operating environment characterized by macroeconomic volatility, import delays, logistics bottlenecks, and local market uncertainty.

The research has three objectives. The first is to examine whether HRM Capabilities are associated with Supply Chain Recovery and Operational Resilience (H1 and H3) and whether Supply Chain Recovery is associated with Operational Resilience (H2). The second is to test whether Supply Chain Recovery mediates the HRM Capabilities-Operational Resilience relationship (H4). The third is to assess Extreme Disruption Intensity as a direct predictor of Supply Chain Recovery (H5) and as a moderator of the HRM Capabilities-Supply Chain Recovery relationship (H6).

The scope is limited to four reflective latent constructs, measured through a cross-sectional online survey that yielded 243 valid responses from operational decision makers and knowledgeable employees in major commercial cities in Iraq. The results are interpreted as statistical associations rather than causal effects, and they are not intended to generalize to all food service firms, all Iraqi firms, or other national settings.

3. METHODOLOGY AND DISCUSSION

Research design

The research design was a quantitative, cross-sectional survey, which was used to estimate a PLS-SEM model between HRM Capabilities, Supply Chain Recovery, Operational Resilience, and Extreme Disruption Intensity in the quick-service restaurant (QSR) industry in Iraq. The design suited well to test statistical relationships between reflective latent constructs and to test direct, indirect, and conditional relationships. There are four reasons why PLS-SEM was chosen. Firstly, this paper is presented as explanatory and prediction-based, rather than confirmatory in the covariance-based SEM sense. Secondly, the model has several reflective latent constructs along with mediation and moderation effects. Thirdly, PLS-SEM does not assume

multivariate normality as covariance-based SEM does, which applies to cross-sectional survey data measured using five-point Likert indicators. Fourthly, when the model is applied in a poorly studied area and complicated operation environment, where theory extension and context-specific model building are suitable (Hair et al., 2019; Hair et al., 2022).

Target population, sampling, and data collection

The target population included operational decision-makers and informed employees who work in QSR organizations in Iraq. The respondents were branch managers, restaurant general managers, assistant managers, restaurant supervisors, operations managers, HR officers, procurement staff, supply chain/logistics staff, and franchise managers. These respondents were chosen since they were likely to have first-hand information on workforce practices, supply chain disruptions, recovery processes, and service continuity in QSR operations.

The questionnaire was sent via the internet to about 400 potential respondents in the QSR industry in Iraq. Following the screening of the returned questionnaires in terms of completeness and eligibility, 243 valid responses were retained to be used in the final analysis, which gave an approximate response rate of 60.8%. The sample that was retained consisted of the respondents of the major commercial places in Iraq such as Baghdad, Basra, Najaf, Karbala, Erbil, Sulaymaniyah, Mosul and Babylon. The retained measurement items did not show any missing values.

In PLS-SEM, the inverse square root method was used to estimate the minimum sample size, which was used to assess sample size adequacy (Kock and Hadaya, 2018). This approach approximates the minimum sample size needed to identify a prespecified minimum absolute path coefficient at a desired level of significance and power. The method suggests a minimum sample size of about 155 cases using a conservative minimum meaningful path coefficient of.20, a significance level of.05, and a statistical power of.80. The sample of 243 valid responses retained thus surpasses this standard. This conclusion is to be understood as sufficient to identify effects of about.20 or more; very small interaction effects can still demand larger samples.

Measurement instrument

The questionnaire assessed four constructs on a five-point Likert scale of 1 = strongly disagree to 5 = strongly agree. Four items based on previous research on HR practices and flexibility-oriented HRM systems were used to measure HRM Capabilities (Chang et al., 2013; Wright et al., 2003). Supply Chain Recovery was assessed using four items based on supply chain resilience and recovery scales (Ambulkar et al., 2015; Chowdhury and Quaddus, 2016). Operational Resilience was assessed using four items based on resilience and disruption-response studies (Ambulkar et al., 2015; Brandon-Jones et al., 2014). Extreme Disruption Intensity was assessed using three items that were modified and contextualized to reflect perceived macroeconomic, logistical, and operating disruption intensity on QSR firms in Iraq (Zhou et al., 2005).

All constructs were defined as reflective since the observed indicators were considered as manifestations of their corresponding latent variables and were supposed to covariate. This specification is a modeling assumption and must be understood as such. The items were contextualized by making minor wording changes to the original scales without altering the conceptual meaning of the scales. The questionnaire did not request brand names, financial records, supplier prices, or personally identifying information.

Data screening and common method bias

The screening of data was done prior to the estimation of the structural model. The dataset that was retained had 243 full responses and all the core measurement items were coded on the anticipated 1-5 scale. Since the research was based on a single cross-sectional questionnaire, common method bias could not be eliminated by design alone. It was thus resolved by procedural and statistical solutions. Procedurally, the questionnaire guaranteed the respondents of confidentiality, did not demand sensitive organizational information, and divided the constructs into separate sections. These steps are in line with generally suggested solutions to minimize method-related response bias (Podsakoff et al., 2003).

The single-factor test of Harman statistically showed that the first unrotated factor accounted 47.37% of the variance, which is less than the 50% diagnostic criterion. The full collinearity VIF values were between 1.086 and 2.185, which is lower than the 3.3 threshold suggested to evaluate full collinearity of common method bias in PLS-SEM (Kock, 2015). These diagnostics do not establish that there is no method bias, but they do not show that common method bias is so strong that it invalidates the model interpretation.

PLS-SEM analysis procedure

The PLS-SEM analysis was conducted in accordance with the two-step procedure that is generally recommended: measurement model assessment and structural model assessment (Hair et al., 2019; Hair et al., 2022). The reflective measurement model was tested based on indicator loadings, Cronbach alpha, rho A, composite reliability, average variance extracted (AVE) and discriminant validity in terms of heterotrait-monotrait ratio (HTMT). The indicative criteria of satisfactory measurement quality were indicator loadings greater than 0.70, reliability coefficients greater than 0.70, AVE greater than 0.50, and HTMT less than 0.85 (Hair et al., 2022; Henseler et al., 2015).

Collinearity diagnostics, standardized path coefficients, bootstrapped t-statistics, p-values, confidence intervals, coefficient of determination (R2), effect sizes (f2), and blindfolding-based cross-validated redundancy (Q2) were used to evaluate the structural model. Bootstrapping with 5,000 resamples was used to assess the statistical significance of the direct, indirect, and interaction effects. The mediation hypothesis was examined by the specific indirect effect of HRM Capabilities on Operational Resilience through Supply Chain Recovery. The moderation hypothesis was examined using the interaction effect between HRM Capabilities and Extreme Disruption Intensity on Supply Chain Recovery. In order to prevent the confusion of blindfolding-based Q2 with out-of-sample predictive performance, PLSpredict was tested independently with a 10-fold, 10-repetition setup and by comparing the prediction errors of the PLS-SEM model with the linear model benchmark (Shmueli et al., 2019).

Table 1. Respondent profile

Variable	Category	n	%
Role	Assistant Manager	45	18.5%
	Supply Chain / Logistics Staff	24	9.9%
	HR Officer / HR Manager	17	7.0%
	Restaurant Supervisor / Shift Leader	31	12.8%
	Branch Manager / Restaurant General Manager (GM)	69	28.4%
	Procurement / Purchasing Staff	17	7.0%
	Operations Manager (Area/District/Corporate)	32	13.2%
	Franchise Manager	8	3.3%
Organization type	Major International Franchise Chain	93	38.3%
	Independent Multi-unit Local Restaurant Chain	68	28.0%
	Large Regional / National Iraqi Chain	82	33.7%
Location	Baghdad	92	37.9%
	Babylon	14	5.8%
	Sulaymaniyah	18	7.4%
	Karbala	26	10.7%
	Basra	36	14.8%
	Najaf	23	9.5%
	Erbil	23	9.5%
	Mosul	11	4.5%
Experience	3 - 5 years	90	37.0%
	More than 10 years	45	18.5%
	6 - 10 years	73	30.0%
	Less than 3 years	35	14.4%

4. RESULTS

Measurement model assessment

The results of the measurement model were in line with reliability and convergent validity of the four reflective constructs. The indicator loadings were all above 0.70, with the observed loadings ranging from 0.818 to 0.929. The alpha values of Cronbach were between 0.869 and 0.942, the rho A values were between 0.890 and 0.950, the composite reliability values were between 0.911 and 0.958, and the AVE values were between 0.719 and 0.852. These findings are in favor of internal consistency reliability and convergent validity under the criteria used in this study.

Table 2. Measurement model results

Construct	Item	Loading	Alpha	rho_A	CR	AVE
HRM Capabilities	HRMC1	0.929	0.942	0.950	0.958	0.852
HRM Capabilities	HRMC2	0.920	0.942	0.950	0.958	0.852
HRM Capabilities	HRMC3	0.915	0.942	0.950	0.958	0.852
HRM Capabilities	HRMC4	0.928	0.942	0.950	0.958	0.852
Supply Chain Recovery	SCR1	0.880	0.869	0.890	0.911	0.719
Supply Chain Recovery	SCR2	0.831	0.869	0.890	0.911	0.719
Supply Chain Recovery	SCR3	0.818	0.869	0.890	0.911	0.719
Supply Chain Recovery	SCR4	0.860	0.869	0.890	0.911	0.719
Operational Resilience	OR1	0.878	0.899	0.914	0.930	0.769
Operational Resilience	OR2	0.864	0.899	0.914	0.930	0.769
Operational Resilience	OR3	0.873	0.899	0.914	0.930	0.769
Operational Resilience	OR4	0.891	0.899	0.914	0.930	0.769
Extreme Disruption Intensity	ED1	0.897	0.899	0.918	0.937	0.831
Extreme Disruption Intensity	ED2	0.915	0.899	0.918	0.937	0.831
Extreme Disruption Intensity	ED3	0.923	0.899	0.918	0.937	0.831

Discriminant validity assessment

The HTMT criterion was used to determine discriminant validity. The values of all HTMT were less than 0.85, with the largest value of 0.740 in the relationship between Supply Chain Recovery and Operational Resilience. The findings indicate the empirical uniqueness of the four constructs below the threshold used in this study (Henseler et al., 2015).

Table 3. Discriminant validity using HTMT

Construct	HRMC	SCR	OR	EDI
HRMC	-	0.648	0.711	0.039
SCR	0.648	-	0.740	0.244
OR	0.711	0.740	-	0.090
EDI	0.039	0.244	0.090	-

Structural model assessment

Collinearity among predictor constructs was tested before testing the hypotheses. The VIF of the predictors of Supply Chain Recovery were between 1.001 and 1.063 and the VIF of the predictors of Operational Resilience were 1.520. These values do not suggest problematic multicollinearity in the structural model. The model explained 39.4% of the variance in Supply Chain Recovery (R2 = 0.394; adjusted R2 = 0.386) and 54.2% of the variance in Operational Resilience (R2 = 0.542; adjusted R2 = 0.539). The latent-variable PLSpredict Q2_predict values were positive for both endogenous constructs (Q2_predict = 0.379 for Supply Chain Recovery; Q2_predict = 0.432 for Operational Resilience), indicating that the PLS-SEM predictions exceeded the indicator-average benchmark. Since these values are out-of-sample prediction indicators, the full PLSpredict assessment is reported separately.

Table 4. Structural model and hypothesis testing

Hyp.	Path	β	t	p	95% CI	f^2	Decision
H1	HRM Capabilities -> Supply Chain Recovery	0.590	16.568	< .001	[0.512; 0.654]	0.573	Supported
H2	Supply Chain Recovery -> Operational Resilience	0.413	7.339	< .001	[0.296; 0.517]	0.243	Supported
H3	HRM Capabilities -> Operational Resilience	0.414	8.802	< .001	[0.321; 0.507]	0.249	Supported
H4	HRM Capabilities -> Supply Chain Recovery -> Operational Resilience	0.244	6.915	< .001	[0.175; 0.313]	-	Supported
H5	Extreme Disruption Intensity -> Supply Chain Recovery	-0.227	4.535	< .001	[-0.322; -0.126]	0.080	Supported
H6	HRM Capabilities x Extreme Disruption Intensity -> Supply Chain Recovery	0.003	0.067	.947	[-0.094; 0.101]	< .001	Not supported

H1, H2, H3, H4, and H5 were supported by the structural model results. Supply Chain Recovery was positively and statistically significantly related to HRM Capabilities (β = 0.590, p < .001), which supports H1. Operational Resilience was positively and statistically significantly related to Supply Chain Recovery (β = 0.413, p < .001), which supports H2. HRM Capabilities were also positively and statistically significantly directly related to Operational Resilience (β = 0.414, p < .001), which supports H3. The indirect effect of HRM Capabilities on Operational Resilience via Supply Chain Recovery was positive and statistically significant (β = 0.244, p < .001), which supports H4 and suggests partial mediation in the estimated model. Extreme Disruption Intensity had a statistically significant negative association with Supply Chain Recovery (β = -0.227, p < .001), supporting H5. Nevertheless, the interaction between HRM Capabilities and Extreme Disruption Intensity was not significant (β = 0.003, p = .947); thus, H6 was not accepted.

Out-of-sample predictive assessment using PLSpredict

In order to evaluate out-of-sample predictive performance, the PLSpredict procedure was performed with a 10-fold, 10-repetition setup, as suggested by Shmueli et al. (2019). The

evaluation was based on the observable indicators of the endogenous constructs, i.e., Supply Chain Recovery and Operational Resilience. The Q2_predict values were all positive, which means that the PLS-SEM predictions were better than the indicator average benchmark. The RMSE values of the PLS-SEM model were compared to the linear model (LM) benchmark. The PLS-SEM model yielded lower RMSE values than the LM benchmark on all 8 endogenous indicators as reported in the SmartPLS output files submitted with the manuscript. This pattern suggests strong out-of-sample predictive power according to the PLSpredict decision rule used. Therefore, the model shows strong predictive performance of the endogenous indicators in this sample, while the interpretation remains limited to the current cross-sectional data and sample context.

The full indicator-level PLSpredict output is included in the SmartPLS results file submitted with the manuscript. It reports Q2_predict, RMSE_PLS, RMSE_LM, and the PLS-SEM < LM decision for SCR1-SCR4 and OR1-OR4.

Mediation and moderation assessment

The mediation outcome shows that Supply Chain Recovery is a statistically significant mechanism between HRM Capabilities and Operational Resilience in this model. Since the direct relationship between HRM Capabilities and Operational Resilience was still important when Supply Chain Recovery was added, the mediation is considered partial, but not complete. Since the study is cross-sectional, this finding must be viewed as an indication of a strong indirect relationship in line with the hypothesized theory, rather than as a conclusive finding of a causal relationship over time.

The relationship between Extreme Disruption Intensity and Supply Chain Recovery was negative and statistically significant. Respondents in this sample who perceived greater disruption intensity also reported reduced supply chain recovery capability. To further explain the non-significant interaction effect in H6 (β = 0.003, t = 0.067, p = .947), a post-hoc simple slopes plot was analyzed to determine the relationship between HRM Capabilities and Supply Chain Recovery at low (-1 SD), mean, and high (+1 SD) levels of Extreme Disruption Intensity. The slopes were nearly identical at the three levels of disruption intensity and remained around 0.59. This trend is graphically represented in almost parallel lines and is in line with the non-significant interaction term. Thus, in this research, Extreme Disruption Intensity can be understood as a direct contextual limitation of Supply Chain Recovery instead of a condition that alters the strength of the HRM Capabilities-Supply Chain Recovery relationship.

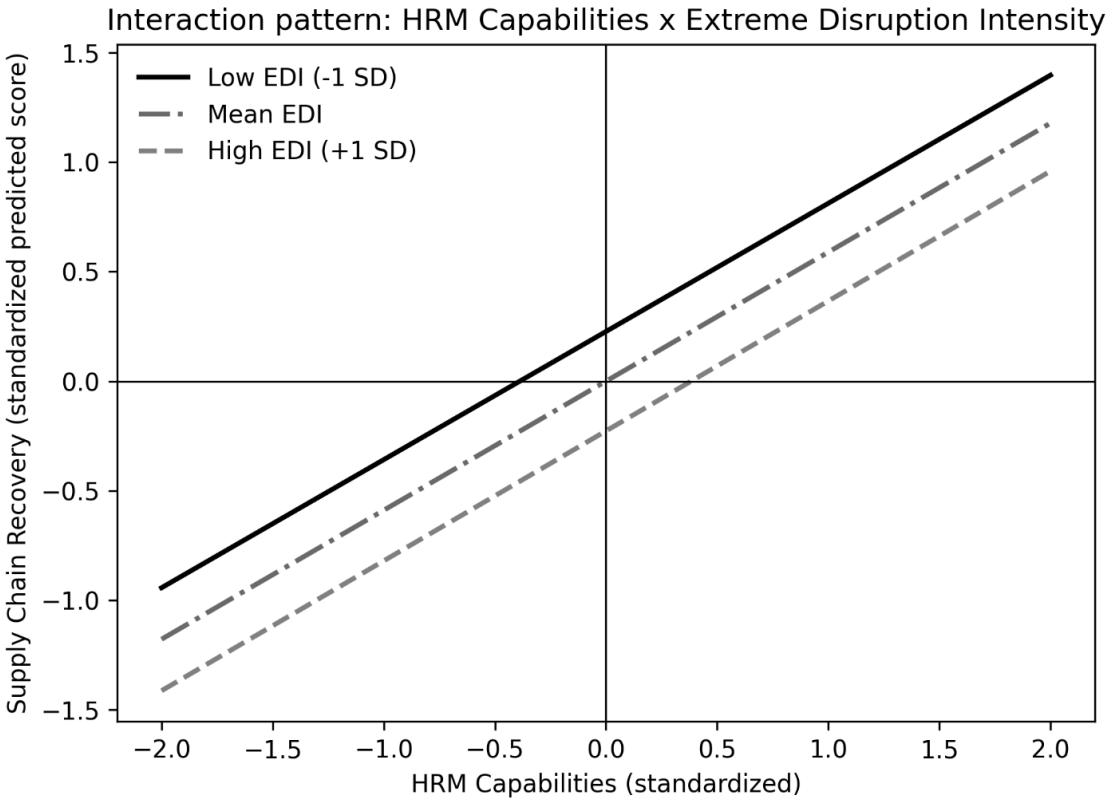


Figure 2. Simple slopes pattern for the non-significant interaction between HRM Capabilities and Extreme Disruption Intensity.

Discussion of findings

The findings are to be viewed as the evidence of a cross-sectional PLS-SEM model, but not as the conclusive causal evidence. In this limitation, the pattern of results is generally consistent with the proposed model: HRM Capabilities was positively related to Supply Chain Recovery and Operational Resilience, Supply Chain Recovery was positively related to Operational Resilience, Supply Chain Recovery mediated part of the HRM Capabilities-Operational Resilience relationship, and Extreme Disruption Intensity was negatively related to Supply Chain Recovery.

H1 was supported. Supply Chain Recovery was positively and statistically significantly related to HRM Capabilities. This finding aligns with the theoretical hypothesis that workforce flexibility, quick staff reassignments, supervisor empowerment, and knowledge sharing during crises can assist QSR organizations to organize recovery efforts in the event of procurement, logistics, or ingredient continuity disruptions. The result also aligns with the previous HRM and capability studies that propose that workforce-related systems may be linked to responsiveness and operating outcomes (Chang et al., 2013; Wright et al., 2003).

H2 was supported. Operational Resilience was positively correlated with Supply Chain Recovery. This finding is consistent with the literature on supply chain resilience that considers recovery, responsiveness, and adaptive supply continuity as significant aspects of disruption management (Ambulkar et al., 2015; Chowdhury and Quaddus, 2016). QSR organizations that reported greater alternative sourcing, logistics recovery, distributor communication, and menu or bundle reconfiguration also reported greater service continuity and operational adaptability in the current sample.

H3 was supported. Even with Supply Chain Recovery, HRM Capabilities were positively related to Operational Resilience. This suggests that workforce-related capabilities may be related to resilient operations through more than one pathway. There are mechanisms that can be based on supply chain recovery and others that can be based on staffing continuity, problem solving, local decision-making, and service process adaptation that are not fully reflected by the recovery mediator.

H4 was supported. The positive and statistically significant relationship between HRM Capabilities and Operational Resilience via Supply Chain Recovery was indirect. Since the direct relationship between HRM Capabilities and Operational Resilience was also important, the trend is in line with partial mediation. This must be taken as a conservative supported indirect relationship, not as evidence of temporal mediation. However, it indicates that one of the possible mechanisms by which workforce-related capabilities are connected to operational resilience in this sample is supply chain recovery (Nitzl et al., 2016).

H5 was supported. Extreme Disruption Intensity was negatively associated with Supply Chain Recovery. The substantive significance of this finding is that it suggests that perceived macroeconomic volatility, frequency of supply shock, and operating pressure can limit recovery conditions despite organizations reporting HRM capabilities. The outcome warns against overstating the ability of internal capabilities to counteract extreme contextual disruption.

H6 was not upheld. The interaction between HRM Capabilities and Extreme Disruption Intensity was not significant. This finding cannot be taken to mean that the intensity of disruption does not matter. Instead, the model suggests that disruption intensity was more of a direct contextual constraint on Supply Chain Recovery than a condition that altered the strength of the HRM Capabilities-Supply Chain Recovery relationship.

A possible explanation is that, in a disruption-prone operating environment like the QSR sector in Iraq, external volatility can be viewed as a background state, as opposed to an episodic contingency that significantly changes the utility of workforce-related capabilities. When companies regularly work in a macroeconomic volatility environment, import delays, logistics bottlenecks, and local market uncertainty, managers might already consider disruption as a normal operating environment. In this case, HRM Capabilities can be equally linked to recovery at all levels of disruption, whereas extreme disruption alone decreases the resources and external choices to recover.

The second interpretation is that HRM Capabilities can be helpful but not enough to overcome externally imposed recovery constraints. Flexibility of the workforce can assist the branches to adjust schedules, reallocate tasks, and sustain service routines, but it might not change the availability of ingredients, suppliers, transportation, or purchasing power when the intensity of disruption is high. The third option is methodological: interaction effects in survey-based PLS-SEM tend to be smaller than direct effects, and the current sample might have been more powerful to identify medium direct effects than very small moderation effects. Based on this, the non-significant moderation finding must be viewed with caution and retested in longitudinal or multi-context studies. Future studies can focus on more immediate moderators, including supplier diversification, digital supply chain visibility, inventory buffers, franchise governance, or local sourcing intensity.

5. CONCLUSIONS

Theoretical implications

This research has three theoretical implications, which are made conservatively in the view of the research design. First, it offers empirical data on a single disruption-prone QSR setting that HRM Capabilities, Supply Chain Recovery, and Operational Resilience can be jointly modeled in a PLS-SEM framework. This helps to argue that HRM Capabilities cannot be studied as internal workforce practices only; they can also be applicable to recovery-oriented operational and supply chain processes. This implication is in line with resource-based and dynamic capabilities arguments, which highlight the importance of organizational capabilities in adaptation (Barney, 1991; Teece, 2007; Teece et al., 1997).

Second, the strong indirect relationship via Supply Chain Recovery assists in explaining how HRM Capabilities can be connected to Operational Resilience. Instead of a direct association, the model demonstrates that a recovery-oriented supply chain construct describes a portion of the relationship. This result adds to a more process-oriented understanding of resilience by connecting workforce capabilities to particular recovery processes. It is also consistent with the PLS-SEM guidelines to test theoretically significant mediation in the case when the model suggests indirect relationships (Hair et al., 2019; Nitzl et al., 2016).

Third, the findings differentiate between direct contextual pressure and moderation. Extreme Disruption Intensity had a direct and negative relationship with Supply Chain Recovery, but did not moderate the relationship between HRM Capabilities and Supply Chain Recovery. This difference is theoretically helpful as it suggests that the intensity of disruption should not be automatically modeled as a boundary condition. The evidence in this study suggests a more straightforward interpretation: the greater the perceived disruption intensity, the less the recovery capability, and the HRM-recovery relationship is statistically consistent at all levels of disruption intensity.

Managerial implications

The findings imply that workforce practices and supply chain recovery procedures can be effectively handled as interrelated operational capabilities by QSR managers in Iraq. Cross-training, flexibility of shifts, empowerment of supervisors, and systematic knowledge sharing can assist employees and managers to react better when suppliers, logistics, ingredients, or demand conditions vary. These practices cannot be considered as standalone HR activities; they can be used to complement the practical recovery routines required to ensure continuity of services.

The results also suggest that recovery planning should combine people-related practices with supply chain routines. Managers can find it helpful to record alternative sourcing, enhance communication with distributors, create flexible menu or bundle options, and develop branch-level recovery plans. Since the research established a negative relationship between the intensity of disruption and supply chain recovery, internal capabilities cannot be considered as adequate. External buffers, supplier diversification, inventory flexibility, and visibility of critical inputs are also factors that managers should take into account.

The non-significant moderation result has a practical implication as well. It implies that managers cannot presume that HRM Capabilities are automatically more or less effective with increased disruption intensity. Rather, the findings indicate the worth of developing HRM

Capabilities on a regular basis as well as decreasing the direct operational load posed by extreme disruptions. This might necessitate concurrent investments in workforce flexibility and supply chain contingency planning.

Limitations and Future Research

There are a number of limitations to this study. To begin with, the data were gathered using a cross-sectional online survey, which restricts causal inference and does not allow tracking the development of capabilities and recovery over time. Longitudinal designs could be employed in future studies to determine whether HRM Capabilities are antecedents of Supply Chain Recovery and whether recovery practices are antecedents of Operational Resilience.

Second, everything was founded on the perceptions of the respondents. Although perceptual measures are common in organizational research, they may be affected by respondent judgment, recall, and common method variance. Future studies could combine survey data with objective or archival indicators, such as service time, delivery delays, product availability, ingredient stockouts, branch-level recovery time, or supplier lead-time variability.

Third, the research was restricted to the QSR industry in Iraq and 243 valid responses. The sample is above the inverse square root standard of identifying effects of about.20 or more in PLS-SEM, but the results cannot be automatically extrapolated to all food service companies, all Iraqi companies, or other national settings. Future studies could use the model in other hospitality, retail, logistics, or food service settings and establish whether the structural relationships are universal across settings.

Fourth, the moderation hypothesis was not upheld. There are other moderators that are more directly linked to recovery capacity can be implemented in future research, like digital supply chain visibility, supplier diversification, organizational size, franchise governance, inventory policy, or managerial experience. Multi-group analysis can also be applicable in case future samples have enough cases in terms of chain type, city, ownership structure, or disruption exposure.

Fifth, all constructs were identified as reflective in the study. Although this specification is theoretically defensible in the framework of the constructs used in this study, future research can explore whether some of the operational capability constructs are more formatively or higher-order constructs. Such extensions should be conceptually explained and evaluated using the assistance of corresponding PLS-SEM.

Concluding remarks

This paper approximated a PLS-SEM model between HRM Capabilities, Supply Chain Recovery, Extreme Disruption Intensity, and Operational Resilience in the QSR industry in Iraq. According to 243 valid responses, HRM Capabilities had a positive relationship with Supply Chain Recovery and Operational Resilience. Supply Chain Recovery had a positive relationship with Operational Resilience and partially mediated the relationship between HRM Capabilities and Operational Resilience. The Intensity of Extreme Disruption was found to have a negative relationship with Supply Chain Recovery, and the moderating role of the Intensity of Extreme Disruption on the HRM Capabilities-Supply Chain Recovery relationship was not statistically significant.

The general trend of results indicates that workforce-related capabilities and supply chain recovery practices can be interrelated organizational capabilities in disruption-prone service operations. Meanwhile, the negative direct relationship between the intensity of disruption and

supply chain recovery indicates that recovery ability can be limited by external pressure. This is why operational resilience in the context under consideration seems to be contingent on internal capacity as well as the capacity to cope with the immediate operational load of disruption. The results are to be viewed as study-specific statistical evidence that is in line with the suggested theoretical model and as a foundation of further longitudinal and comparative studies.

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APPENDIX A. CONSTRUCT INDICATORS

The construct indicators were coded as follows: HRM Capabilities (HRMC1-HRMC4), Supply Chain Recovery (SCR1-SCR4), Operational Resilience (OR1-OR4), and Extreme Disruption Intensity (ED1-ED3). All indicators were measured on a five-point Likert scale, where higher values indicated stronger agreement with the relevant statement.