Conceptualization of 'Relational Coordination' as Reflective-Formative Higher-Order Latent Construct

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Abstract

Despite the multidimensional nature of the relational coordination (RC) construct, prior research has explored it as a lower-order reflective construct, based on a simple summation of mean scores of its (observed) manifestations. This study evaluates the psychometric properties of RC while conceptualizing it as a type II reflective-formative higher-order latent construct. Using quota sampling procedure, data was gathered from employees of the healthcare sector of Peshawar, Pakistan. Results of analysis using embedded two-stage approach, revealed that RC can be conceptualized as a higher-order latent construct, with Relational Dimension and Communication Dimension as its lower-order constructs, that form the overall domain of the construct. The study contributes to existing literature and implies that, while linking RC to its antecedents and/or outcomes, instead of computing RC scores via linear summation and average, it should be conceptualized as a latent construct. The study successfully applied PLS-SEM in a new context as prior literature has not analyzed RC as a latent construct, particularly in the context of healthcare.

Keywords: *relational coordination, latent Construct, higher-order-construct, reflective-formative, PLS-SEM*

Introduction

For the accomplishment of successful teamwork, coordination and interaction among team members is essential. RCT hypothesizes that the quality and efficiency outcomes are simultaneously affected by relational coordination, especially in the conditions of reciprocal interdependence of task, the uncertainty of task or input, and time constraints. Relational Coordination (RC) is successfully linked with quality and efficiency outcomes (Gittell & Logan, 2015) in a variety of organizational settings, including healthcare, airline, banking, and education. It is also found to be predictive of a variety of positive outcomes for individuals performing coordinated work processes (Havens, Gittell & Vasey, 2018; McDermott et al., 2019). It is positively associated with work engagement, job satisfaction and quality of life (Gittell, Weinberg, Pfefferle & Bishop, 2008; Havens et al., 2018), proactive work behaviors, greater career

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satisfaction, reduced burnout, and increased motivation (Cramm, Hoeljmakers & Nieboer, 2014; Naruse, Sakai & Nagata, 2014). RC is defined as "a process of mutually reinforcing communicating and relating among workers to integrate coordinating tasks" (Gittell, 2002, p. 300). Relational Coordination Theory (RCT) posits that relationship and communication quality between individuals affects how well they jointly accomplish coordination (Gittell, 2003). Thus, RC is a multidimensional construct, where two broad dimensions are the relational and communication dimension. Within the relational dimension, three sub-dimensions are mutual respect, shared knowledge, and goals reinforced by four sub-dimensions of communication dimension i.e. frequent, timely, accurate, and problem-solving communication (Gittell, 2003, 2006).

Despite the multidimensional nature of RC, previous studies have explored RC as a lower-order reflective construct computing its composite score based on a simple summation of mean scores of its (observed) manifestations using a linear weighting process (Gittell, et al., 2020, Altalib, et al., 2019; Falatah, & Conway, 2019). This is critical for computing the numerical RC scores and examining the strengths of relational ties among task performers. However, for linking RC to its antecedents and outcomes conceptualizing it as a latent factor is more appropriate to account for measurement error (Chin, 1998; Hair, Hult, Ringle, & Sarstedt, 2014). Therefore, this research endeavored to assess the psychometric properties of RC while conceptualizing it as a higher-order construct (HOC), with relational dimension (RelD) and communication dimension (ComD) being the lower-order constructs (LOCs) defining the RC as reflective-formative HOC. Recently, structural equation modeling has been used to test complex models involving higher-order constructs (Ringle, Sarstedt, Mitchell & Gudergan, 2020). Using HOC adds to the parsimony of the model (Polites, Roberts & Thatcher, 2012) and in the case of formative constructs, HOCs help to reduce collinearity problems (Hair, Sarstedt, Ringle & Gudergan, 2018). Therefore, this study employed Partial Least Square-Structural Equation Modeling (PLS-SEM) to evaluate RC as a higher-order reflective-formative latent construct.

Measurement of RC

RC is typically assessed via Gittell's (2003) RC Survey, a 7-items 5-point Likert type scale, that assesses communication and relational dimensions of RC between workers as they interact on the job. RC among workers is measured by surveying them about their relationships (3-items)

and communication (4-items) with other workers involved in that same work process (Gittell, 2012). Collectively, these 7-items form indicators/manifests of the relational coordination construct. However, despite this multidimensional nature, previous studies have explored RC as a lower-order reflective construct measured across these seven dimensions (e.g., Altalib, et. al., 2019; Falatah & Conway, 2019; Gittell, et al., 2020; Sajid, et. al., 2019) using the procedure highlighted by Gittell (2012). Using this procedure RC is computed as a composite score based on a simple summation of mean scores of its (observed) manifestations using a linear weighting process; meaning that all the indicators equally contribute to form the composite (Henseler et al., 2014) RC score. This is necessary for computing RC scores and assessing the strengths of relational ties among task performers. However, for linking RC to its antecedents and outcomes conceptualizing it as a latent factor is more appropriate to account for measurement error (Chin, 1998, Hair et al., 2014), which is the difference between measured and true value (Hair, Hult, Ringle & Sarstedt, 2017). This research, therefore, hypothesized that RC can be conceptualized as a Type II higher-order reflective-formative latent construct (Sarstedt et. al., 2019) and evaluated psychometric properties for such conceptualization. The higher-order conceptualization is depicted in Figure 1.

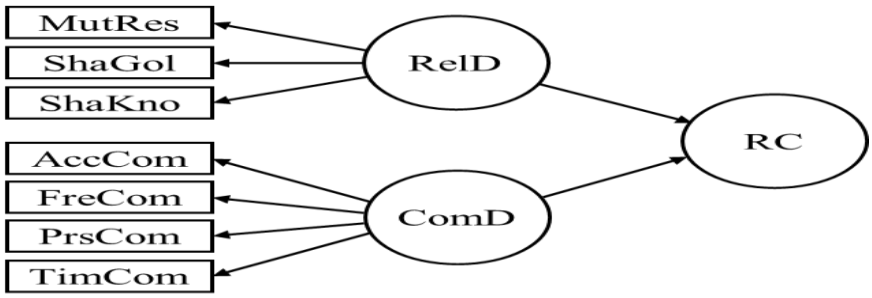

Figure 1: Relational Coordination as Type II reflective-formative HOC

Methods

Procedure

Following the procedure highlighted by Gittell (2012) for assessment of RC, a broad focal work process of "Patient Care" was selected, followed by the selection of cross-functional workgroups, coordinating for the accomplishment of the focal work process. Six functional groups (Doctors, Residents, Nurses, Technologists, Technicians/ Paramedics, and Administrators) involved in the focused

work process of 'patient-care', were selected based on relevant literature (Gittell, 2012; Gittell et. al., 2020) and informational interviews. Informational interviews were conducted with five healthcare practitioners, two subject matter experts, and four patients, and were based on only one question, i.e., "In your view, which functional groups are involved to successfully coordinate the process of patient care?". The results led to the identification of the six functional groups. After administering the survey, RC scores were computed for each of the respondents, by computing a variable for all the seven dimensions and then computing the aggregation of these individual scores. At the dyadic level, six variables were computed for each of the respondents–one for relational coordination with doctors, another for relational coordination with residents, and so on (See annexure-1 for detailed computation). In the PLS-SEM path model, RC was incorporated as a Type II higher-order reflective-formative construct. Using the embedded two-stage approach suggested by Ringle, Sarstedt & Straub (2012) and Sarstedt et. al., (2019) was used to assess the path model. At stage 1, the measurement model of the lower-order constructs (LOCs) was assessed followed by stage 2 assessment of the measurement model of HOC and the structural model. While estimating the PLS-SEM path model, Mode B was used to estimate Type II: Reflective-formative specified RC construct as suggested by Sarstedt et. al., (2019).

Table 1: Population and Sample

	Population			
	Hospital 1	Hospital 2	Hospital 3	Total
Doctors	380	299	214	893
Residents	1054	1024	879	2957
Nurses	975	382	227	1584
Technicians/ Paramedics	568	361	213	1142
Technologists	199	126	83	408
Administrators	127	54	41	222
Total	3303	2246	1657	7206
	Sample			
	Hospital 1-Quota	Hospital 2- Quota	Hospital 3- Quota	Total
Doctors	26	21	15	62
Residents	73	71	61	205
Nurses	68	27	16	110
Technicians/ Paramedics	39	25	15	79
Technologists	14	9	6	28

Administrators	9	4	3	15
Total	229	156	115	500

Population and Sample

Data was collected from healthcare professionals working in three tertiary care providing hospitals operating in the public sector in Peshawar, Pakistan. Following Hair et al., (2017) recommendation of a satisfactory sample of 10–20 cases per parameter, the minimum required sample was computed to be 300. However, considering the 'the larger the better' as a rule of thumb for sample size, the target sample size was set to be 500. Considering the non-availability of sample frame and stratified nature of data quota sampling technique was employed (Saunders, Lewis & Thornhill, 2015) to select a sample of respondents from each stratum. Out of 456 questionnaires, that were received back, 438 were used for analysis, after discarding incomplete, incorrect, or straight-lined. Table 1 presents the population and sample details and Table 2 presents characteristics of the sample.

Table 2: Demographic characteristics of the respondents

Demographic Variables	Category	Frequency	Percentage
Gender	Male	278.00	63.47
	Female	160.00	36.53
Age (Years)	21-30	162.00	36.99
	31-40	192.00	43.84
	41-50	37.00	8.45
	51-60	38.00	8.68
	>60	1.00	0.23
	Non-Response	8.00	1.83
Experience (Years)	1-10	358.00	81.74
	11-20	48.00	10.96
	21-30	26.00	5.94
	>30	1.00	0.00
	No Response	5.00	0.01
Education	College	15.00	3.42
	Bachelor/MBBS/BS	388.00	88.58
	Masters/FCPS	28.00	6.39
	MS/M. Phil	6.00	1.37
	PhD	1.00	0.23
Functional Groups	Doctors	56.00	12.79
	Residents	180.00	41.10

Nurses	96.00	21.92
Technicians/Paramedics	69.00	15.75
Technologists	24.00	5.48
Administrators	13.00	2.97

Data Analysis & Results

PLS-SEM was used to analyze the research model, using the Embedded Two-Stage approach. SmartPLS3.0 (Ringle, Wende & Becker, 2015) software was used to test the measurement model at stage 1, followed by the evaluation of the measurement model and structural model at stage 2 as recommended by Hair et al., (2017) and Sarstedt et. al., (2019). The use of PLS-SEM was considered for several reasons. First, because of the exploratory nature of the study, there is little insight into the structure of RC (Richter, Sinkovics, Ringle & Schlägel, 2016). Second, for social sciences research, PLS-SEM is a recommended approach (Richter et al., 2016) and has a higher statistical power (Hair et al., 2017).

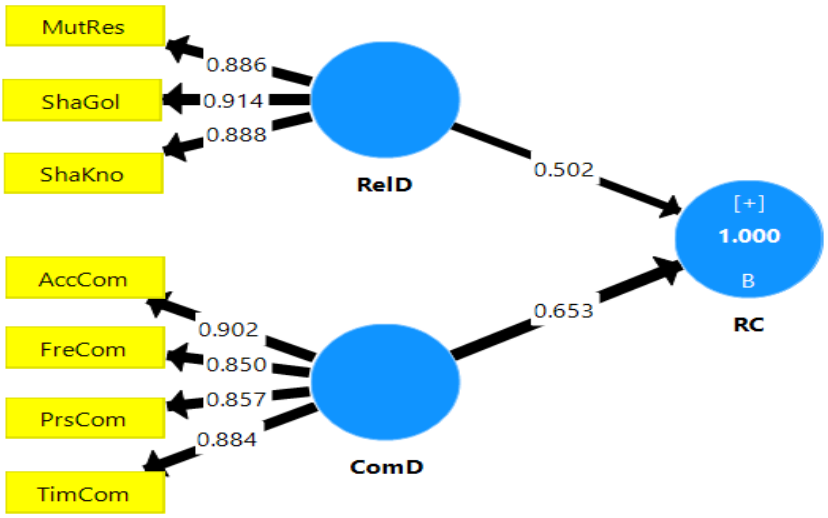

Figure 2: PLS path model (measurement model for LOCs)

Stage 1: Measurement Model of LOCs

At stage 1 the measurement model of LOCs (RelD and ComD) was assessed in terms of internal consistency reliability, Convergent Validity (CV), and Discriminant Validity (DV) as suggested by Hair et al., (2017). Internal consistency reliability is the extent to which the

items/indicators of a construct truly measures that latent construct (Hair, Black, Babin & Anderson, 2010). A highly regarded measure of internal consistency reliability is Composite reliability (CR) instead of generally used Cronbach's α (Hair et al., 2017). A composite reliability score of up to "0.6 is acceptable in exploratory research but values above 0.95 indicate redundancy" (Avkiran, 2017, p. 4).

Table 3: LOCs Reliability and Validity (psychometric measurements)

Constructs	Indicators	Outer Loading	*t*-stat.	Confidence Intervals (bias corrected)		CA	CR	AVE
				2.50 %	97.50 %			
RelD	ShaGol	0.914*	97.229	0.892	0.929	0.877	0.924	0.802
	ShaKno	0.888*	71.795	0.86	0.909			
	MutRes	0.886*	76.038	0.859	0.906			
ComD	AccCom	0.902*	85.511	0.879	0.92	0.896	0.928	0.762
	FreCom	0.850*	55.11	0.813	0.875			
	TimCom	0.884*	69.452	0.858	0.907			
	PrsCom	0.857*	53.486	0.825	0.884			

Notes: CA=Cronbach's Alpha, CR=Composite Reliability, AVE=Average Variance Extracted, RelD=Relational Dimension, ComD=Communication Dimension.
*** $p < 0.01$**

Indicators loadings, CR values, and AVE values for both the LOCs are presented in Table 3. The CR value for ComD (0.928) and RelD (0.924) provided evidence for internal consistency reliability (Nunnally and Bernstein, 1994; Hair et al., 2014). CV is the "extent to which a measure correlates positively with alternative measures of the same construct" (Hair et al., 2017, p.112). Average Variance Extracted (AVE) of a construct and outer loadings of the indicators are determinants of and CV (Hair, Ringle & Sarstedt, 2011; Hair et al., 2014). The outer loadings (Table 3 and Figure 2) exceeded the critical value of 0.708 for both the constructs, representing satisfactory results (Nunnally, 1978; Hair et al., 2014). AVE scores for both the constructs i.e., ComD and RelD were

found to be 0.762 and 0.802 respectively, thus confirming the CV. Both inner and outer VIF values were found to be well below the cut-off value of 5 (Hair et al., 2017), thus there were no collinearity issues. Discriminant validity (DV) is "the degree to which a construct is truly distinct from other constructs by empirical standards" (Hair et al., 2017, p. 115). Fornell and Larker (1981) test and Henseler, Ringle & Sarstedt (2015) Heterotrait-Monotrait (HTMT) ratios of correlations were examined to evaluate the DV of the LOCs.

Table 4: Tests of Discriminant Validity

	Fornell and Larker Test		HTMT Ratios
	ComD	RelD	ComD
ComD	**0.873**		
RelD	0.488	**0.896**	0.551

Notes: ComD=communication Dimension, RelD=Relational Dimension
The bold numbers on the diagonal represent the square root of AVE. Off-diagonal numbers are correlations among constructs.

According to Fornell and Larker criterion, the square root of AVE should be higher than the values of its bivariate correlations with all other constructs (Hair et al., 2017). Values of the square root of the AVE (Table 4) for each component exceeded 0.873 and were greater than the correlation between them. An HTMT score should be less than $HTMT_{0.85}$ (Clark and Watson, 1995) or $HTMT_{0.90}$ (Gold, Malhotra & Segars, 2001). The results of the HTMT ratio of correlation (Table 4) showed that the LOCs exhibited discriminant validity at $HTMT_{0.85}$, confirming that the constructs measure a unique concept.

Stage 2: Measurement Model of HOCs

At stage 2, the latent variable scores of LOCs were saved as new variables in the dataset and were specified as formative indicators for RC, followed by an assessment of the model. As the PLS algorithm requires at least two constructs to estimate the path model, therefore, before running the algorithm, the composite score of RC (computed as linear summation) was added as a new construct to the path model (Figure 3). The measure model for HOC (i.e., RC, specified as formative HOC) was then evaluated in terms of outer weights, internal consistency reliability, Convergent Validity (CV), and Discriminant Validity (DV).

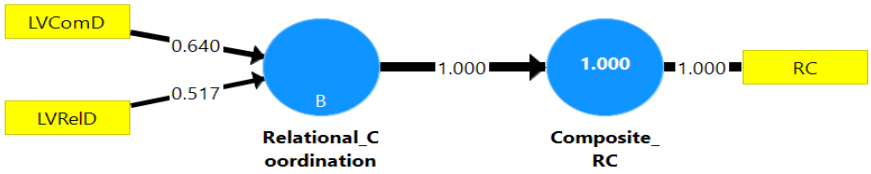

Figure 3: PLS path model (measurement model for HOCs)

Table 5: HOC Reliability and Validity (psychometric measurements)

Constructs	Indicators	Outer Weights	*t*-stat.	Confidence Intervals (bias corrected)		VIF	Sig.
				2.50 %	97.50 %		
RC	LVComD	0.640	50.997	0.615	0.664	1.313	0.00
	LVRelD	0.517	33.983	0.49	0.549	1.313	0.00

Notes: VIF=Variance Inflation Factor, RC=Relational Coordination, LVComD=Latent Variable score of Communication Dimension, LVRelD=Latent Variable Score of Relational Dimension.

Table 5 presents the results for evaluation of measurement model of reflective-formative specified higher-order construct 'RC'. The values of weights, t-statistic, and significance of weights show that both the indicators (RelD and ComD) are significant determinants of RC. VIF value of 1.313 also indicates the non-presence of collinearity issues. Redundancy analysis on an alternative single or multi-item measure should be used to assess the CV of the higher-order formative constructs (Hair et.al., 2017; Sarstedt et. al., 2019). However, no alternative single- or multi-item measure is available for RC. Therefore, redundancy analysis was performed using the RC score yielded by (unweighted) linear summation of the average of its reflective indicators which yielded a path coefficient of 1.000.

Discussion

The purpose of this study was to assess the psychometric properties of relational coordination construct while conceptualizing it as a type II reflective-formative higher-order construct (Sarstedt et. al., 2019). The analysis of psychometric properties of the lower order constructs 'relational dimension' and communication' revealed that both the dimensions are significant determinants of their respective indicators. Similar results are reported by prior research (e.g., Falatah & Conway,

2019 and Gittell et al., 2020), however, these researchers computed RC as linear summation and reported Cronbach alpha as a measure of reliability rather than composite reliability. The high and significant loadings of the indicators on their respective constructs, composite reliability, convergent and discriminant validity of the constructs (Hair et al., 2017) provided evidence of successful conceptualization. Moreover, the analysis using embedded two-stage approach (Ringle et al., 2012; Sarstedt et. al., 2019) provided evidence that two dimensions of RC i.e. relational dimension and communication dimension significantly affects the relational coordination construct, and form the overall domain of the construct (Gittell et al., 2020). Thus, the findings revealed that RC can be conceptualized as a higher-order reflective-formative construct.

Limitations and future research directions

This research is not without limitations. The cross-sectional design and non-random sampling procedure for selecting samples from within the quota limit the generalizability. Moreover, RC was successfully conceptualized as higher-order reflective-formative construct, the scope of the study was limited in that no antecedent or outcome construct of RC was included in the study. Therefore, future studies are recommended (1) to employ longitudinal designs (2) and use probability sampling techniques. Moreover, (3) incorporating antecedents and/or outcomes constructs of RC such as work engagement and job satisfaction (Gittell et al., 2020), job embeddedness (Mitchell et al., 2001), turnover intention (Falatah & Conway, 2019), and/or mediating and moderating construct such as motivation (Waddimba et al., 2016) would further provide significant evidence for conceptualizing RC as higher-order construct.

Conclusion and Implications

Employing the embedded two-stage approach to evaluate the reflective-formative higher-order conceptualization of RC, findings of the present study revealed that RC can be successfully conceptualized as a higher-order construct, with adequate reliability and validity. This conceptualization was tested by collecting data from healthcare professionals in Peshawar, Pakistan. The findings revealed that the two constituent dimensions of RC (i.e., relational dimension and communication dimension) as lower-order constructs are formatively associated with RC. Both the lower-order constructs are however specified as reflective constructs influencing their respective indicators. Thus the methodological implication of these findings is that, instead of computing

RC scores via linear summation and average, it should be conceptualized as a latent construct, while linking it to antecedents and/or outcomes. Furthermore, for social science research, SEM is contemplated to be a superior methodology (Memon et al., 2018). However, previous RC studies mostly relied on first-generation analysis methods. Therefore, this research implies that RC should be conceptualized as a higher-order reflective-formative construct, using SEM as a method of analysis, particularly PLS-SEM.

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