

Development and Validation of Human Resource System Model Using Exploratory and Confirmatory Factor Analysis

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Abstract

This study aims to empirically develop and validate a human resource (HR) system model via exploratory and confirmatory factor analysis (EFA and CFA). The framework proposed, and findings expect to add to an understanding of the procedures that can be embraced for designing the HR system on the basis of the bundling of different strategic HR practices. The data were collected through a structured questionnaire. The sample frame for this study consisted of officer-level employees from 11 Nepalese commercial banks. The final research sample consisted of 248 respondents. This study proposes an answer to how the HR system model can be developed and tested. It validated the extraction of 8 HR practices (dimensions) from 38 items, which were further validated as first-order constructs with 33 items, and the second-order HR system model with 30 items. The tested HR system model provides a comprehensive and holistic picture of the HR system and could be applied to Nepalese organizations. The methods and procedures adopted by this study to develop and validate the HR system model are expected to help Nepalese HR managers and practitioners design their HR policies and practices toward enhanced organizational performance (OP). The findings of this study are significant in the Nepalese context, where human resource management (HRM) still needs to be taken as a system approach on the basis of a multidimensional concept.

Keywords: HR System, Confirmatory Factor Analysis, Exploratory Factor Analysis.

Introduction

There has been a growing agreement in the strategic human resource management (HRM) literature about the need to integrate HRM practices (Boon et al., 2019). Many studies have suggested that specific human resource (HR) practices help develop unique qualities of human resources to enhance competitive advantage and performance (Michie & Sheehan, 2001; Ahmad & Schroeder, 2003; Guest et al., 2003). HR policies and practices may only be effective if they are developed as parts of the overall HR system. A robust HR system is an intangible asset that generates value by being incorporated into an organization's operational systems to develop human capabilities.

Nepal's human resource management practices are at an early stage of development; the investment in human resources in Nepal is still less regarded as providing benefits to the organization (Gautam & Davis, 2007), and there is a somewhat contradictory pattern in the workplace (Adhikari, 2005). Nepalese organizations tend to follow the systems and practices adopted from developed countries (Gurung & Choi, 2019). Furthermore, the development and validation of the HR system model is highly relevant in Nepal in the pretext of taking HRM as a unidimensional concept on the basis of individual practices rather than a multidimensional

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HR system perspective. For example, Bhandari (2008) and Pandey (2015) investigated the relationship between individual HRM practices and organizational outcomes in Nepalese banks without developing and validating a model of the HR system. On the basis of the horizontal fit (bundling) of the configurational perspective (Arthur, 1994; MacDuffie, 1995; Delery & Doty, 1996; Marchington et al., 2011), this study explores the possible strategic HR practices bundle in Nepalese commercial banks to develop and validate the HR system model.

Given the strategic importance of the HRM system in organizations and the lack of valid instruments to measure employees' perceptions of the practices and policies of the HR system, the present study has the objective of developing and validating the HR system model by taking samples of Nepalese commercial banks. The banking sector has been selected for this study for its importance in the economy, relatively better governance, and enriched performance (Gautam & Davis, 2007), even with more regulatory and competitive pressures arising from changing customer needs and expectations and operating in a complex and dynamic environment.

Literature Review

SHRM Models

There are four SHRM models: universalist, contingent, contextual, and configurational, as described by Delery and Doty (1996). The universalist models confirm with a high degree of statistical significance the impact of human resource management on organizational performance (Huselid, 1995; Pfeffer, 1998; Becker & Huselid, 1998). However, the universalistic theory is criticized as becoming prescriptions only for red oceans full of like-minded firms competing on the same HR terms (Harney & Collings, 2021). The contingent perspective describes factors related to strategic, organizational, and environmental factors that mediate the relationship between human capital and organizational performance (Hendry & Pettigrew, 1990; Becker & Gerhart, 1996). It emphasizes the need for the best fit between HRM strategies and organizational strategies (Iqbal, 2019). Studies have shown that both of these perspectives fail to analyze the complexity of HR strategies (Schuler & Jackson, 1987; Marler, 2012). Furthermore, the configurational framework advocates internal dynamics within the SHRM construct and suggests that HR functions or practices can be defined as a system composed of diverse, interconnected elements (Wright et al., 1992; Jiang et al., 2012) and justifies the need for internal consistency (Verburg et al., 2007; Kidron et al., 2013). On the basis of the configurational perspective (Delery & Doty, 1996), the fit in HRM has been widely discussed through vertical and horizontal fit.

Vertical Fit

Vertical fit refers to the alignment of the HRM system with other organizational characteristics (Guest, 2011). The concept of vertical fit is one of the preliminary approaches of strategic HRM. Fombrun et al. (1984) proposed a framework that emphasized the analysis of the factors that affect organizations both externally and internally. The study of Miles and Snow (1984) revealed the vertical fit between business and HR strategies. According to Boxall and Purcell (2003), vertical fit encompasses the HR strategies considered to improve organizational performance. All these studies emphasized the links between organizational objectives and HRM approaches.

Horizontal Fit

The horizontal fit advocates the alignment of HR activities or practices with each other for mutual reinforcement. The level of internal consistency among HR practices enhances organizational performance through synergies (Fombrun et al., 1984). This perspective asserts that HRM should be designed as a cohesive and interconnected set of policies and practices

(Marchington et al., 2011). According to Marchington and Grugulis (2000), HR practices should be combined to shape a coherent system so that they are effectively implemented. A high degree of horizontal fit leads to synergies for better organizational performance (Ridder et al., 2012; Kidron et al., 2013). Delery and Doty (1996) advocated the importance of internal consistency for the HRM system and explored synergistic effects resulting from this fit. MacDuffie (1995) stated that innovative HR practices affect performance as a bundle with interrelated and consistent elements, not individually.

In line with the above concepts, this study has embraced a systemic perspective of HRM instead of focusing on individual HR practices in isolation. To date, Nepalese research has yet to attempt to address the development and validation of an HR system on the basis of the bundling concept, and this study aims to fill this gap.

Methodology

This study has adopted a quantitative approach to collect and analyze data and validate the results. HR practices were measured through 48 items taken from the extant literature. In accordance with Gardner, Wright, and Moynihan (2011), bundles of HR practices were conceptualized as a formative index. The data related to HR practices from the perspective of the employees were collected via questionnaires with a Likert scale (Likert, 1932) ranging from 1 (strongly dissatisfactory) to 7 (enormously satisfactory) (Theriou & Chatzoglou, 2008; Lin & Kuo, 2007). Eleven commercial banks (out of 20) were selected randomly. The participants of this study were 252 employees at the officer level of the sample banks. Confirmatory factor analysis (CFA) was also used, with composite reliability (CR) assessed for various HRM dimensions. A CR greater than 0.7 should be considered adequate (Hair et al., 2010; Hu & Bentler, 1999).

Scale Development

The scale of the HR system was developed in two steps: exploratory factor analysis (EFA) and confirmatory factor analysis (CFA). EFA was performed to extract HR dimensions or factors from the HR items. Confirmatory factor analysis (CFA) was utilized to determine if the data aligned with the proposed measurement model for HR practices, both individually and collectively, as the final model assessing the HR system.

In the first step, first-order CFA of 8 HR practices was performed to check the model fit of an individual dimension called unidimensionality (Kim & Mueller, 1978), i.e., to assess whether the various items within each dimension of HRM genuinely reflect those dimensions. The second-order CFA was used to check that the theorized HR dimensions loaded into the primary constructs. Like the first-order factors (individual HR practices), the second-order factor (HR system) was also wholly latent and unobservable. In accordance with Byrne (1994), Nunnally, (1978), Bollen and Long (1993), Harrison and Rainer (1996), Hair, Anderson, Tatham & Black (1998), Hu and Bentler (1999) and Gaskin and Lim (2016), different fit measures were used to evaluate the model fit for each construct, as shown in Table 1.

Test of Normality

Some conditions were checked before conducting the EFA. The missing data were excluded via the listwise deletion method (Tabachnick & Fidell, 2007). Furthermore, the Mahalanobis distance (Mahalanobis, 1936) statistics ($p < 0.05$) were calculated to identify the multivariate outliers, on the basis of which four outlier responses were removed.

Table 1: Process of Scale Development

Steps	Activities
Identification of items and factors	Literature review of best HR practices; Discussion with academician/HR experts/senior managers Identified 48 HR related items
Face and content validity	Qualitative approach; Discussed with a professor of HRM, two HR managers, and two senior bank managers; 41 items were retained with some addition and deletion
Missing data and test of normality	Listwise deletion method; Mahalanobis distance; 4 responses removed
Exploratory factor analysis	Eight factors with 38 items, three items dropped due to low or cross-loadings, factors explained 78% variations; Reliability: $\alpha > 0.7$; Face validity: meaningful and based on concept; Convergent validity: item loadings- > 0.5 ; Discriminant validity: inter-construct correlation < 0.7
First-order CFA	Eight factors were validated with 33 items, 5 items dropped on modification indices and standardized residual covariances; Dimensions 8 (HR practices); Reliability: $CR > 0.7$; Convergent validity: item loadings- > 0.5 , $AVE > 0.5$; Model fit: $CMIN/DF < 3$, $CFI > 0.9$, $SRMR < 0.08$, $RMSEA < 0.06$
Second-order CFA	The HR system construct with 8 factors and 30 items was validated, 3 items dropped on modification indices, and standardized residual covariances; Dimension 1 (HR system); Dimensions 8 (HR practices) Reliability: $CR > 0.7$; Convergent validity: first-order constructs loadings- > 0.5 , $AVE > 0.5$; Discriminant validity: interconstruct correlations < 0.7 , square root of the AVE values of the dimensions $>$ interconstruct correlations; Model fit: $CMIN/DF < 3$, $CFI > 0.9$, $SRMR < 0.08$, $RMSEA < 0.06$.

Analysis and Presentation

As stated in the methodology section, the data were analyzed via exploratory and confirmatory factor analyses.

Extraction of HR Dimensions: Exploratory Factor Analysis

EFA of the 41 HR items was performed on the measured variables. It was necessary to conduct EFA of HR items since they were taken from different researchers. Eight factors related to HR practices were found, which explained 77.61% of the total variance. The KMO measure of 0.915 was well above the threshold of 0.6. These findings indicate that the samples were adequate for the model. The eigenvalues of the factors ranged from 1.616--13.985. Initially, the number of items was reduced from 41 to 38. Among the 41 items measuring HR practices, 3 were eliminated because of their low loadings on any factor or cross-loadings on other factors. These 38 items were subsequently categorized into eight factors: training and development, performance-based compensation and promotion, internal career opportunities, broadly defined job descriptions, job security, worker involvement in problem solving, teamwork, and selective hiring.

Career opportunity - ICAR1	0.791	0.798
Organizational efforts for career advancement -ICAR2	0.744	0.804
Career feedback by the supervisor - ICAR3	0.664	0.704
Development of leaders - ICAR4	0.757	0.785
In-house training- TRAIN1	0.853	0.789
Opportunities for growth and development- TRAIN2	0.727	0.798
Effectiveness of training- TRAIN3	0.838	0.824
Systematic process for identifying development needs- TRAIN4	0.351	0.452
Relevancy of training- TRAIN5	0.849	0.846
Training opportunities- TRAIN6	0.609	0.651
Not worry about job losing- JSEC1	0.671	0.670
Employees as critical assets- JSEC2	0.772	0.787
Expression of opinion freely JSEC3	0.819	0.820
Commitment of management not to lay off employees- JSEC4	0.791	0.786
Clear about job duties- JDES1	0.842	.824
Skill and qualification in the job description- JDES2	0.830	.850
Matching of job and skills- JDES3	0.813	.822
Purpose of job in the job description- JDES4	0.761	.620
Kaiser–Meyer–Olkin (KMO) Measure of Sampling Adequacy		0.915
Bartlett's Test of Sphericity	Chi-Square	7363.556
DF		666
Sig.		0.000

Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.

The Cronbach's α for all the factors is greater than 0.7 (0.853--0.914), indicating that the factors are reliable. The item loadings were higher than 0.5 and greater than 0.7 to satisfy convergent validity. The correlations among the factors were less than 0.7, supporting discriminant validity (Gaskin & Lim, 2016). This indicates that the extracted factors of HRM represent different concepts. All the factors were conceptually sound. Satisfying face validity.

Table 3: Factor correlation matrix of HR practices

Factors	1	2	3	4	5	6	7	8
1. Training and development	1.000							
2. Performance based Compensation and Promotion	0.339	1.000						
3. Internal career opportunity	0.420	0.471	1.000					
4. Broadly defined job description	0.294	0.341	0.511	1.000				
5. Job security	0.257	0.473	0.414	0.248	1.000			

6. Workers' involvement in problem-solving	0.210	0.311	0.175	0.129	0.441	1.000		
7. Teamwork	0.343	0.454	0.551	0.359	0.479	0.421	1.000	s
8. Selective hiring	0.353	0.461	0.459	0.451	0.441	0.340	0.514	1.000

Test of the unidimensionality of an individual HR dimension-first-order model eight different dimensions of the HR system were supported by the EFA. The model fit test of each HR dimension is needed since the questionnaire items were taken from various sources. This was achieved through CFA, which is a theory-testing approach. The first-order CFA aims to check the model fit of the individual dimension of HRM, called unidimensionality, and evaluate the dataset by confirming the underlying structure on a theoretical basis (Mueller, 1996). MIs were examined during the evaluation of model fit to obtain the direction of modification. Considering these issues, the measurement model of each dimension of the HR system is presented in table 4.

Table 4: Summary of initial findings (CFA) of HR dimensions

HRM Dimensions	No of items*	CMIN/DF <3	AVE >0.5	CFI >0.9	SRMR <0.08	RMSEA <0.06	CR >0.7	Remarks
Selective hiring	6/4	1.694	0.595	0.997	0.022	0.053	0.850	SEHIR2 and SEHIR4 are removed due to low loadings.
Teamwork	5/4	0.724	0.655	1.000	0.010	0.000	0.883	TEAM4 is removed due to high standardized residual covariance.
Workers' involvement in problem-solving	4/4	0.322	0.603	1	0.009	0.00	0.858	No alteration
Performance based Compensation and Promotion	5/4	4.490	0.673	0.979	0.035	0.119	0.911	COMP6 is removed due to high standardized residual covariance.
Internal career opportunity	4/4	3.112	0.714	0.994	0.018	0.092	0.909	No alteration
Training and development	6/5	1.684	0.683	0.997	0.017	0.053	0.914	TRAIN4 is removed and TRAIN5 and TRAIN6 are made parameter-free.
Job security	4/4	1.947	0.630	0.998	0.012	0.062	0.869	JOBSEC1 and JOBSEC2 are made parameter-free.
Job Description	4/4	2.360	0.683	0.996	0.023	0.074	0.894	No modification

* The numerators are the initial number of items, and the denominators are the final items.

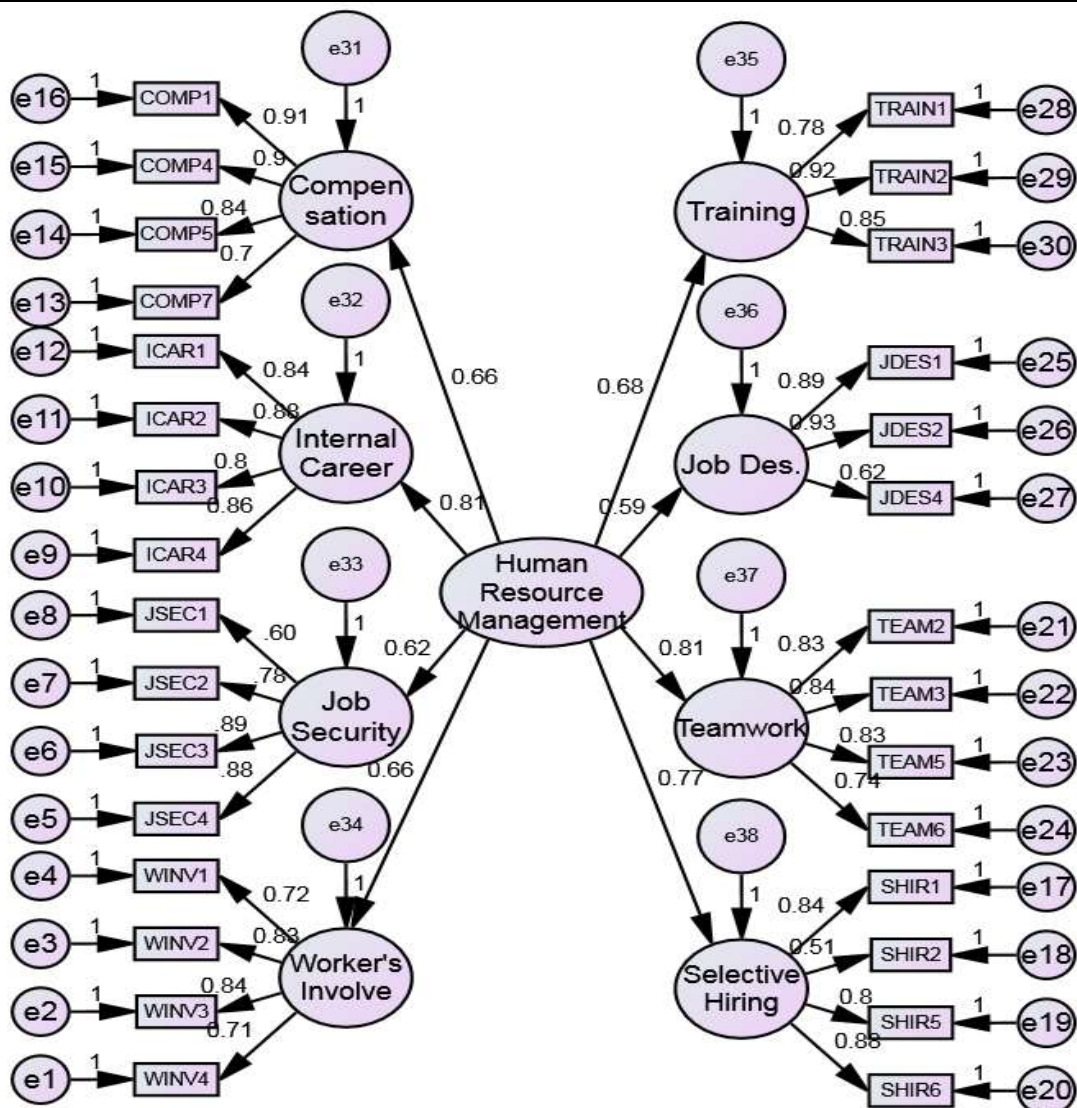
Development and Validation of the HR System-Second-order Model

A second-order CFA of the HR dimensions was conducted to determine whether the eight HRM dimensions were correlated. In this analysis, the HR system was treated as a second-order construct, with the dimensions serving as first-order constructs.

Primary model: The model fit measures for the HRM system included a satisfactory CMIN/DF (2.625) and SRMR (0.082). However, the CFI (0.879) and RMSEA (0.081) were below satisfactory thresholds, indicating a poor model fit. Consequently, the eight-dimensional, 33-item HR model requires further refinement. The CFA results of Gaskin and Lim (2016) indicated that the proposed model did not fit the data well.

Modified and final model: Due to the poor fit of the primary model, modifications were necessary. Through item content analysis, modification indices (MIs), and standardized residual covariances, three items—TRAIN5 (Relevancy of training), TRAIN6 (Availability of training opportunities), and JOBDE3 (Matching of job and skills)—were removed. The refined 30-item model was then tested for model fit. The modified and final models yielded acceptable results. All four model fit indices—CMIN/DF (2.612), SRMR (0.075), CFI (0.912), and RMSEA (0.05)—met the recommended satisfactory values. The composite reliabilities (CRs) for all HR dimensions exceeded the satisfactory value of 0.70, supporting the model's reliability. Additionally, the average variance extracted (AVE) for each construct supported their convergent validity (0.597--0.724), and the square roots of the AVE being higher than the inter-construct correlations confirmed the discriminant validity of the HRM dimensions. The outputs of the CFA analysis indicated a good fit between the model and the data. The final model of the HR system is presented in figure 1.

Figure 1: The final measurement model of the HR system



The standardized loadings of the 8 dimensions (0.587--0.811) were above the acceptable values. The HR system model was a valid model for Nepalese commercial banks.

Discussion

The objective of this study was to develop and validate the HR system model on the basis of the horizontal internal configurational approach of strategic HRM. The collected data were analyzed via EFA and CFA. EFA identified 8 HR practices (selective hiring, training and development, teamwork, performance-based compensation and promotion, internal career opportunities, broadly defined job descriptions, job security, and workers' involvement in problem solving) from 38 HR items (4 items dropped being low or cross-loading) that explained 78% of the total variance. Each individual HR practice was further validated for unidimensionality via first-order CFA. Hereafter, a second-order measurement model of the HR system with the 8 first-order HR practices with 30 items was tested for validation. Cronbach's alpha and the CR coefficient showed good reliability for both the first- and second-order constructs. Validity analysis was performed through qualitative (discussion with academician and bank managers) approaches as well as quantitative methods by analyzing CR, AVE, loading, and correlation.

The 8 HR practices identified by EFA and further validated as first-order constructs provided support for their unidimensionality. The development and validation of the HR system as a second-order construct with those 8 practices supported the horizontal internal fit of strategic HRM partially on the basis of a configurational perspective that states that HR practices should be 'bundled' to be most effective for superior organizational performance (Delery and Doty, 1996) through synergy. The findings of this study are in line with those of Azmi (2009), who concluded that the HR function needs to be integrated internally, i.e., within its subfunctions. The full support may be achieved when this study is taken further to test the hypothesis of whether the system approach of HRM leads to different measures of organizational performance.

Theoretical and Managerial Implications

This study has several theoretical implications. First, the validated model of the HR system provides insights into the conceptualization of the HR architecture as a system, since it highlights the issues of horizontal fit at two levels, the first being the fit between items within an individual HR practice and the second being the fit between the HR practices within the HR system. Second, since the HR items and practices were adopted in the best practices model, they may be applicable in academic studies as well as current practices in diverse organizations. Third, the tested model of the HR system would be rather more important in Nepalese contexts where HR issues are mostly understood and dealt with concerning individual practices, as Gautam and Davis (2007) state, the integration of HR policies and practices at different levels of Nepalese organizations is poor. Hence, the model may be expected to provide fundamental theoretical insight into managing HRM policies and practices for superior organizational outcomes. Fourth, the design of the HR system sends signals and messages to employees, affecting their perceptions and giving work situations a psychological meaning. With greater alignment in HR practices, employee perception is positively affected. Similarly, employees can easily understand the HR system if the practices are consistent and integrated for greater synergy.

The results of this study provide the first insight for management in banks to identify how human resources can be used strategically as a source of sustainable competitive advantage by developing mutually reinforcing HR systems and practices. This is in line with Buller and McEvoy (2012), who state that when designing and aligning HR practices with one another

and with strategic goals, it is necessary to have the right HR systems in place with their effective implementation by managers and employees.

The method and process of developing and validating the HR system model provide foundations for managers to identify the activities or items to be incorporated into specific HR practices as well as to decide the types of practices for their HR system. It further enables them to locate the HR areas where improvements are needed to enhance organizational performance. The validated HR system model, consisting of eight individual HR practices, provides a list of HR items that should be a part of their HR plans, policies, and activities. The findings of this study also provide insight into the relative importance of different HR practices.

Finally, the validation of the HR system model also indicates that commercial banks have prioritized HRM over the years, given that they are operating in highly competitive, regulative, and dynamic environments. The system thinking of HR can enhance HR effectiveness, which in turn is likely to affect employee satisfaction and productivity and prepare them for the achievement of their strategic objectives, as Barney (1995) argues that individual practices have a limited ability to generate competitive advantage in isolation.

Limitations and Directions for Future Research

This study has several limitations. First, this study was based on the responses of officer-level employees. Future studies can collect data from both officers and nonofficer-level employees, which may reflect a more pragmatic view of the HR system model. Most likely, an HR model with different practices would emerge if employees at all levels are incorporated. Since employees at lower levels may have different perceptions of the HR system in Nepal, significant variation between higher- and lower-level employees can be observed in terms of benefits, opportunities, recognition, and the working environment. Second, this study used a structured questionnaire based on a Likert scale. Future researchers can also use open-ended questions as well as group discussions to collect data that can provide triangulation for the findings. Third, alignment between the HR system and organization or contextual factors, as well as corporate strategy, is crucial for describing an HR system. Hence, future researchers can incorporate a double fit in their studies to develop and validate the HR system model. Finally, the validated HR system can better justify whether HRM practices are linked to employees' operational and financial performance, which can be addressed by future researchers.

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