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Abstract: During the economic transformation to a market-based socialist economy, Chinese construction organizations have developed advanced technologies. However, soft management is recognized as the bottleneck constraining them in competing in the international market. There are extensive studies of human resource (HR) management in Western countries. HR Management in Chinese construction organizations merits investigation. A HR practices measurement scale is required to understand whether and how HR management contributes to organizations’ performance. This paper develops such a measurement scale. An initial scale, developed from previous research, is adapted following consultation with academic researchers and industry experts. Data is collected by a questionnaire survey. After confirmatory and exploratory factor analyses, the second-order HR practices measurement scale has desirable model-to-data fit, which demonstrates that the observed items are reasonable measures of the respective HR practices. A 15-item measurement scale of HR practices is developed, which comprises the four categories of employment relations - job description and participation, training, staffing, and rewards.

Keywords: Human resource management, human resource practices, measurement scale, factor analysis

DOI: 10.7492/IJAEC.2013.016

1 INTRODUCTION

Over the last 30 years of economic transformation to a market-based socialist economy, Chinese construction organizations have employed advanced technical methods, technologies, and experiences in various types of projects in an evolving competitive environment. Currently, there are 55 Chinese construction organizations on the list of top 250 international contractors (Engineering News Record 2013). However, a significant gap between Chinese construction companies and international counterparts remains (Zhou et al. 2009). Zhao and Shen (2008) recognize “lack of well-trained human resources” to be a major weakness when Chinese contractors compete in the international market. The main problems concerning HR management in Chinese construction organizations have been highlighted by industry experts as: static personnel management, high employee turnover, inflexible job arrangements, lack of efficient motivating reward policy, lack of fairness in promotion, and low effectiveness of training (Huang 2004; Lai et al. 2005; Ma 2005; Song 2004). Before the 1990s, HR management in China was no more than personnel management and administration (Ahlstrom et al. 2005). During the process of economic transformation and foreign firms’ investment in China’s market, especially after World Trade Organization (WTO) entry in 2001, Chinese organizations have recognized the requirement to establish HR policy and practices to support the achievement of organizational goals in the increasingly competitive and dynamic environment. Current HR practices in Chinese companies include employee selection, staff training, job mobility, job security, appraisal of employees’ performance, rewards, clear and up-to-date job description, and employees’ participation in decision making (Sun et al. 2007; Warner 2008).

Notions of HR management differ significantly be-
Between countries. Adoption of HR management is also varied - greatest in USA and UK and unknown in other countries (e.g. Iran) with an array between those extremes (Tayeb 2001). Previous studies of HR management are mainly from Western countries. HR management research in the context of Chinese construction organizations is sparse. A HR practice measurement scale is required in quantitative investigations to understand the role of HR management in a Chinese context. Hence, this paper aims to develop a valid measurement scale of HR practices in the context of Chinese construction organizations. The objectives are to (1) clarify current HR practices adopted, and (2) develop a HR practice measurement scale in the context of Chinese construction organizations.

2 HUMAN RESOURCE MANAGEMENT

HR management is a multi-level construct, which should be aligned with organizational culture and strategy. Arthur and Boyles (2007) suggest five aspects to define and analyse HR issues, including climate, principles, policies, programs, and practices.

2.1 HR Climate, Principles and Policies

According to Arthur and Boyles (2007), HR climate refers to the shared employees’ perceptions and interpretations of the meaning of the HR principles, policies, programs, and practices in an organization. HR principles, defined as values, beliefs and norms, are the most abstract component. Generally, HR principles interact with organizational culture and guide organizational decision making in HR issues. More specifically, HR policies refer to organizational goals or strategies for managing human assets, and incorporate the choice of HR program in terms of recruitment, training, appraisal, job design and participation (Wright and Boswell 2002).

2.2 HR Program

HR program is defined as a set of formal HR activities used in the organization, which should be aligned with HR policies (Arthur and Boyles 2007). Previous empirical strategic HR management studies have focused on HR programs by identifying bundles of internally consistent HR practices and investigating the relationship between these sets of practices and organizational performance. For example, Arthur (1992, 1994) identifies two categories of HR practices that he labels “control (cost reducers)” and “commitment”.

2.3 HR Management in Construction

HR management is important for construction organizations. In a project based industry, success of a project depends on skilled labour and professional staff from different functional departments coordinating and applying their skills and behaviour during project realisation. Based on the nature of construction products and services, Loosemore et al. (2003) identify five challenges for managing people in construction as: the unique, one-off nature of projects; projects’ tendency to be awarded at short notice; projects’ reliance on a transient workforce; increasingly demanding clients; and a male-dominated culture. In order to overcome these challenges, construction organizations need to establish HR policies and practices to recruit qualified staff, provide extensive training opportunities, satisfy employees’ expectations, secure employee involvement, collect suggestions, increase commitment and reduce conflict, and balance requirements of project stakeholders (Maloney 1997; Raiden et al. 2006). However, Dainty et al. (2007) review the current context of construction employment and reveal that skills shortages, informal employment practices, lack of employee involvement (such as task participation and team working) impede productivity improvement because of the interplay of structural and cultural factors, in spite of repeated calls for the construction industry to improve its HR practices.

3 HUMAN RESOURCE PRACTICES

3.1 Approaches to Measure HR Practices

HR practices emphasize the implementation and experience of an organizational HR program by employees. Strategic HR management researchers prefer to adopt either a resource-based or a control-based approach to measure HR practices. A resource-based approach emphasizes practices of internal employees’ development, such as training and job design (Delery and Doty 1996). A control-based approach, on the contrary, examines the extent to which HR practices relate to market pay levels and results-oriented performance (Snell 1992). But neither approach can capture the domain of HR practices adequately (Bamberger and Meshoulam 2000). Hence, they suggest combining the two approaches as orthogonal dimensions of a measure of high-performance HR practices, which includes three HR subsystems: (1) people flow (i.e. staffing, training, mobility, and job security), (2) appraisal and rewards, and (3) employment relations (i.e. job design, and participation). Sun et al. (2007) apply this bundle of HR practices in the context of China’s hotel industry to examine the effect of organizational citizenship behaviour (OCB) on the relationship between high-performance human resource practices and performance.

In order to implement the HR practices discussed above, the internal fit among each practice should also be emphasized (Becker and Huselid 1998; Delery and Shaw 2001; Evans and Davis 2005). So, HR practices in this paper are examined from an integrated system.
perspective, which is both internally consistent and coherent among each practice and externally aligned with organizational strategy and structure.

3.2 Staffing and Recruitment

Staffing and recruitment is an important practice for organizations to attract qualified applicants, to ensure that the desired applicants accept the job offers, and to ensure that they continue in the employment of the firm (Ma and Allen 2009). Job attraction is essential for the candidates to apply. There are some possible predictors of applicant attraction, such as job and organizational characteristics, recruiter characteristics, perceptions of the recruitment process, perceived fit, perceived alternatives, and hiring expectancies (Rynes et al. 1991; Breaugh 2008). The results of recruitment are identified by Chapman et al. (2005) as job pursuit intentions, job-organization attraction, acceptance intentions, and job choice. Generally, when there is a lack of staff with specific knowledge and skills, organizations may either “buy” from the labour market (recruitment), or “make” their own staff by their acquiring the necessary knowledge (training).

3.3 Training

In complex operational environments, organizations need to train their employees to acquire new technology skills and knowledge as long-term investments. One additional reason to arrange training activities is for multitasking and role transitions within an organization. Training for employees concerns not only improving their skills to perform current jobs, but also preparing them for future responsibilities. Goldstein (1980) defines training as “the acquisition of skills, concepts, or attitudes that results in improved performance in an on-the-job environment”. From the outcome perspective, Goldstein and Ford (2002) describe “training” as a systematic approach to learning and development to improve individual, team, and organizational effectiveness.

3.4 Mobility

Mobility is described by Delery and Doty (1996) as “internal career ladder or opportunities”. Clear career opportunities can help employees plan their future within the organization and choose the learning direction. For example, Organizations which have clear plans may motivate employees to achieve their personal goals through fulfilling job requirements. Another reason to examine mobility is related to succession planning, which is recognized as a high priority for an organization in preparing its human resource plan (Tsui and Wu 2005).

3.5 Job Security

Job security is “the degree to which an employee could expect to stay in his/her job over an extended period of time” (Delery and Doty 1996). Usually, job security arises from the terms of the employment contract or labour legislation that prevents arbitrary termination and layoffs. Job security can be enhanced by well-devised human resource planning and flexible organizational structure (Marchington and Wilkinson 2008).

3.6 Appraisal and Rewards

In order to achieve business goals and continuous development, an organization is required to design and implement proper reward and appraisal practice (Becker and Huselid 1998). The reward practices are underpinned by an organizational philosophy in which employees are valued and rewarded (Armstrong 2006). If the organization pays more than its rivals, it can attract more individuals who possess superior job-related abilities. This can increase the quality of the applicant pool, and can also motivate employees to apply their skills and knowledge in their work-related activities (Way 2002). Rewards and appraisal are not focused merely on the amount of pay, but on communicating preferred behaviours and accentuating long-term investment in employees (Tsui and Wu 2005). There are two types of reward practices - intrinsic and extrinsic (Allen and Kilmann 2001). For construction organizations, group-based performance payment is emphasized, because employee appraisal which emphasizes group-based achievement can enhance employees’ retention and motivate them to apply their skills and behaviour in group work (Armstrong 2006).

3.7 Employment Relation Practices

Because of the changing working environment and characteristics of multitasking, role transitions and involvement, employees need to solve conflict, and to collaborate with their colleagues. Employee relations practices concern stable and cooperative relationships, commitment achievement, and mutuality development (Armstrong 2006). IRS (1993) identifies four approaches to employee relations as adversarial, traditional, partnership, and power sharing. Usually, employee relations practices include job description, flexible job design and encouragement of participation. Flexible job assignments (e.g. job rotation, ability to perform job, and job enrichment) can broaden employees’ knowledge, skills, abilities and behaviour, and thence, produce superior output (Armstrong 2006; Evans and Davis 2005).
4 DEVELOPMENT OF A MEASUREMENT SCALE

This paper aims to develop a measurement scale of HR practices in the context of Chinese construction organizations. The initial measurement scale is based on Sun et al. (2007) which investigates hotels in China, supplemented by Chen and Huang (2009) and Lopez et al. (2006). HR practices scale of Sun et al. (2007) is developed from Bae and Lawler (2000) (originally from Snell and Dean (1992), and Delery and Doty (1996)).

4.1 Pilot Test

In order to pilot the implementation of the initial measurement instrument in the context of Chinese construction organizations, four participants (two academic researchers and two industry-based experts who each have over 20 years work experience) are consulted. The instrument is improved and refined according to the participants’ suggestions and characteristics of the specific context of Chinese construction organizations.

4.2 Measurement instrument in Chinese

The measurement instrument is originally constructed in English and so, required translation into Chinese. The “translation/back-translation” technique is used to ensure the reliability and validity requirements of measurement scales (Behling and Law 2002; Ding and Ng 2007). The instrument in Chinese is developed following the suggestions of Behling and Law (2002):

1. A bilingual researcher is asked to translate the original draft scales from English into Chinese, and then two Chinese academic researchers are consulted to substantiate the question items and improve the understanding of the language as the draft Chinese version scales;
2. Another two bilingual researchers (i.e. peer researchers who have no knowledge of the original English scales) are employed to translate the draft Chinese version back into English;
3. The original and back-translated English versions are compared and discussed among the four skilled researchers in a meeting; The draft Chinese version is modified according to the discussion of any differences which emerged at this step, and is refined based on the comments from the two Chinese industry experts to improve the application of the questionnaire in the context of Chinese construction organizations.

5 SAMPLES AND DATA COLLECTION

According to their personnel, total assets, equipment capacity, finance capacity, experience, etc., Chinese construction organizations are classified into four categories of: premier grade, 1st grade, 2nd grade, 3rd grade or under. This paper focuses on the premier grade and 1st grade, because most of them are state-owned enterprises (SOEs) with more than 10 years history, and represent current HR practices employed. There are 174 contractors in premier grade and 2445 in 1st grade in 2005 (National Bureau of Statistics of China 2008). 10% are selected as the sample using the snowball method.

Due to practical considerations of sampling employees of major Chinese contractors (vast numbers of employees in each organization, notoriously low responses to random approaches, lack of reliable data, etc.) and the “hidden” population, snowball sampling is adopted (i.e. chain-referral, respondent-driven sampling). Salganik and Heckathorn (2004) explain the potential for making unbiased estimations from hidden population with respondent-driven sampling, and argue that “these estimates are asymptotically unbiased no matter how the seeds are selected”.

Initially, 117 middle level staff (as potential seeds) were selected from the personal contact list of the researcher and the list of a leading Chinese academic researcher. They are from different firms and have various personal characteristics (e.g. age, work experience, job position and educational level). Then, the 42 participants who returned the questionnaire were asked (as seeds) to recruit similar level colleagues or friends in premier or 1st grade construction firms to complete the questionnaire. Finally, 335 questionnaires were collected; 9 of them were eliminated as those respondents were obviously unconcerned (e.g. the same rating for all items). 326 responses were retained for analysis (from 306 contractors).

Among the respondents, only 55 (16.9%) are from firms which have 10 years or less history. There are more respondents from premier grade (58%) than from first grade firms (42%). The correlation between firm history and grade is positive (correlation coefficient = 0.419, p < 0.01), which means the longer the firm has existed, the higher grade the firm has attained. 190 (58.3%) participants are 20-29 years old and 172 (53.9%) participants have less than 5 years work experience. 144 (44.2%) are technical staff and 115 (35.3%) commercial staff. Almost 90% of the respondents have a bachelor’s degree or above (about 22.7% participants have master’s degree), which means that the majority of respondents should have significant capability to learn by themselves.

6 DATA ANALYSIS AND RESULTS

6.1 Analytical Procedure

First, the raw data are prepared and screened for non-response bias and multivariate normality. Second, exploratory factor analysis is adopted to identify and retain the latent variables (i.e. developing first-order and second-order factor models of HR practices). The relia-
bility and validity of the measurement scale are tested, i.e. measurement model test, including evaluation of goodness-of-fit of measurement model, and revising the measurement model related to the observed variables as derived from the sample data.

6.2 Non-Response Bias Test

In order to improve the validity of the empirical findings, it is necessary to test for non-response bias. According to Armstrong and Overton (1977), the early respondents and late respondents (separating by the date of July 1, 2010) are assumed as the proxy "respondents" (i.e. 147 valid questionnaires) and "non-respondents" (i.e. 179 valid questionnaires) respectively. Then, independent-samples T-test is employed to compare the differences of mean scores of the variables between the two groups (Tseng and Lee 2009). The variables in this test include: selective staffing, training, mobility, job security, appraisal, rewards, job description, and participation. The mean scores of all the variables between the two groups show no differences at the 95% confidence level. Hence, the non-response bias is unlikely to limit the validity of this research.

6.3 Univariate Normality Test

The application of structural equation modelling, especially the adoption of maximum likelihood to estimate the parameters, requires statistical assumptions - notably, multivariate normality (Kaplan 2000). Although, in the real world, the assumption of multivariate normality is unlikely to be met (West et al. 1995; Lei and Lomax 2005), the assumption is assessed in this study to improve the accuracy of parameter estimates. Multivariate normality includes (Kline 2005): (1) all the univariate distributions are normal, (2) the joint distribution of any pair of the variables is bivariate normal, and (3) all bivariate scatterplots are linear and homoscedastic. It is impractical and difficult to assess all the aspects of multivariate normality; the method through inspection of each observed item’s univariate distributions and then deleting outlier items, may contribute to multivariate normality (Kline 2005). This study assesses the univariate distributions of each item. The distribution of non-normality is manifested by two indicators: skew and kurtosis (Curran et al. 1996), which can be calculated by using the SPSS program.

The ratio of the value of an unstandardized skew/kurtosis index for each observed variable over its standard error is used by researchers (Curran et al. 1996; DeCarlo 1997) to indicate the non-normality conditions. Generally, there is no clear consensus regarding an acceptable degree of non-normality (Finney and DiStefano 2006). The variables with absolute values of skew index greater than 3.0 are described as extremely skewed (Kline 2005; Curran et al. 1996) argue that the absolute value approaching 2.0 is suspect; Lei and Lomax (2005) state the values between -2.0 and +3.5 are generally selected to indicate skew. Regarding kurtosis, DeCarlo (1997) suggests absolute value below 3.0 is described as normal distribution; Curran et al. (1996) argue the absolute value above 7.0 is suspect; and Kline (2005) suggests that the absolute value of the kurtosis index greater than 10 indicates a problem of non-normal distribution.

Concerning the skew index of the 26 observed variables of HR practice, 16 variables have an absolute value below 2.0; 8 variables’ absolute value of skew index is between 2.0 to 3.0; and two variables (HR17 and HR23) have values of -3.52 and 4.04 respectively. Regarding kurtosis, 21 variables have an absolute value below 3.0; 5 variables have a value of the kurtosis index between -3.13 and -3.66. From the results of the skew and kurtosis indices, except for the two variables of HR17 and HR23 which have a skew distribution problem, the data of the other variables measuring HR practices can be regarded as normally distributed.

Regarding violation of normality, Finch (1993) finds that moderate non-normality has negligible effects on parameter estimates using maximum likelihood. Similarly, Lei and Lomax (2005) examine the robustness of structural equation models using data with different degrees of non-normality, and find that non-normality conditions have no significant differences on the standard errors of parameter estimates, but have a significant effect on bias of parameter estimates. However, they suggest that the non-normality might not be of extreme concern to researchers, because “the worst effect of the bias is generally considerably less than 10%”.

Hence, the two variables (HR17 and HR23) whose data distributions have moderate non-normality problems are retained for analysis in the measurement model.

6.4 Exploratory Factor Analysis of HR Practices Measurement Scale

In order to test the application of the measurement scale in the context of Chinese construction organizations, exploratory factor analysis is adopted to extract latent variables which cause the observed variables to covary. The data set was split into two parts to improve the quality of factor analysis (Kline 2005), one for exploratory factor analysis and the other for confirmatory factor analysis (Ding and Ng 2008). The exploratory factor analysis is done by SPSS 16.0 in the following steps (Floyd and Widaman 1995; Costello and Osborne 2005):

1. Bivariate correlation between each pair of observed variables of HR practices are tested. The results show that the majority of them are significant at the 0.025 level (1-tailed) except for the correlations between the two variables (HR 10 and HR12), which means that the 26 items are not totally independent. Additionally, Bartlett’s test of Sphericity result (approximately Chi-
Table 1. Exploratory factor analysis of HR practices: rotated factor matrix$^{a,b}$

<table>
<thead>
<tr>
<th>Construct</th>
<th>Factor</th>
<th>Item-total</th>
<th>Cronbach’s α</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Correlation</td>
<td></td>
</tr>
<tr>
<td>HR1</td>
<td>0.623</td>
<td>0.428</td>
<td>Staffing</td>
</tr>
<tr>
<td>HR2</td>
<td>0.550</td>
<td>0.466</td>
<td>(HR1-4)</td>
</tr>
<tr>
<td>HR3</td>
<td>0.724</td>
<td>0.577</td>
<td>α = 0.674</td>
</tr>
<tr>
<td>HR4</td>
<td>0.486</td>
<td>0.386</td>
<td></td>
</tr>
<tr>
<td>HR5</td>
<td>0.746</td>
<td>0.714</td>
<td>Training</td>
</tr>
<tr>
<td>HR6</td>
<td>0.757</td>
<td>0.750</td>
<td>(HR5-8)</td>
</tr>
<tr>
<td>HR7</td>
<td>0.764</td>
<td>0.779</td>
<td>α = 0.860</td>
</tr>
<tr>
<td>HR8</td>
<td>0.571</td>
<td>0.591</td>
<td></td>
</tr>
<tr>
<td>HR9</td>
<td>0.433</td>
<td>0.398</td>
<td>Mobility (HR9-10)</td>
</tr>
<tr>
<td>HR10</td>
<td>0.666</td>
<td>0.398</td>
<td>α = 0.570</td>
</tr>
<tr>
<td>HR11c</td>
<td>0.355</td>
<td>0.380</td>
<td></td>
</tr>
<tr>
<td>HR12</td>
<td>0.376</td>
<td>0.358</td>
<td></td>
</tr>
<tr>
<td>HR13</td>
<td>-0.670</td>
<td>0.599</td>
<td></td>
</tr>
<tr>
<td>HR14</td>
<td>-0.366</td>
<td>0.598</td>
<td></td>
</tr>
<tr>
<td>HR15</td>
<td>0.498</td>
<td>0.580</td>
<td>Rewards</td>
</tr>
<tr>
<td>HR16</td>
<td>0.429</td>
<td>0.565</td>
<td>(HR17-19)</td>
</tr>
<tr>
<td>HR17</td>
<td>0.652</td>
<td>0.538</td>
<td>α = 0.754</td>
</tr>
<tr>
<td>HR18</td>
<td>0.702</td>
<td>0.538</td>
<td>Employment</td>
</tr>
<tr>
<td>HR19</td>
<td>0.622</td>
<td>0.538</td>
<td>α = 0.754</td>
</tr>
<tr>
<td>HR20</td>
<td>0.595</td>
<td>0.538</td>
<td>Relations</td>
</tr>
<tr>
<td>HR21</td>
<td>0.513</td>
<td>0.538</td>
<td>(HR20-26)</td>
</tr>
<tr>
<td>HR22</td>
<td>0.506</td>
<td>0.539</td>
<td>α = 0.850</td>
</tr>
<tr>
<td>HR23</td>
<td>0.582</td>
<td>0.677</td>
<td></td>
</tr>
<tr>
<td>HR24</td>
<td>0.569</td>
<td>0.597</td>
<td></td>
</tr>
<tr>
<td>HR25</td>
<td>0.633</td>
<td>0.650</td>
<td></td>
</tr>
<tr>
<td>HR26</td>
<td>0.702</td>
<td>0.650</td>
<td></td>
</tr>
</tbody>
</table>

Eigenvalues | 9.926 | 1.936 | 1.470 | 1.375 | 1.226 | 1.091 |
Cumulative Variance Extracted (%) | 15.594 | 28.538 | 38.342 | 47.759 | 51.849 | 55.144 |

Note: Extraction Method: Principal Axis Factoring. Rotation Method: Varimax with Kaiser Normalization.

$^a$ Rotation converged in 7 iterations.
$^b$ Only cases for the first half data set are used in the analysis phase.
$^c$ The item is removed from the instrument.

Square = 2208.957 with degree of freedom = 325, at significant level $P < 0.01$ is evidence that “all the 26 observed variables of HR practices are independent” is rejected. The result of Kaiser-Meyer-Olkin measure of sampling adequacy (0.9 > 0.8) provides evidence of good homogeneity of variables. All the three tests above allow exploratory factor analysis to be conducted.

2. The principle axis factoring method is chosen to extract common factors.

3. The cut-off near eigenvalue (= 1.00) is adopted to choose the number of factors retained for rotation (Floyd and Widaman 1995). Because the initial eigenvalue of factor 6 = 1.091 and factor 7 = 0.857, and the unrotated 6 factors cumulatively explain 65% of the variance, 6 factors are retained for rotation. Simultaneously, the scree test plot shows an “elbow” at number 7, which also indicates 6 factors retained is accepted.

4. The varimax method (i.e. factors are kept uncorrelated) is chosen to rotate factors to simplify and clarify the data structure, which (compared with oblique rotation method) can produce more interpretable results. The results of the rotated factor matrix are shown in Table 1, in which weak loading scores (less than 0.32, (Tabachnick and Fidell 2000)) and lower scores (the ‘cross-loading’ item which loads at 0.32 or higher on two or more factors) are deleted. Based on the results in Table 1, HR11 loads on three factors with similar scores and then, is dropped from the analysis. Interestingly, HR14, HR15 and HR16 are observed variables of “appraisal practice”, but these three variables have loading scores as 0.498, 0.429 and 0.516 respectively load on factor 1. Factor 1 has the other seven strong loaders (better than
and can be identified as “employment relation practice” (i.e. practices of job design and participation according to Bamberger and Meshoulam (2000). In order to ensure the factor purity of the measurement model, the three items of HR14, HR15 and HR16 are discarded. The loading value of HR12 and HR13 on factor 5 (security practice) is negative, which indicates that these two items are not appropriate in the context of Chinese construction SOEs and should be removed from the measurement instrument. Hence, five factors to manifest HR practices are extracted and retained, i.e., employment relations (HR20-26), training (HR5-8), rewards (HR17-19), and mobility (HR9-10). The extracted factors are consistent with the theoretical HR practices configuration of Bamberger and Meshoulam (2000), and the empirical work of Sun et al. (2007). The five factors, after rotation, account for 55% of variance in HR practice measurement.

Additionally, Cronbach’s alpha (i.e. form of internal consistency reliability coefficient) and item-total correlation (i.e. additional information to check whether any item is not consistent with the rest of the scale) of the five factors’ scale are tested, the results of which are listed in the last two columns of Table 1. Cronbach’s alphas of three factors (i.e. training, rewards, and employment relations) exceed the criterion of 0.7 (Nunnally 1978), and all the item-total correlations of the three factors exceed 0.5 (Netemeyer et al. 2003). Both tests indicate that observed variables of these three factors are internally consistent. Cronbach’s alpha of mobility is 0.570 (< 0.7), which means that the observed variables are not measuring the same factor, so the two items HR9-10 are removed from the HR practices measurement instrument. Cronbach’s alpha of staffing is 0.674 (~ 0.7), and three of four items’ item-total correlations are below 0.5, which need careful checking in addition to inter-item correlations between the four observed variables HR1-4. The inter-item correlations relating to HR1 and HR4 are lower than 0.4 (Clark and Watson 1995; Ding and Ng 2008), and the item-total correlations of HR1 and HR4 are 0.428 and 0.386 (< 0.5), so these two items (HR1 and HR4) are deleted to purify the measurement of staffing practice.

Finally, four factors, employment relations (HR20-26), training (HR5-8), staffing (HR2-3), and rewards (HR17-19), are retained to manifest HR practices according to the results of exploratory factor analysis with the first half-set data. Next, confirmatory factor analysis is employed to verify that the observed items

Table 2. Convergent validity of four factors of HR practices first-order measurement model

<table>
<thead>
<tr>
<th>Factor</th>
<th>Items</th>
<th>CFA* Loading</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Staffing</td>
<td>HR2 Long-term employee potential is emphasized.</td>
<td>0.857</td>
<td>***</td>
</tr>
<tr>
<td>(C.R. = 0.61)</td>
<td>HR3 The Members of the department or project team of which the new worker will be part, participate in the selection of candidates.</td>
<td>0.437</td>
<td>***</td>
</tr>
<tr>
<td>Training</td>
<td>HR5 Formal training programs are provided for employees.</td>
<td>0.745</td>
<td>***</td>
</tr>
<tr>
<td>(C.R. = 0.83)</td>
<td>HR6 There are comprehensive training policies and programs.</td>
<td>0.844</td>
<td>***</td>
</tr>
<tr>
<td></td>
<td>HR7 There are formal training programs to teach new staffs the skills they need to perform their job.</td>
<td>0.877</td>
<td>***</td>
</tr>
<tr>
<td></td>
<td>HR8 There is training for problem-solving ability.</td>
<td>0.604</td>
<td>***</td>
</tr>
<tr>
<td>Rewards</td>
<td>HR17 The organization has a mixed system of rewarding: fixed + variable.</td>
<td>0.852</td>
<td>***</td>
</tr>
<tr>
<td>(C.R. = 0.74)</td>
<td>HR18 Individuals in this job receive bonuses based on the profit of the organization or the project.</td>
<td>0.685</td>
<td>***</td>
</tr>
<tr>
<td></td>
<td>HR19 The company offers incentives to its employees related to their performance.</td>
<td>0.540</td>
<td>***</td>
</tr>
<tr>
<td>Employment</td>
<td>HR20 The duties in his job are clearly defined.</td>
<td>0.533</td>
<td>***</td>
</tr>
<tr>
<td>relations</td>
<td>HR21 The job has an up-to-date description.</td>
<td>0.597</td>
<td>***</td>
</tr>
<tr>
<td>(C.R. = 0.79)</td>
<td>HR22 The job description for a position accurately describes all of the duties performed by individual employees.</td>
<td>0.625</td>
<td>***</td>
</tr>
<tr>
<td></td>
<td>HR23 Employees in this job are often asked by their supervisor to participate in decisions.</td>
<td>0.763</td>
<td>***</td>
</tr>
<tr>
<td></td>
<td>HR24 Inform the employees about economic and strategic information.</td>
<td>0.642</td>
<td>***</td>
</tr>
<tr>
<td></td>
<td>HR25 Employees are provided the opportunity to suggest improvements in the way things are done.</td>
<td>0.564</td>
<td>***</td>
</tr>
</tbody>
</table>

Note:* Standard Factor loading (λ value) from confirmatory factor analysis

6 P-Value is significant at p < 0.05. ***, P < 0.001
7 C.R. = composite reliability = (sum of standardized loading)^2/((sum of standardized loading)^2 + (sum of indicator measurement error))
6.5 Confirmatory Factor Analysis of First-Order HR Practices Measurement Scale

The confirmatory factor analysis to assess the 4-factor first-order HR practices measurement scale is conducted by AMOS18 (Analysis of Moment Structures) to evaluate the initial model fit to the data (second half set) by the maximum likelihood estimation method. In the initial first-order HR practices measurement model, the modification index (MI) between items HR25 and HR26 is high (MI = 19.097), which indicates high error covariance between these two items, so item HR26 is deleted from the revised model. The revised model ($\chi^2 = 163.71, \text{df} = 84, \text{SRMR} = 0.06, \text{RMSEA} = 0.08, \text{CFI} = 0.91, \text{IFI} = 0.91, \text{TLI} = 0.89$) yields more satisfactory model-data-fit statistics.

In order to further assess the strength of the revised measurement model, unidimensionality, convergent validity, and discriminant validity of the first-order HR practices construct are examined, which is consistent with previous empirical studies (Teo et al. 2006; Chang and Chen 2008).

Unidimensionality is crucial in theory testing, and is defined as “the existence of one latent trait or construct underlying a set of measures” (Anderson et al. 1987). That the observed variables, as indicators to measure a latent construct, should be unidimensional is a necessary condition for estimation in measurement models (Kumar and Dillon 1987). The assessment of unidimensionality includes internal consistency and external consistency. The model-fit indices can be used to assess the unidimensionality of construct operationalization (Anderson et al. 1987), e.g. standard root mean square residual, comparative fit index, etc. The results of goodness-of-fit indices ($\chi^2 = 163.71, \text{df} = 84, \text{SRMR} = 0.06, \text{RMSEA} = 0.08, \text{CFI} = 0.91, \text{IFI} = 0.91, \text{TLI} = 0.89$) indicate that the model fits the data well. The indices of four factors' composite reliability ($\rho = 0.89$) provide evidence of unidimensionality of scale items in the refined measurement model.

Convergent validity is assessed by two criteria (Gerbing and Anderson 1988; Chang and Chen 2008): standard factor loadings of observed items on the respective construct and significance level (i.e. reliability of observed items), and composite reliability of constructs (i.e. the reliability of a summated scale). The results are shown in Table 2. All the significant factor loadings (i.e. A value) of observed items are above 0.40 (Bollen 1989; Taylor and Todd 1995) at $p < 0.001$ level, which indicates that all the observed items exhibit satisfactory reliability. Then, the composite reliability score is calculated by Fornell and Larcker (1981). As Table 2 shows, the indices of four factors’ composite reliability is greater than 0.6 (Hair et al. 1998; Chang and Chen 2008). So, both criteria demonstrate adequate convergent validity of the first-order HR practices measurement scale.

Discriminant validity refers to testing statistically whether two constructs differ, which means that the observed variables for different latent constructs should not be highly correlated. Violation of discriminant validity occurs when there is conceptual overlap between two latent constructs. According to Cho (2006), if the inter-item correlations between items within one factor are higher than those between items measuring different factors, the measurement scale can be considered to have adequate discriminant validity. Table 3 presents the squared inter-item correlations among the observed variables in the HR measurement scale. From the results, the correlation score between two items within the same factor is higher than that between items from different factors, e.g. the squared correlation between HR2 and HR3 (0.25) is higher than other correlation scores related to HR2 and HR3. Hence, it can be concluded that discriminant validity of HR practices measurement is justified.

Thus, the revised first-order HR practices measurement scale is satisfied in unidimensionality, convergent validity, and discriminant validity. The unstandardized estimations of the HR practices measurement model with all the first order factors are inter-correlated. The goodness-of-fit indices ($\chi^2 = 163.71, \text{df} = 84, \text{SRMR} = 0.06, \text{RMSEA} = 0.08, \text{CFI} = 0.91, \text{IFI} = 0.91, \text{TLI} = 0.89$) indicate that the model fits the data well. The coefficients between observed variables and the related factor are all significant at 0.01 level.

Table 4 shows the correlation and covariance between the four factors of HR practices, which signify that the four factors are highly correlated, with correlation coefficients from 0.236 to 0.710 at $P < 0.05$ level. The inter-correlations between the four factors indicate statistically the existence of a higher level order construct, i.e. human resource practices, which is consistent with the conceptual model.

6.6 Second-order HR Practices Measurement Scale

According to Chin (1998), a second-order measurement scale consists of “a higher order latent variable that is modelled as causally impacting a number of first order latent variables”. So, the second-order latent variable is not directly connected to any measured items. The purpose of the second-order measurement test is to identify a general construct (i.e. HR practices) underlying the first order factors (employment relations, training, staffing and rewards). The goodness-of-fit indices ($\chi^2 = 249.63, \text{df} = 86, \text{SRMR} = 0.06, \text{RMSEA} = 0.08, \text{CFI} = 0.92, \text{IFI} = 0.92, \text{TLI} = 0.90$) indicate that the second-order HR practices model fits the data well and the higher level construct (i.e. HR practices) is identified (Byrne 2001). Figure 1 presents the estimates of unstandardized path coefficients and variances at $P < 0.001$ level by the maximum likelihood method.
### Table 3. Squared inter-item correlation among the HR practices construct

<table>
<thead>
<tr>
<th></th>
<th>HR2</th>
<th>HR3</th>
<th>HR5</th>
<th>HR6</th>
<th>HR7</th>
<th>HR8</th>
<th>HR17</th>
<th>HR18</th>
<th>HR19</th>
<th>HR20</th>
<th>HR21</th>
<th>HR22</th>
<th>HR23</th>
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</tr>
<tr>
<td>HR6</td>
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<td>0.08</td>
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<td>0.07</td>
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</tr>
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<tr>
<td>HR17</td>
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<td>0.05</td>
<td>0.04</td>
<td>0.08</td>
<td>0.08</td>
<td>1</td>
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</tr>
<tr>
<td>HR19</td>
<td>0.02</td>
<td>0.09</td>
<td>0.04</td>
<td>0.02</td>
<td>0.04</td>
<td>0.13</td>
<td>0.22</td>
<td>0.24</td>
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<td></td>
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</tr>
<tr>
<td>HR20</td>
<td>0.09</td>
<td>0.07</td>
<td>0.12</td>
<td>0.12</td>
<td>0.14</td>
<td>0.10</td>
<td>0.09</td>
<td>0.08</td>
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<td>1</td>
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<td>HR21</td>
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<td>0.11</td>
<td>0.08</td>
<td>0.13</td>
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<td>0.18</td>
<td>0.08</td>
<td>0.08</td>
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<td>0.18</td>
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<tr>
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<td>0.04</td>
<td>0.12</td>
<td>0.17</td>
<td>0.27</td>
<td>0.18</td>
<td>0.12</td>
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</tr>
<tr>
<td>HR23</td>
<td>0.16</td>
<td>0.08</td>
<td>0.08</td>
<td>0.13</td>
<td>0.17</td>
<td>0.14</td>
<td>0.15</td>
<td>0.10</td>
<td>0.09</td>
<td>0.17</td>
<td>0.22</td>
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<td>1</td>
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</tr>
<tr>
<td>HR24</td>
<td>0.11</td>
<td>0.12</td>
<td>0.12</td>
<td>0.16</td>
<td>0.17</td>
<td>0.17</td>
<td>0.07</td>
<td>0.05</td>
<td>0.10</td>
<td>0.17</td>
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<td>0.23</td>
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<tr>
<td>HR25</td>
<td>0.13</td>
<td>0.18</td>
<td>0.12</td>
<td>0.11</td>
<td>0.12</td>
<td>0.13</td>
<td>0.08</td>
<td>0.07</td>
<td>0.12</td>
<td>0.20</td>
<td>0.14</td>
<td>0.09</td>
<td>0.28</td>
<td>0.28</td>
<td>1</td>
</tr>
</tbody>
</table>

### Table 4. Correlation and covariance between four factors of HR practices

<table>
<thead>
<tr>
<th>Test between Each HR Practice</th>
<th>Correlation Estimates</th>
<th>Covariance Estimates</th>
<th>S.E.</th>
<th>C.R.</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Employment Relations and Training</td>
<td>0.710</td>
<td>0.251</td>
<td>0.057</td>
<td>4.388</td>
<td>***</td>
</tr>
<tr>
<td>Employment Relations and Staffing</td>
<td>0.589</td>
<td>0.271</td>
<td>0.063</td>
<td>4.332</td>
<td>***</td>
</tr>
<tr>
<td>Employment Relations and Rewards</td>
<td>0.513</td>
<td>0.180</td>
<td>0.051</td>
<td>3.526</td>
<td>***</td>
</tr>
<tr>
<td>Training and Staffing</td>
<td>0.563</td>
<td>0.296</td>
<td>0.065</td>
<td>4.590</td>
<td>***</td>
</tr>
<tr>
<td>Training and Rewards</td>
<td>0.316</td>
<td>0.127</td>
<td>0.045</td>
<td>2.816</td>
<td>0.005</td>
</tr>
<tr>
<td>Staffing and Rewards</td>
<td>0.236</td>
<td>0.123</td>
<td>0.057</td>
<td>2.167</td>
<td>0.030</td>
</tr>
</tbody>
</table>

Note: S.E. = standard error of the covariance; C.R. = critical ratio; P-value is significant at \( P < 0.05 \), ***, \( P < 0.001 \).

In sum, the HR practices measurement model is assessed first by exploratory factor analysis with the first-half set data, which measures HR practices by four factors, i.e., staffing, training, rewards, and employment relation. Then, the first order measurement model is refined by confirmatory factor analysis with an acceptable fit to the second-half set data. Finally, the second-order HR measurement model is developed with desirable goodness-of-fit indices.

### 7 DISCUSSION

Six factors of HR practices are extracted by exploratory factor analysis, as shown in Table 1. The resultant scale is slightly different from the original scale of Sun et al. (2007) which uncovers eight factors in the context of China’s hotels. The factor “employment relations” identified as a unique factor, including job description and participation, retains consistent with the theoretical configuration of high-performance HR practices (Bamberger and Meshoulam 2000).

After confirmatory factor analysis, four factors are retained. First-order HR practices identifies four factors with model chi-square of 163.71 (df = 84, SRMR = 0.063 < 0.1, RMSEA = 0.08 < 0.1; CFI = 0.91 > 0.9; IFI = 0.91 > 0.9; ILI = 0.89 ≥ 0.9). The high correlation and covariance between the four factors at significance level (\( p < 0.05 \)) in Table 4 indicate the existence of a higher order construct, i.e. HR practices.

The second-order HR practices measurement scale has desirable model-to-data fit (\( \chi^2 = 249.63, \text{df} = 86, \text{SRMR} = 0.06 < 0.1, \text{RMSEA} = 0.08 < 0.1; \text{CFI} = 0.92 > 0.9; \text{IFI} = 0.92 > 0.9; \text{ILI} = 0.90 ≥ 0.9 \)), including four categories of: employment relations, training, staffing, and rewards. The results demonstrate that the observed items are reasonable measures of the respective HR factors (see Figure 1).

However, the indicators to measure practices of “appraisal, job security and mobility” in China’s context need to be developed further in future studies (Warner 2008).

#### 7.1 Items to Measure “Appraisal”

Three items to measure “appraisal practice” are loaded on the factor “employment relations”. Then, these three items are discarded to ensure the factor purity of the measurement model. Cunningham and Rowley (2007) propose two principles to affect pay and reward as: avoidance of income polarization so as to keep social stability; maintenance of harmonious interpersonal relationships in the workplace. Culture characteristics of harmony and collectivism may also affect appraisal practice in Chinese SOEs. Currently, Chinese firms have clear job descriptions called “post wage system (gangwei gongzi)”, which comprise a basic part and a supplementary part of wages (Akhtar et al. 2008). The basic part wage is determined by the intensity and complexity of the job duties; the supplementary part wage...
is determined by the accomplishment of the job duties - analogous to Western bonus scheme systems.

7.2 Items to Measure “Job Security”

The loading values of two observed items on “job security” are negative and Cronbach’s alpha reliability coefficient is very low (0.304). This is consistent with Sun et al. (2007) “job security” factor reliability ($\alpha = 0.55 < 0.70$). Both tests demonstrate that the two observed items are not reliable measures of job security in China’s context. In the reformed Chinese SOEs, firms can offer permanent jobs and employees enjoy “lifetime employment” (Warner 2008), which is also called the “iron rice bowl” in the former planned economy, so, job security is not an essential concern for employees in Chinese construction SOEs.

7.3 Items to Measure “Mobility”

The Cronbach alpha reliability coefficient is low (0.570) for “mobility”. The possible reason is that two of three observed items are reverse-coded, which may not be suitable for Chinese respondents. A clear career path and internal promotion opportunity is important for employees especially in a knowledge-based economy, which is identified by Akhtar et al. (2008) in a sample of 465 Chinese enterprises.

8 CONCLUSION

Within the highly competitive economic environment, human resources in Chinese construction SOEs are required to be acquired, trained, retained, and developed, in order to motivate them to perform. HR practices in Chinese construction organizations include multidimensional practices of job description, participation, training, staffing, and rewards, which is consistent with strategic HR practices in a Western context. In order to achieve competitive advantage, Chinese construction organizations should adopt multiple HR practices in their personnel management. Furthermore, the organization’s HR strategy and HR planning should fit with the organizational strategy, and should be adapted to strategy changes.

A reliable and valid human resource measurement scale in the context of Chinese construction organizations has been developed after exploratory and confirmatory factor analyses. This measurement scale includes 15 items to indicate four HR practices of employment relations, training, staffing, and rewards. This HR measurement scale can be used in future quantitative studies to investigate the role of HR practices in affecting other organizational variables in the context of Chinese construction organizations, for example, organizational learning, social structure, organizational performance, and individual behaviour. In future research, the indicators to measure job security, mobility and appraisal in China’s context are suggested for further investigation.
REFERENCES


APPENDIX: Human Resource Practices
Measurement Scale
Below are items that organizations may use in the HR management. For each item, indicate the extent of your agreement or disagreement as a description of the practices employed by your company: (1) strongly disagree; (2) moderately disagree; (3) neither disagree nor agree; (4) moderately agree; (5) strongly agree.

HR1 Great efforts are taken to select the right person.
HR2 Long-term employee potential is emphasized.
HR3 The Members of the department or project team of which the new worker will be part, participate in the selection of candidates.
HR4 In the selective process not only is knowledge and experience taken into account, but also the capacity to work in synergy and continuous learning.
HR5 Formal training programs are provided for employees.
HR6 There are comprehensive training policies and programs
HR7 There are formal training programs to teach new staffs the skills they need to perform their job.
HR8 There is training for problem-solving ability.
HR9 Employees have few opportunities for upward mobility. (R)
HR10 Promotion in this organization is based on seniority. (R)
HR11 Employees have clear career paths in this organization.
HR12 Employees in this job can be expected to stay with this organization for as long as they wish.
HR13 Job security is almost guaranteed to employees in this job.
HR14 Performance appraisals are based on objective quantifiable results.
HR15 Performance appraisals are based on employee’s behaviours.
HR16 Employee appraisals emphasize long term and group-based achievement.
HR17 The organization has a mixed system of rewarding: fixed + variable.
HR18 Individuals in this job receive bonuses based on the profit of the organization or the project.
HR19 The company offers incentives to its employees related to their performance.
HR20 The duties in his job are clearly defined.
HR21 The job has an up-to-date description.
HR22 The job description for a position accurately describes all of the duties performed by individual employees.
HR23 Employees in this job are often asked by their supervisor to participate in decisions.
HR24 Inform the employees about economic and strategic information.
HR25 Employees are provided the opportunity to suggest improvements in the way things are done.
HR26 Supervisors keep open communications with employees in this job.

Note: R represents “Reverse-coded”.