

Transforming Psychological Capital and Flow Experience of R&D Employees into Performance

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Abstract--Flow experience has not yet been fully addressed in the field of psychological capital (PsyCap) research. This paper finds that flow experience is an important positive psychological capacity which should be considered for inclusion into PsyCap. Based on the investigation of R&D employees, the results show the expanded PsyCap integrated with flow experience has good tested reliability and validity. It is revealed expanded PsyCap has strong predictive power on employee performance than original PsyCap (represented by Luthans' HERO model). Flow experience contributes to PsyCap with the emotional attributes resulting in the incremental effect of PsyCap. This paper also discusses motivating R&D workforce by leveraging expanded PsyCap.

I. INTRODUCTION

PsyCap is widely looked at as a kind of strategic resource for a competitive advantage, which can create value beyond human and social capital. Under the influence of the positive psychology movement, Luthans and colleagues have combined positive psychological capabilities conceptually into the higher-order core construct of what they call PsyCap[1-3]. The psychological capabilities are the selected states of positive organizational behavior (POB) consisting of hope, Self-efficacy, optimism, and resiliency, which are referred as the HERO model [1-3].

However, with the review of the related conception of positivity, including positive traits, positive state-like psychological resource capacities, positive organizations (drawn from positive organization scholarship), and positive behaviors, Luthans and Youssef [4] suggested the categorization of PsyCap is open for further development and inclusion of other potential positive capacities rather than being a closed taxonomy. Empirical assessment relating to the 'fit' of any of the additional constructs is yet to be published despite theoretical identification of these psychological resources to the PsyCap framework. Expansion of the PsyCap nomological network is on the top agenda of future research so that PsyCap can reach its full potential [5].

Flow experience was first named by Csikszentmihalyi at that time he interviewed climbing enthusiasts, chess players, composers and athletes, and found that they were engaged in activities with the unique experience of attentiveness, no fatigue, and filled with a sense of excitement and happiness. We argue flow experience can be considered for inclusion into PsyCap as it is a positive psychological capacity meeting POB criteria and being critical for R&D employees to achieve challenging jobs [6]. The research of PsyCap on R&D employees has attracted increased attention. For example, an empirical research of India's R&D employees conducted by Gupta and Singh [7] indicated PsyCap plays an

intermediary role in the relationship between leadership behavior and employee innovation behavior. When subordinates experience more PsyCap, they show a higher level of innovative behavior. We believe both flow experience and PsyCap have great potential for practical application so that flow experience can be combined with PsyCap to enhance the predicting power of PsyCap as a high order factor. However, the research on construct itself of PsyCap is still stagnant. At present, there is no dedicated empirical research worked on how flow experience is integrated with PsyCap components to motivate R&D employees.

In view of the above problems, this paper will make contributions in the following three aspects:

First, PsyCap is expanded in terms of the structure and inclusion so as to enhance the effectiveness of PsyCap as positive capacities. The potential psychological capacities are to be identified which satisfy the criteria of PsyCap and can provide the incremental effect for overall PsyCap. In order to ensure normalization of extension of PsyCap, this paper firstly discusses the conformity of flow experience on the basis of PsyCap operationalization definition.

Second, the study of effectiveness of PsyCap in Chinese context is exercised with the suggestion on re-formulating PsyCap. Due to the differences of culture, the effectiveness of PsyCap in China is lower than that of western countries where PsyCap originated. In this paper, extensive questionnaires were conducted to dig out potential psychological capacities valid to the Chinese context.

Third, PsyCap specific to R&D employees is explored that provides practical implications for the R&D workforce management. Since R&D employees need to deal with challenging tasks and complex issues, PsyCap is very important to innovation management as a motivational factor that fuels individuals with dynamic psychological resources.

This paper will be organized through the following framework. (1) the current state of the research on extending PsyCap is reviewed, (2) the feasibility of flow experience as a new capacity of PsyCap is discussed, (3) exploratory and confirmatory analysis on the extended PsyCap incorporated with flow experience is carried out, (4) comparative analysis of expanded PsyCap and original PsyCap is carried out, (5) the suggestions for future research are provided.

II. PSYCAP AND FLOW EXPERIENCE

Luthans, Avolio and et al. [8] defined PsyCap as a core psychological factor of positivity in general that goes beyond human and social capital to build a competitive advantage. To be considered as a POB state contributing to PsyCap, the

following criteria must be met: (1) positive and strength-based; (2) theory and research based; (3) valid measures; (4) state-like and open to development. These criteria provide fundamental rules to carry out PsyCap research in the context of Chinese culture. Dawkins, Martin and et al. [5] argued we should proceed cautiously in the expansion of PsyCap methodically and systematically rather than rush towards an 'all inclusive' approach.

Csikszentmihalyi and Csikszentmihalyi [9] described flow experience as an emotional experience that people are fully absorbed in some kind of activity. Hoffman and Novak [10] argued flow experience is the process of optimal experience when the individual is aware of the balance of ones skills and challenges, and stays focused. Flow experience can well meet the criteria of being a PsyCap component as it drives individual to cope with the challenging tasks and attain success by stimulating the positive emotion and behaviors.

We study the conformity of flow experience to be a potential capacity contributing to PsyCap. Firstly, flow experience is of a strong attribute of positivity. It is testified to impact individual behavior, attitude and performance widely. For example, Demerouti [11] found that when employees work conscientiously, flow experience can predict the performance of employees. Secondly, flow experience is discussed with solid theoretical basis. Since Csikszentmihalyi proposed the early model of balance between skills and challenge, much qualitative and quantitative researches have been done and proposed some other important models [12-17], such as Jackson and Marsh [15] proposed nine-factor model, Bakker [17] presented work-related flow inventory (WOLF) that contains absorption, work enjoyment and intrinsic work motivation. Thirdly, flow experience can be measured effectively. The corresponding scale was also developed that was proved to have good tested reliability and validity [17].

Finally, Flow experience is state-like in nature and open to development. People may consider flow experience as a situational factor which is more momentary and changeable. However, the work of Csikszentmihalyi [12] indicated individuals with autotelic personality may have psychological characteristics that make them more prone to flow experience regardless of the situation. Jackson and Ecklund [18] discussed operationalization of flow experience and defined it as both a state and a trait construct. They developed different scales to measure state flow experience and trait flow experience. Fullagar and Kelloway [19] found that 74% of the variation of flow experience comes from the state factors mainly impacted by situational characteristics, and the rest from the trait factors, thus proving flow experience is a state-like capacity. The nature of state-like positions flow experience somewhere along a continuum between transient states which are very changeable, and the traits which are very stable. Fullagar and Kelloway [19] concluded that flow experience clearly fulfills the criteria of POB outlined by Luthans, Avolio and et al. [8] because it is 'state-like in nature' as a POB construct to be developmental. That is well in line

with the construct of PsyCap which is conceptualized as a state-like construct which is relatively malleable and thus can be developed through training interventions [20].

In summary, flow experience supported by theoretical work can meet the criteria to be a POB state contributing to PsyCap. Flow experience is most likely to enhance the structure of PsyCap as it can coordinate with other existing psychological capacities very well to improve overall effect.

III. OPERATIONALIZATION OF PSYCAP: TASK ORIENTATION

In order to expand PsyCap effectively, the operationalization of PsyCap should be further clarified. Luthans, Youssef and Avolio [21] proposed operational definition of PsyCap as an individual's positive psychological state of development: (1) having confidence (efficacy) to take the necessary effort to successfully complete challenging tasks; (2) making a positive attribution (optimism) to success in the present and in the future; (3) sustaining toward goal, and reset the path to reach the goal when necessary (hope); (4) maintaining and bouncing back, and even beyond to succeed when plagued by problems and adversities (resilience). This definition depicts the whole process through which the individual succeed at task. Task orientation is the underlying character of PsyCap.

Flow experience is task oriented that is quite fit for the mechanism of operationalization of PsyCap. Luthans and Youssef [4] proposed to be open for further development of PsyCap and called for attention of flow experience and other potential capacities. Schallberger and Pfister [22] found flow experience is mainly motivated by high levels of positive activity, which occurs more in the work rather than in the leisure activity. Flow experience is derived from the engaged activities so that it is obviously of task orientation associated with ones attempt to fulfill tasks. As a result, flow experience, like other existing capacities of PsyCap, is the task-oriented psychological capacity so that it can integrate well into PsyCap. To incorporated flow experience into PsyCap, this paper is followed by three surveys to provide empirical evidence. To keep it simple, this paper refers the PsyCap integrated with flow experience as expanded PsyCap. In the following studies, we examine the reliability and validity of expanded PsyCap and make comparative analysis of expanded PsyCap and original PsyCap.

IV. EMPIRICAL STUDY OF PSYCAP: FLOW EXPERIENCE INCORPORATED AS A NEW CAPACITY

A. Survey of psychological capacities for possible inclusion in PsyCap

We investigated R&D personnel employing four methods. (1) Focus group interviews. Interviewees are R&D personnel with more than three years of tenure. Twenty-seven people divided into 3 groups were interviewed in Shanghai, China. Demographic distribution of firm type, age, and job level was

considered. Interviews were conducted face-to-face or via video conference. Each interview lasted around three hours. The topic focus is what positive psychological capacities impact individual performance. These psychological capacities should be task-oriented, directly related to working tasks, and state-like and open for development. (2) Literature review. Extant research papers on PsyCap were reviewed along with extensive reading of biography of excellent R&D experts, in order to supplement the limitation of the interview. (3) Open-ended questionnaire. The survey is to collect related behaviors that can meet PsyCap criteria among three high-tech firms in Shanghai. Of 200 surveys distributed, 130 complete surveys were returned. Sixty-seven percent of respondents were male, average age was 34 years. Thirty-seven percent of respondents had bachelor degree and 44% were graduates. (4) Expert consultation. Three organizational behavior scholars and two human resources executives were consulted to solicit behaviors and attitudes of relevant psychological capacities that are in favor of task fulfillment.

B. Classification and Encoding

We sorted the collected information into normalized statement. Of total of 976 items, we encoded and further removed some items through the following steps. (1) Deleted 52 items of ambiguous statement, (2) on the basis of semantic analysis, removed 287 items that were not task-oriented and

can't meet the criteria of PsyCap, (3) consolidated the items with semantic similarity but different expression, and 43 items were left. (4) Clarified the conception of each item and consolidate into the categorization of psychological capacities. We invited an associate professor and a Ph.D. colleague who are familiar with POB domain to fulfill this job. They discussed the results together to form a consensus. Then, reverse classification was arranged to test the accuracy of the results. Three Ph.D. students who didn't participate in the preceding procedure sorted all statements again and obtained results as followings: 18 statements were categorized consistently in the predetermined dimensions across three students; 6 statements were categorized consistently by two students, 3 statements were categorized only by one student, and 1 statement was not categorized in the predetermined dimensions by all three students. The author deleted 1 statement that was not categorized in the predetermined dimensions by all three students. In the end, 27 statements are concluded, which are divided into 5 categories.

We give the name of each category in accordance with the conception of relevant psychological capacity. Each category, the corresponding statements, and the similarity of the classification are shown in Table 1. Of the 5 categories, self-efficacy, optimism, hope and resilience are the existing capacities of PsyCap, while flow experience is the new one included in PsyCap.

TABLE 1 THE CLASSIFICATION OF PSYCAP CAPABILITIES OF CHINESE R&D EMPLOYEES

Capacities	Definition	Items	Frequency	Similarity
Self-efficacy	Believing oneself have the ability to use cognitive resources to obtain specific results	1. I believe I can do the job.	232	94%
		2. I believe I can communicate well with my colleagues and people outside of my company.		
		3. I am full of confidence in my ability of innovation.		
		4. I believe I can analyze the long-term problems, and find solutions.		
		5. I believe I can find a new way to solve the problem during my work.		
Flow experience	Fully absorbed in some kind of activity to gain optimal experience	1. I highly concentrate on my work.	141	92%
		2. My ability can match work requirements.		
		3. I'm crazy about my work.		
		4. When I work, I do it for myself.		
		5. I like the work experience.		
		6. I understand my work goal.		
Optimism	An explanatory style that the positive events are attributed to internal, inherent, and universal reasons	1. In the work, when I faced with uncertainty, I always expected the best	104	86%
		2. I always see the bright side of things in my work.		
		3. I think I usually obtain good results in my work.		
		4. I approach this job as if 'every cloud has a silver lining'.		
		5. In this job, things never work out the way I want them to.		
Hope	A positive expectation to one's goals	1. I found a reliable way to achieve the goal.	85	73%
		2. I will get the results I am unable to get before.		
		3. I think my job is very promising.		
		4. I have a variety of opportunities to make me successful.		
		5. I am getting closer to my work goal.		
		6. The way of reaching the goal is in my control.		
Resilience	Having a kind of ability, in the experience of setbacks and difficulties, bounce back, and even achieve better results	1. I can get through difficult times at work because I've experienced difficulty before.	67	81%
		2. Even if the work is hard, I can persist in doing it.		
		3. I usually work under pressure in stride.		
		4. The more difficult the situation is, the more actively I can deal with.		
		5. When I fail, I will still strive for the best results.		

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C. Exploratory analysis of expanded PsyCap

1) Formulation of the preliminary questionnaire

According to the results of the above investigation and the relevant theoretical studies, we compiled a preliminary questionnaire. In order to ensure the reliability and validity of the questionnaire, the items are drawn from our investigation as well as the existing published scales. We referred to PsyCap scale developed by Luthans, Avolio and et al. [29], self-efficacy scale developed by Tierney and Farmer [23], flow experience scale developed by Bakker and Schaufeli [24], optimistic scale developed by Scheier and Carver [25], hope scale developed by Snyder, Sympson and et al. [26], resilience scale developed by Klohn [27]. In total, 42 scale items are selected. We use a Likert 5 point scale to evaluate from completely disagree to fully agree.

2) Survey sample

For this study, we collected data from thirteen firms in Shanghai. Out of the 400 R&D employees invited to participate in the study, a total of 296 completed all sections of the survey, for a response rate of 74%. In the employee sample, 63% people were men and 37% were women. Of those surveyed the average age was 32 years old, and 25% people had master's degree or above, 64% people had bachelor's degree, the rest were below college degree. Of the companies, 21% of firms were MNC, 17% were joint

ventures, 8% were state-owned firms, and 54% were private firms.

3) Analysis of the survey

- a) Reliability and validity of the scale. We used SPSS to analyze. The overall Cronbach's alpha coefficient was 0.93 that was on high level of reliability. The total variance was 63.46% for all components of PsyCap, which indicated PsyCap had good construct validity.
- b) Discrimination of the items. We carried out a t-test by set 27% percentile of all samples as high score group and low score group. Two items did not reach 0.05 significant level. The t value between high score and low score is less than 3.0. These three items were deleted.
- c) Exploratory factor analysis (EFA). The reverse items were converted. The value of KMO was 0.91, Bartlett spherical test was 6008.57 ($p=0.000 < 0.001$), that showed the samples were suitable for factor analysis. Using the method of Varimax, according to the principle that the eigenvalue is greater than 1, the items of factor load less than 0.50 or above 0.5 in more than 1 factor should be deleted. After several EFA, fourteen items were deleted. The preliminary scale was developed with good convergent validity and discriminant validity. We named each component according to the meaning. Variations of each component were interpreted as shown in Table 2.

TABLE 2 FACTOR ANALYSIS OF PSYCHOLOGICAL CAPITAL AND ITS DEFINITION

Items	Components				
	1	2	3	4	5
I'm crazy about my work.	0.66				
I'm totally immersed in my work.	0.81				
I highly concentrate on my work.	0.69				
I usually feel very happy during my work.	0.62				
I enjoy doing my job.	0.68				
I like the work experience.	0.68				
I believe I can find a new way to solve the problem during my work.		0.58			
I feel confident in representing my work area in meetings with management.		0.71			
I believe I can analyze the long-term problems, and find solutions.		0.75			
I am full of confidence in my ability of innovation.		0.68			
I believe I can communicate well with my colleagues and people outside of my company.		0.72			
I feel confident setting goals in my work area.		0.62			
Right now I see myself as being pretty successful at work.			0.68		
I found a reliable way to achieve the goal.			0.77		
I will get the results I am unable to get before.			0.72		
I have a variety of opportunities to make me successful.			0.67		
The way of reaching the goal is in my control.			0.68		
I can get through difficult times at work because I've experienced difficulty before.				0.63	
Even if the work is hard, I can persist in doing it.				0.78	
I usually work under pressure in stride.				0.77	
The more difficult the situation is, the more actively I can deal with.				0.58	
I always see the bright side of things in my work.					0.70
I think I usually obtain good results in my work.					0.62
I approach this job as if "every cloud has a silver lining".					0.73
I'm optimistic about what will happen to me in the future as it pertains to work.					0.70
Eigenvalue	8.59	2.07	1.89	1.37	1.31
Explained variance	34.37	8.27	7.57	5.49	5.26
Factor name	Flow	Self-efficacy	Hope	Resilience	Optimism
	experience				

Note: factor load less than 0.50 is omitted.

d) Internal consistency reliability. Coefficient alpha of overall PsyCap was 0.92 and each component of PsyCap was above 0.70, of which flow experience was the highest ($\alpha=0.86$), followed by self-efficacy ($\alpha=0.84$), hope ($\alpha=0.82$), resilience ($\alpha=0.78$), optimistic ($\alpha=0.75$). It showed that expanded PsyCap scale formed by the 25 item has good reliability.

The results of EFA showed that flow experience contributed to PsyCap with the greatest variation, which reached 34.37% of the total variance. That suggested as a kind of positive psychological resource, flow experience can effectively supplement PsyCap and has a better explanatory effect.

4) Confirmatory factor analysis (CFA) of Expanded PsyCap

a) Study sample

In order to increase the reliability of analysis, data sources were different from the previous study. Data was collected from R&D teams of fifteen firms in Beijing, Shanghai and Jiangsu province. Surveys adopted by the preliminary scale were distributed to 900 employees. Of the return of 656 surveys, 619 surveys were valid yielding a response rate of 69%. The average age of respondents was 32 years; 71% were men, and 29% were women. 39% people had master's degree or above, 49% people had bachelor's degree, the rest was below college degree. 23% firms were MNC, 16% were joint ventures, 13% were state-owned firms, and 48% were private firms.

b) Model setting

Set the following model: (1) single factor model. Assume that 25 items have a common latent variable; (2) two factors model. The two factors are flow experience and the other dimensions of expanded PsyCap; (3) four factors model. Fullagar and Kelloway [19] found that flow experience is significantly related to positive emotions, so flow experience is combined with one of other PsyCap components as one factor, and the rest are other PsyCap

components; (4) five factors model. The factors are flow experience and other PsyCap components.

c) Result of CFA

Using AMOS 17.0, CFA was performed to estimate the research model. Model fit was evaluated using the various fit indexes described as Table 3. Zero model fit the data poorly as the values of chi-square/degrees of freedom was 26.98. GFI, AGFI, TLI and CFI of Single factor model and two factors model were below 0.90, and RMSEA was greater than 0.08, that showed the two models didn't fit the data well. Five factors model fit the data well with chi-square of 732.55 on 265 degrees of freedom, and other goodness-of-fit statistics ($P < 0.001$; RMSEA = 0.05; GFI = 0.91; AGFI = 0.89; TLI = 0.93; CFI = 0.94), that was superior to any of the four factors model. The results of CFA showed that flow experience has good discriminant validity and act as an independent factor that can't be aggregated into other PsyCap components.

V. COMPARATIVE ANALYSIS OF EXPANDED PSYCAP AND ORIGINAL PSYCAP

A. Study sample

Data was collected from R&D teams of seventeen firms in Beijing, Shanghai and Jiangsu province. Surveys adopted by the scale discussed before were distributed to 700 employees. Of the return of 481 surveys, 454 surveys were valid yielding a response rate of 65%. The respondents' average age and organization tenure were 31 years and 4 years respectively. The respondents were 69% men, and 31% women. The respondents education levels were 23% master's degree or above, 61% bachelor's degree, the rest were below college degree. Of the companies 23% firms were MNC, 46% were joint ventures, 6% were state-owned firms, and 25% were private firms. From the organizational level, 70% were general staff, 22% were supervisors, 7% were middle management, 1% was senior management.

TABLE 3 CONFIRMATORY FACTOR ANALYSIS OF PSYCAP MODEL

Model	χ^2	df	χ^2/df	RMSEA	GFI	AGFI	TLI	CFI
Null model	8095.29	300	26.98	0.21	0.21	0.14	0.00	0.00
Single factor	2073.18	275	7.54	0.10	0.74	0.70	0.75	0.77
Two factors	1599.64	274	5.84	0.09	0.80	0.76	0.81	0.83
Four factors A	1274.77	269	4.74	0.08	0.82	0.78	0.86	0.87
Four factors B	1157.65	269	4.30	0.07	0.85	0.82	0.87	0.89
Four factors C	1013.89	269	3.77	0.07	0.87	0.85	0.89	0.90
Four factors D	1181.91	269	4.39	0.07	0.84	0.81	0.87	0.88
Five factors	732.55	265	2.76	0.05	0.91	0.89	0.93	0.94

Note: n = 701; *** p < 0.001, ** p < 0.01, * p < 0.05

- A merge flow experience and self-efficacy as a potential factor
- B merge flow experience and resilience into a potential factor
- C merge flow experience and optimism into a potential factor
- D merge flow experience and hope into a potential factor

B. Measurement

Expanded PsyCap is developed by this study, flow experience was measured by 13 items adapted from Bakker [17]. Employee performance was measured by 7 items adapted from Williams and Anderson [28]. Regarding original PsyCap, the scale of 24 items as of PCQ developed by Luthans, Avolio and et al. [29] is widely used. Newman, Ucbasaran and et al. [30] found 60% of research used PCQ to measure PsyCap and the rest used short version of PCQ or some of its items when he reviewed 60 papers of PsyCap empirical research during the period from year 2004 to 2013. Therefore, we use PCQ as the scale of original PsyCap.

C. Reliability and Validity of the Construct

The internal consistency reliability of the expansion of expanded PsyCap and original PsyCap are shown in Table 4. Coefficient alpha of overall Expanded PsyCap and each of its components were above 0.70, indicating good reliability.

TABLE 4 RELIABILITY OF EXPANDED PSYCAP AND ORIGINAL PSYCAP

Expanded PsyCap		Original PsyCap	
	Cronbach's α		Cronbach's α
expanded PsyCap	0.93	flow experience	0.88
		self-efficacy	0.87
		hope	0.82
		resilience	0.78
		optimism	0.76
original PsyCap	0.87	self-efficacy	0.85
		hope	0.75
		resilience	0.59
		optimism	0.53

Coefficient alpha of original PsyCap was also above 0.70, but the optimism and resilience were below 0.60. Dawkins, Martin and et al. [5] found the same problem when he reviewed the past studies. In particular, the reliability of overall construct and each component of expanded PsyCap are better than original PsyCap. Using AMOS 17.0, goodness-of-fit statistics of these two models were estimated.

The statistics of expanded PsyCap ($\chi^2 (265) = 781.69$, $\chi^2/df = 2.95$; RMSEA = 0.07, CFI = 0.91) and that of original PsyCap ($\chi^2 (246) = 640.36$, $\chi^2/df = 2.60$; RMSEA = 0.06, CFI = 0.89, TLI = 0.88) shown both of them had good construct validity.

D. Descriptive Information

Table 5 presents descriptive information and correlations for the study variables. Flow experience, original PsyCap, and expanded PsyCap are all positively and significantly correlated with employee performance ($r = 0.49$, $P < 0.01$; $r = 0.54$, $p < 0.01$; $r = 0.58$, $p < 0.01$, respectively). Relation of expanded PsyCap and job performance is at the highest degree. In addition, ($r = -0.02$) gender type ($r = -0.01$) and age ($r = 0.03$), company, degree ($r = 0.01$) and organizational level ($r = 0.09$) and expand the psychological capital were not significantly correlated, suggesting that extended psychological capital little difference in different gender, age, type, degree and level of the organization's employees.

E. Result of regression analysis

To examine the issue of multicollinearity, we calculated variance inflation factors (VIFs) in each of the regression equations. The maximum VIF within the models was below 2.0, which was well below the rule-of-thumb cut-off of 10. To test the effectiveness of PsyCap predicting employee performance, control variables (gender, age, tenure, firm type, education and position level) were first entered into the equation (see the Table 6). From the hierarchical regression results are listed in Table 6, we can see all the control variables except position level don't have a significant impact on employee performance. The reason for position level significantly impact employee performance is that the staff of higher ability have more opportunities to be selected to higher level position, thus increase the possibility of higher performance.

TABLE 5 MEANS, STANDARD DEVIATIONS, AND CORRELATIONS

Variable	Mean	s.d.	1	2	3	4	5	6	7	8	9
1 Gender(1=male)	1.31	.46									
2 Age	31.29	6.61	-.10*								
3 Tenure	4.07	4.15	.03	.60**							
4 Firm type ^a	2.85	.83	-.09	.06	.15**						
5 Education ^b	3.07	.67	.11*	.16**	.17**	.02					
6 Position level ^c	1.39	.67	-.05	.45**	.24**	.02	.18**				
7 Flow experience	3.59	.62	.01	-.08	-.20**	-.06	-.07	.05			
8 Original PsyCap	.00	3.18	-.03	.02	-.11*	.05	.03	.14**	.62**		
9 Expanded PsyCap	.00	3.86	-.02	-.03	-.13**	-.01	.01	.09	.78**	.90**	
10 Employee performance	3.55	.65	.00	.05	-.05	-.02	.07	.19**	.49**	.54**	.58**

Note: n = 454; ** p < 0.01, * p < 0.05

a firm type: (1) state-owned firms; (2) private firms; (3) joint venture; (4) MNC

b education: (1) below college degree; (2) college degree; (3) bachelor's degree; (4) master's degree; (5) doctor's degree and above

c Position level: (1) general staff; (2) supervisors; (3) middle management; (4) senior management

TABLE 6 RESULTS OF REGRESSION ANALYSIS TESTING EFFECTS TO EMPLOYEE PERFORMANCE

	Model 1	Model 2	Model 3	Model 4	Model 5
Control variables					
Gender	.011	-.004	.012	.015	.004
Age	.020	.010	-.012	.007	-.008
Tenure	-0.117*	-.009	-.012	-.016	.014
Firm type	-.008	.005	-.047	-.012	-.028
Education	.051	.076	.035	.044	.054
Position level	0.201***	0.152***	0.119**	0.134**	0.118**
Independent variable					
Flow experience		0.486***			0.259***
Original PsyCap			0.527***		0.367***
Expanded PsyCap				0.561***	
R ²	.049	.272	.312	.353	.352
F	3.803**	23.828***	28.898***	34.694***	30.155***
ΔR ²	.049	.224	.263	.304	.303
F for ΔR ²	3.803**	137.039***	170.803***	209.405***	103.956***

Note: n = 454; *** p < 0.001, ** p < 0.01, * p < 0.05; Values are standardized regression coefficients.

Next the independent variables were entered in turn. Flow experience (model 2, $\beta = 0.486$, $P < 0.001$), original PsyCap (model 3, $\beta = 0.527$, $P < 0.001$) and Expanded PsyCap (model 4, $\beta = 0.561$, $P < 0.001$) had significant positive impact on employee performance. Expanded PsyCap ($R^2 = 0.353$) compared with original PsyCap ($R^2 = 0.312$) had stronger explanatory power to employee performance. In model 5 ($\Delta R^2 = 0.303$), flow experience was entered into the equation together with original PsyCap, there was a significant increase in model fit compared with model 3 ($\Delta R^2 = 0.263$) where only original PsyCap was entered, indicating that flow experience is a good complement to original PsyCap by bring incremental effect for the construct.

VI. DISCUSSION OF THE RESULTS

This study discussed the principles applied to expand PsyCap and explore the feasibility of flow experience as potential capacity of PsyCap. We developed the scale to measure the expanded PsyCap based on the investigation of Chinese R&D employees which has sound reliability and validity. We also verified the effectiveness of expanded PsyCap predicting employee performance. This study of expanded PsyCap has been supported by empirical evidence and finds some interesting topics that can be further explored.

Firstly, we have found that flow experience is an important psychological capacity which has been ignored by previous research. The empirical analysis shows that the stronger explanatory power of flow experience to PsyCap variation (explaining 34.37% of variance), which presents us a promising direction in the study of extending PsyCap. Expanded PsyCap ($R^2 = 0.353$) is obviously better than original PsyCap ($R^2 = 0.312$) to predict employee performance. The result provides preliminary empirical support to the value of integrating flow experience into PsyCap. The original psychological capacities of self-efficacy, optimism, hope and resilience provide the cognitive psychological resources to R&D employees in terms of positive explanation to the individual ability, goal and attribution. That is accepted by our model of expanded

PsyCap. In addition, flow experience replenishes PsyCap with the emotional resource and extends PsyCap to a more comprehensive construct by providing incremental effect.

Although people argue that flow experience is multifaceted and measured by all relevant components, the work of Schiefele [31] showed there is weak evidence for this proposition and thus presented theoretical and empirical arguments in support of a unidimensional interpretation of flow experience. In this paper, we employed field study methodology to find out the potential components of PsyCap. Some of them fall in the concept of flow experience, although they aren't the full spectrum of what Jackson and Marsh [15] presented as a nine factors model. After EFA and CFA, we see only the factors of concentration and enjoyments at work remain as part of PsyCap. So the result of this paper provides preliminary evidence that flow experience can be considered for inclusion into PsyCap. Nevertheless, not all the dimensions proposed in various flow experience models but only some selected ones are included in PsyCap to abide by the law of parsimony.

Secondly, flow experience plays a motivational role to R&D employees so as to enhance the predictive power of PsyCap. Bakker [17] presented three important dimensions of flow experience that are absorption, work enjoyment and intrinsic work motivation. The operationalization of flow experience for R&D employees in the following ways: (1) Challenging and complex R&D tasks require R&D employees to be highly engaged in the work and to constantly concentrate on solving the problems. (2) R&D employees usually have higher work autonomy and can get a positive sense of self control of the work, resulting in emotional intimacy and attachment to their jobs. In addition, (3) R&D employees mainly are motivated by the work itself rather than external factors such as salary and fame. They have strong intrinsic motivation to devote themselves to R&D work. Thus, flow experience that derived from the R&D work can make R&D employees gain self enhancement of work feedback and stimulate intrinsic interest in achieving innovative results.

Thirdly, expanded PsyCap better adapt to Chinese context

than original PsyCap. This study shows that the reliability and validity of original PsyCap is lower than expanded PsyCap, especially for resilience and optimism that is below the generally accepted standard (0.7). The result is consistent with the study done by Luthans, Avolio and et al. [8]. The main reason is not just translation errors when using scale of PsyCap developed by western scholars, but more importantly the explanatory methodology of PsyCap in another cultural context is no longer valid. In this study, in addition to the new capability of the flow experience, the other psychological capabilities of expanded PsyCap are similar to the original PsyCap, but the implication of these capabilities is different. For example, western scholars believe that the hope mainly refers to the pathways and willpower, but in the Chinese context, it is more expressed as a positive expectation to one's goals. This may be related to the Chinese preference on the subjective trend and feeling, but not the process and the details of the objective. Therefore, even in the same psychological capacity, expanded PsyCap has different scale items compared with the western scale so as to better fit the specific explanation of Chinese context.

VII. IMPLICATIONS

Our study contributes to research on PsyCap in several ways.

- 1 We expand PsyCap and develop the scale to measure PsyCap, that further understanding of the structure and inclusion of PsyCap. More importantly, it will help take effective measures to invest and intervene with PsyCap. In face of dynamic environment, the work is becoming more and more complicated and uncertain. Only with a better understanding and good utilization of PsyCap, individuals can equipped themselves with a positive psychological advantage to resist psychological pressure, overcome difficulties, and maximize their potential.
- 2 Flow experience enriches the scope of PsyCap and opens up a new perspective for the application of PsyCap. Flow experience is a powerful driving force for the individual to gain success. It has its own specific positive role, for example, Skadberg and Kimmel [32] found that when the site visitors are in the state of flow experience, they can learn more from a website. Choi, Kim and Kim [33] investigated network learning and indicated that flow experience is related to the learning outcomes, which can directly and indirectly affect the learning results. These studies shown PsyCap has more potential value to be employed after it is integrated with flow experience.
- 3 The study of R&D employees' PsyCap lays the solid foundation for accelerating performance of R&D employees. From a global perspective, technology innovation is increasingly vital to social development. R&D employees are the key to technology innovation. The study R&D employees' PsyCap can reveal the black box of the process transforming individual resources to innovation and effectively realizing the potentials of

talents.

VIII. LIMITATIONS AND FUTURE DIRECTIONS

In this study, both the expanded PsyCap and employee performance were measured by the same group of respondents, an approach that has been adopted in several studies. Although self-reported measures are subject to common method bias, they have been reported to correlate with supervisory ratings of creativity [34]. R&D employee is highly engaged in creativity and innovative performance. It has been argued that managers may not notice a great deal of employee innovative performance and employees are the ones who are aware of what they do in their jobs that make them creative [35]. Nonetheless, it would be useful to investigate whether the results would coincide with different measures.

Furthermore, flow experience is described as a psychological state influenced by state-based factors with individuals varying in their propensity to go through flow experience [36]. Kimiecik and Stein [37] suggested that for athletes the relationship between flow experience and engaging in sporting activities is contingent upon whether the athletes have a task- or ego- involved goal orientation. It is on the future research agenda to examine whether flow experience and PsyCap have any correlation with each other as two independent constructs, for instance, whether PsyCap moderates the relationship between situational characteristics and flow experience, or serves as the antecedent of flow experience.

REFERENCES

- [1] Luthans F, Youssef C M. Human, Social, and Now Positive Psychological Capital Management: Investing in People for Competitive Advantage. *Organizational Dynamics*, 2004, 33(2): 143-160.
- [2] Luthans F, Luthans K W, Luthans B C. Positive Psychological Capital: Beyond Human and Social Capital. *Business Horizons*, 2004, 47(1): 45-50.
- [3] Youssef C M, Luthans F. Positive Organizational Behavior in the Workplace the Impact of Hope, Optimism, and Resilience. *Journal of Management*, 2007, 33(5): 774-800.
- [4] Luthans F, Youssef C M. Emerging Positive Organizational Behavior. *Journal of management*, 2007, 33(3): 321-349.
- [5] Dawkins S, Martin A, Scott J, et al. Building On the Positives: A Psychometric Review and Critical Analysis of the Construct of Psychological Capital. *Journal of Occupational and Organizational Psychology*, 2013, 86(3): 348-370.
- [6] Csikszentmihalyi, M. *Beyond Boredom and Anxiety: the Experience of Play in Work and Games*: San Francisco: Jossey-Bass. 1975.
- [7] Gupta V, Singh S. Psychological Capital as a Mediator of the Relationship Between Leadership and Creative Performance Behaviors: Empirical Evidence From the Indian R&D Sector. *The International Journal of Human Resource Management*, 2014(ahead-of-print): 1-22.
- [8] Luthans F, Avolio B J, Walumbwa F O, et al. The Psychological Capital of Chinese Workers: Exploring the Relationship with Performance. *Management and Organization Review*, 2005, 1(2): 249-271.
- [9] Csikszentmihalyi M, Csikszentmihalyi I S. *Optimal Experience: Psychological Studies of Flow in Consciousness*. Cambridge: Cambridge University Press, 1992.

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- [10] Hoffman D L, Novak T P. Marketing in Hypermedia Computer-Mediated Environments: Conceptual Foundations. *The Journal of Marketing*, 1996: 50-68.
- [11] Demerouti E. Job Characteristics, Flow, and Performance: The Moderating Role of Conscientiousness. *Journal of occupational health psychology*, 2006, 11(3): 266.
- [12] Csikszentmihalyi M. *Flow: The Psychology of Optimal Experience*. New York: Harper and Row, 1990.
- [13] Csikszentmihalyi M. *The Evolving Self: A Psychology for the Third Millennium*. New York: HarperCollins, 1993.
- [14] Jackson S A. Toward a Conceptual Understanding of the Flow Experience in Elite Athletes. *Research quarterly for exercise and sport*, 1996, 67(1): 76-90.
- [15] Jackson S A, Marsh H W. Development and Validation of a Scale to Measure Optimal Experience: The Flow State Scale. *Journal of sport and exercise psychology*, 1996, 18: 17-35.
- [16] Bakker A B. Development and Validation of the Work-Related Flow Inventory (WOLF). Manuscript submitted for publication, 2004.
- [17] Bakker A B. The Work-Related Flow Inventory: Construction and Initial Validation of the WOLF. *Journal of vocational behavior*, 2008, 72(3): 400-414.
- [18] Jackson S A, Eklund R C. Assessing Flow in Physical Activity: The Flow State Scale-2 and Dispositional Flow Scale-2. *Journal of Sport & Exercise Psychology*, 2002, 24, 133-150.
- [19] Fullagar C J, Kelloway E K. Flow at Work: An Experience Sampling Approach. *Journal of occupational and organizational psychology*, 2009, 82(3): 595-615.
- [20] Luthans F, Avey J B, Patera J L. Experimental analysis of a web-based training intervention to develop positive psychological capital[J]. *Academy of Management Learning & Education*. 2008, 7(2): 209-221.
- [21] Luthans F, Youssef C M, Avolio B J. *Psychological Capital: Developing the Human Competitive Edge*. Oxford University Press, 2007.
- [22] Schallberger U, Pfister R. Flow Experiences in Work and Leisure. An Experience Sampling Study About the Paradox of Work. *Magazine for Work and Organizational Psychology*, 2001, 45(4): 176-187.
- [23] Tierney P, Farmer S M. Creative Self-Efficacy: Its Potential Antecedents and Relationship to Creative Performance. *Academy of Management Journal*, 2002, 45(6): 1137-1148.
- [24] Bakker A B, Schaufeli W B. Positive Organizational Behavior: Engaged Employees in Flourishing Organizations. *Journal of Organizational Behavior*, 2008, 29(2): 147-154.
- [25] Scheier M F, Carver C S. Optimism, Coping, and Health: Assessment and Implications of Generalized Outcome Expectancies. *Health psychology*, 1985, 4(3): 219.
- [26] Snyder C R, Sympson S C, Ybasco F C, et al. Development and Validation of the State Hope Scale. *Journal of Personality and Social Psychology*, 1996, 70(2): 321.
- [27] Klohnen E C. Conceptual Analysis and Measurement of the Construct of Ego-Resiliency. *Journal of Personality and Social Psychology*, 1996, 70(5): 1067.
- [28] Williams L J, Anderson S E. Job Satisfaction and Organizational Commitment as Predictors of Organizational Citizenship and In-Role Behaviors. *Journal of Management*, 1991, 17(3): 601-617.
- [29] Luthans F, Avolio B J, Avey J B, et al. Positive Psychological Capital: Measurement and Relationship with Performance and Satisfaction. *Personnel Psychology*, 2007, 60(3): 541-572.
- [30] Newman A, Ucbasaran D, Zhu F, et al. Psychological Capital: A Review and Synthesis. *Journal of Organizational Behavior*, 2014, 35(S1): S120-S138.
- [31] Schiefele U. Response to Engeser: on the Nature of Flow Experience. *Psychological Reports*, 2013, 112(2): 529-532.
- [32] Skadberg Y X, Kimmel J R. Visitors' Flow Experience while Browsing a Web Site: Its Measurement, Contributing Factors and Consequences. *Computers in Human Behavior*, 2004, 20(3): 403-422.
- [33] Choi D H, Kim J, Kim S H. ERP Training with a Web-Based Electronic Learning System: The Flow Theory Perspective. *International Journal of Human-Computer Studies*, 2007, 65(3): 223-243.
- [34] Axtell C M, Holman D J, Unsworth K L, et al. Shopfloor innovation: Facilitating the suggestion and implementation of ideas[J]. *Journal of occupational and organizational psychology*, 2000, 73(3): 265-285.
- [35] Janssen O. Job demands, perceptions of effort-reward fairness and innovative work behaviour[J]. *Journal of Occupational and organizational psychology*, 2000, 73(3): 287-302.
- [36] Kimiecik S A, Jackson J C. Psychological correlates of flow in sport. *Journal of Sport & Exercise Psychology*, 1998, 20: 358-378.
- [37] Kimiecik J C, Stein G L. Examining flow experiences in sport contexts: Conceptual issues and methodological concerns[J]. *Journal of Applied Sport Psychology*, 1992, 4(2): 144-160.