Research on career success of computer information technology research and development (R&D) personnel

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Abstract. To explore the influence mechanism of psychological capital on career success, a questionnaire survey was conducted among 288 research and development personnel of computer information technology in China. The results showed that psychological capital, career commitment, person-organization fit, total score and each dimension of career success were significantly positively correlated with each other; psychological capital significantly positively predicts objective and subjective career success, and the predictive effect of both can be realized through the mediating role of career commitment; in the second half of the mediated path between psychological capital and subjective career success, career commitment is regulated by person-organization fit. Compared with individuals with a low level of person-organization fit, individuals with a high level of person-organization fit have a stronger mediating effect on the relationship between psychological capital and subjective career success.

1. Introduction
At present, the rapid development of computer information technology has greatly promoted the interconnection of human beings. As a “new momentum” of development, digital economy has become a global consensus. As early as 2015, China has put forward the “internet +” action plan with great foresight. According to the latest data, China has the largest number of IPv6 addresses in the world. As of June 2019, China had 854 million internet users, with an internet penetration rate of 61.2%, and users’ monthly mobile traffic usage was 7.2GB, 1.2 times the global average. This has also intensified a new round of competition for computer information technology talents. Under the guidance of the national strategy of cyber power, it is hard for China to continuously improve its competitiveness without an computer information technology R&D team that matches the development needs of enterprises, identifies with its own career and is full of confidence in its career development. In order to manage the computer enterprise more effectively to meet the challenges, the organization needs to turn to a new paradigm. In this paradigm, the outstanding competitive advantage of sustainable development can no longer be built on the traditional scarce resources, while the development characteristics and potential advantages of psychological capital are suitable for the current fast-paced work environment [1]. Career success is an important result of individual career experience. Employees’ career success is beneficial to the development of the organization. People
who are satisfied with their career are more willing to put into their own work, make greater contributions to organizational performance, and have less turnover tendency [2].

R&D personnel of computer information technology enterprises are important founders of the computer industry. They have contributed high efficiency and convenience to this era and have also paid a huge physical and mental price. Therefore, we want to explore the factors that affect the career success of computer information technology R&D personnel under the current new management paradigm based on the potential advantages of sustainable development of psychological capital, and introduce personal and situational factors to comprehensively explore the mechanism.

2. The theoretical basis and research assumption

2.1. The relationship between psychological capital and career success

Career success refers to the work-related achievements and positive psychological feelings accumulated and obtained by individuals in their work experience [3]. It includes objective and subjective elements. In career-related research, both objective and subjective career successes have received great attention. Traditionally, researchers have paid more attention to objective career success, which is usually associated with economic indicators, such as salary and promotion [4]. However, in the current borderless career background, due to the mobility and unpredictability of employees among enterprises, researchers are increasingly focusing on personal significance to evaluate career success, namely subjective career success. Subjective career success usually reflects one's satisfaction and sense of accomplishment with one's career or job [5].

Luthans et al. pointed out that psychological capital is a positive psychological force beyond human and social capital, which is manifested in four dimensions: Hope, self-efficacy, resilience and optimism [6]. These four dimensions can effectively improve organizational performance and have an impact on career success [7]. Specifically, individuals who is full of hope will keep moving forward and pursue the achievement of their goals. People with high self-efficacy tend to choose challenging tasks and work hard. People with strong resilience have the ability to overcome adversity and uncertainty and grow up in setbacks and difficulties. Optimists make correct attributions to success, establish an empirical advantage, and overcome a series of difficulties along the career path.

Career success is regarded as a dynamic concept that changes with time [8]. Therefore, individuals must be in an active "plastic state" and develop appropriate behaviors and skills to meet new job requirements [1]. In the current complex and changeable economic environment, employees are faced with great uncertainty, pressure and anxiety. Human capital and social capital are only the potential ability to achieve high performance, while psychological capital is an important tool to transform potential ability into realistic attitude and behavior [9]. In recent years, many researches have put forward the positive effects of psychological capital on employees' attitudes and behaviors, such as career commitment, career investment, subjective well-being, etc [10-12]. Williams, Kern, & Waters describe psychological capital as a resource pool that enables individuals to adapt to challenges, improve organizational performance, and promote job satisfaction [13]. Therefore, the level of positive psychological capital is an important predictor of enterprise employees' career success.

2.2. The mediating role of career commitment

The positive predictive effect of psychological capital on career commitment has been confirmed in some studies [12, 14-15]. Career commitment is defined as an individual's attitude towards his profession or career [16]. Career commitment, as the psychological link between individual and career, is bound to be affected by personality characteristics. Rodney and Lauress found that extroverted personality and positive emotion were positively related to career commitment when studying the relationship between personality, emotional factors and career commitment [17]. Emma & Sarah found that career commitment and job stress interacted and were significantly negatively correlated [18]. According to the theory of self-determination [19], the characteristics of self-efficacy, optimism, hope and resilience contained in psychological capital can promote the satisfaction of
individual autonomy, competence and relationship needs, and tend to have higher life satisfaction, positive emotion and lower level of negative emotion, which further helps employees to overcome difficulties and challenges and obtain positive career attitude, thus helping them to stick to and put into their own work [12]. The study found that self-efficacy as one of the components of psychological capital can predict the career commitment of catering service employees [20].

On the other hand, because career commitment refers to the degree to which employees wish to develop and progress in their career, many studies emphasize the expected relationship between career commitment and career success, and career commitment can promote the realization of career success [21-23]. Research shows that due to large-scale layoffs, mergers and acquisitions and other challenges faced by contemporary enterprises, the responsibility for career management has gradually shifted from the organization itself to individual employees. Organizations no longer provide job security to employees, which will lead to an increase in personal commitment to their career rather than to the organization [24]. Therefore, individuals who are committed to career development may make large investments and make extra efforts to maintain their career development, thus promoting higher objective and subjective career success. In addition, some studies have shown that the relationship between psychological capital and career success is mediated by some other variables. For example, Zhou et al. concluded that organizational sponsorship can play a mediate role in the influence of psychological capital on subjective and objective career success [25]. The lack of empirical research has prompted us to consider whether career commitment will play a mediating role in the relationship between psychological capital and career success (objective career success and subjective career success) in the background of R&D personnel in computer information technology. Previous studies have confirmed that career commitment plays a mediating role in the impact of some variables on career success. For example, Zhou proved that career commitment of female teachers in colleges plays a mediating role in the impact of career calling on career success [26]. Chen showed that career commitment can mediate the impact of core self-evaluation on career success [27]. Therefore, this study assumes that career commitment can mediate the effect of psychological capital on career success (H1). Career commitment is a positive career attitude generated by psychological capital, which can urge individuals to make greater efforts to achieve career success.

2.3. The moderating effect of person-organization fit

Wang & Yang pointed out that the realization of career success can focus on the influence of some regulatory variables from the perspective of the joint action of individual and situational factors [28]. As two independent and related individuals, the fit between individuals and organizations is one of the most extensive research topics in organizational behavior research [29]. Trait excitation theory [30-31] points out that employees will not only be stimulated to specific behaviors under the condition that the external situation is consistent with individual characteristics, but also actively search for situational factors related to their own characteristics to obtain internal incentives. Perceived person-organization fit can predict employees' work behaviors and attitudes [32].

Person-organization fit mainly discusses the consistency and compatibility of personal and organizational values, cultural, strategic needs, goals, etc. It is mainly divided into similarity fit and demand-supply, demand-ability fit. When an employee conforms to the values and cultural of an enterprise organization, the employee can better understand and identify with the strategic goals of the enterprise, and link the career aspirations to the organization’s goals, and would make efforts to achieve the organizational goals without any dispute. Organizations are also more likely to perceive the needs of employees and continuously optimize the organizational environment to meet the different needs of these employees. A high degree of person-organization fit has been proved to be related to a variety of organizational results, including enhancing organizational commitment, employee creativity, improving job performance, job satisfaction, reducing turnover intention, and promoting career success [33-35]. Arthur et al. pointed out that when individuals and organizations fit, organizations provide opportunities for individuals to meet their needs, and the satisfaction of needs leads to employees' good attitudes, such as job satisfaction and career commitment [36]. On the
contrary, when the level of person–organization fit is low, individuals usually show lower job satisfaction, organizational commitment and higher turnover intention [33]. Therefore, this study further assumes that person–organization fit can play a moderating role (H2) in the impact of career commitment on career success.

With the dependence of computer industry on information technology, the effective selection, management and training of R&D personnel are becoming more and more important. Therefore, enterprises should employ those who are more likely to succeed in their careers and allocate more resources to meet the needs of such core talents and promote their career development, because technology will represent the organization's future competitive advantage. To sum up, this study intends to explore the impact of psychological capital on career success and its mechanism, and to build a moderated mediating model based on previous theories and studies. The model assumes that career commitment can mediate the impact of psychological capital on career success, and person-organization fit can moderate the impact of this mediating path. The model assumption was shown in Fig. 1.

![Hypothetical model of psychological capital, career commitment, person-organization fit and career success](image)

Figure 1. Hypothetical model of psychological capital, career commitment, person-organization fit and career success

3. Method

3.1. Subjects
The participants were the R&D personnel from computer information technology enterprises. The psychological capital, person-organization fit, career commitment and career success of some R&D personnel in major cities across China were measured by random sampling method. The questionnaires were mainly distributed through the Internet. Finally, 288 valid questionnaires were obtained, with an average age of 31.60±5.38 years, including 201 males (69.79%) and 87 females (30.21%).

3.2. Instruments
This questionnaire includes five sections, namely personal basic information, psychological capital, person-organization fit, career commitment and career success. We selected the basic information (sex, age, marital status, educational background, working years) as control variables.

3.2.1. Psychological Capital Scale
The psychological capital scale [1] designed by Luthans, Youssef & volio includes 4 dimensions and 24 items, namely, self-efficacy (items 1-6), hope (items 7-12), resilience (items 13-18) and optimism (items 19-24). Among them, items 13, 20 and 23 are entitled reverse scoring questions, which are scored from 1 to 5. The higher scores indicating higher psychological capital level. The internal consistency coefficient of this scale is 0.85.

3.2.2. Career Commitment Scale
The 7-item career commitment scale [16, 37] developed by Blau was used, three reverse items in the original scale were changed to positive items according to Pei suggested. Take a score of 1~7 points, and add up the scores of all items to get the average, which is the subject's career commitment score. The higher the score, the higher the individual's career commitment level. The internal consistency coefficient of this scale is 0.90.
3.2.3. Person-organization Fit Scale
The person-organization fit scale developed by Cable and De Rue includes 3 dimensions and 9 items, namely, value fit (items 1-3), demand-supply fit (items 4-6) and demand-ability fit (items 7-9). The scale is scored at 1-5 points. The items of the scale are all positive items, that is, the higher the score, the higher the degree of person-organizational fit. The internal consistency coefficient of the person-organization fit questionnaire is 0.87.

3.2.4. Career Success Scale
Career success scale consists of objective and subjective career success sub-scales. The objective career success scale developed by Eby et al. and the subjective career success scale designed by Greenhause et al. were used, the objective career success scale includes 2 dimensions and 6 items, namely, perception of the internal market competitiveness of the organization. Taking a score of 1 to 5 points, the items in this scale are all positive items, that is, the higher the score, the higher the career success level. The α coefficient of the career success scale is 0.82, which has good internal consistency reliability.

4. Results

4.1. Common Method Bias Control
In addition to procedural control of possible common method deviations, such as anonymous responses. Harman single factor test was used to test the deviation of the common method. The results showed that the variance explained by the first factor is 29.04%, which is lower than the critical value of 40%, indicating that there was no obvious common method deviation in this study.

4.2. Descriptive Statistics and Correlation analysis
Table 1 lists the average, standard deviation and correlation analysis results of the variables in this study. The results showed that psychological capital, career commitment, person-organization fit, career success total scores, and each dimension of career success are all significantly positively correlated with each other.

|                    | M    | SD  | 1  | 2  | 3  | 4  | 5  | 6  |
|--------------------|------|-----|----|----|----|----|----|----|
| 1 Psychological capital | 98.26 | 10.40 | 1  |    |    |    |    |    |
| 2 Professional commitment | 37.22 | 7.08  | 0.58*** | 1  |    |    |    |    |
| 3 Person-organization fit | 34.99 | 5.19  | 0.64*** | 0.72*** | 1  |    |    |    |
| 4 Career success        | 41.95 | 5.95  | 0.61*** | 0.66*** | 0.76*** | 1  |    |    |
| 5 Objective career success | 23.06 | 3.18  | 0.46*** | 0.44*** | 0.52*** | 0.82*** | 1  |    |
| 6 Subjective career success | 18.90 | 3.78  | 0.58*** | 0.66*** | 0.76*** | 0.88*** | 0.46*** | 1  |

Note: ***p<0.001, **p<0.01, *p<0.05, the same below.

4.3. The Moderated Mediating Model Test
This study standardized all variables to avoid multicollinearity. Process plug-in model 4 in SPSS macro compiled by Hayes was used, whether the direct predictive effect of psychological capital on career success (objective career success and subjective career success) is influenced by the mediation of career commitment was tested. From Table 2, it can be seen that under the condition of controlling gender and age, psychological capital can significantly positively predict career commitment and subjective and objective career success. At the same time, career commitment can positively predict objective career success and subjective career success.
Table 2. Psychological capital and career commitment predict career success

| Result variable       | predictive variable       | β    | SE  | t    | p       | 95% CI   |
|-----------------------|--------------------------|------|-----|------|---------|----------|
| Career commitment     | Psychological capital    | 0.57 | 0.05| 11.61| <0.001 | [0.47, 0.66] |
| Objective career success | Psychological capital | 0.30 | 0.63| 4.72 | <0.001 | [0.17, 0.42] |
|                       | Career commitment        | 0.25 | 0.06| 3.93 | <0.001 | [0.12, 0.37] |
| Subjective career success | Psychological capital | 0.30 | 0.05| 10.55| <0.001 | [0.20, 0.39] |
|                       | Career commitment        | 0.53 | 0.05| 10.55| <0.001 | [0.43, 0.62] |

Therefore, the results of mediating effect showed that the mediating effect of career commitment is significant. The direct effect (0.30) of psychological capital on objective career success and the partial mediating effect (0.14) of career commitment account for 68.18% and 31.82% of the total effect (0.44), respectively. The direct effect (0.29) of psychological capital on subjective career success and the partial mediating effect (0.30) of career commitment account for 49.15% and 50.85% of the total effect (0.59), respectively. It shows that psychological capital can both predict career success directly and indirectly through the career commitment.

The moderating effects of person-organization fit were shown in Table 3. After person-organization fit was put into the model, psychological capital significantly positively predicted career commitment ($\beta = 0.59, p < 0.001$); psychological capital and person-organization fit also significantly positively predicted objective career success ($\beta = 0.28, p < 0.001; \beta = 0.25, p < 0.01$). However, the career commitment, the interaction of career commitment and person-organization fit have no significant impact on objective career success ($\beta = 0.09, p > 0.05; \beta = -0.01, p > 0.05$). In addition, not only psychological capital, career commitment and person-organization fit have significant positive predictive effects on subjective career success ($\beta = 0.11, p < 0.05; \beta = 0.28, p < 0.001; \beta = 0.53, p < 0.001$), the interaction between career commitment and person-organization fit also had a significant impact on subjective career success ($\beta = 0.06, p < 0.05$). Therefore, only the latter half of the mediating model of psychological capital $\rightarrow$ career commitment $\rightarrow$ subjective career success was regulated by person-organization fit.

Table 3. Moderated mediating model test

| Regression equation (N = 288) | Global fit index | Significance |
|-------------------------------|------------------|--------------|
| Result variable               | predictive variable | R    | R²  | F    | $\beta$ | t     |
| Career commitment             | Psychological capital | 0.61 | 0.37| 27.16| 0.59   | 12.17*** |
| Objective career success      | Psychological capital | 0.60 | 0.36| 17.06| 0.28   | 4.15*** |
|                               | Career commitment | 0.09 |     | 1.17 |        |       |
|                               | Person-organization fit | 0.25 |   | 3.34** |        |       |
|                               | Career commitment * person-organization fit | -0.01 |   | -0.16 |        |       |
Subjective career success          0.81    0.65    57.08

Psychological capital            0.11    2.12*
Career commitment               0.28    5.11***
Person-organization fit          0.53    9.44***
Career commitment * person-
organization fit                 0.06    2.01*

Note: All variables in the model are brought into the regression equation using standardized variables.

The mediating effect of career commitment with different levels of person-organization fit was shown in Table 4. Analyzing the mediating model of psychological capital, career commitment (mediation) and subjective career success, it was found that when the level of person-organization fit was high, the mediating effect value of career commitment is 0.21, and its 95% Bootstrap confidence interval is [0.10, 0.33], not including 0, which is significant. When the person-organization fit level is low (average minus one standard deviation), the mediating effect value of career commitment is 0.13, and its 95% Bootstrap confidence interval is [0.04, 0.23], which is also significant without 0.

In order to reveal the specific moderated effect of person-organization fit, a simple slope test was conducted. The results showed (see Fig. 2) that the predictive effect of career commitment on subjective career success of individuals with higher level of person-organization fit (simple slope = 0.35, t = 4.84, p < 0.001) was higher than that of individuals with lower level of person-organization fit (simple slope = 0.22, t = 3.91, p < 0.001). This shows that after making a stable career commitment, when the person-organization fit level is high, enterprise R&D personnel are more likely to perceive subjective career success.

| Mediating variable | Person-organization fit | Indirect effect value | Boot standard error | Boot CI lower limit | Boot CI upper limit |
|--------------------|-------------------------|-----------------------|---------------------|---------------------|--------------------|
| Career commitment  | M-SD                    | 0.13                  | 0.05                | 0.04                | 0.23               |
|                    | M                       | 0.17                  | 0.05                | 0.08                | 0.27               |
|                    | M+SD                    | 0.21                  | 0.06                | 0.10                | 0.33               |

Note: Boot standard error, Boot CI lower limit and Boot CI upper limit refer to the standard error of indirect effect estimated by the deviation corrected percentile Bootstrap method, the lower limit and upper limit of 95% confidence interval.
Figure 2. Moderated effect of person-organization fit on relationship between career commitment and subjective career success

5. Discussion

The results of correlation analysis showed that psychological capital, person-organization fit, career commitment, career success total scores, and each dimension of career success are all significantly positively correlated with each other, indicating that the positive psychological strength of computer information technology R&D personnel was closely linked with their work environment adaptation and subjective and objective career achievement [38-40]. This study found that psychological capital is a direct factor that affects the career success of R&D personnel in the computer information technology industry. The broaden-and-build theory shows that positive emotions can promote the upward development of individuals [41]. This study further provides empirical basis for this theory.

In addition to direct impact, the results of this study showed that career commitment can play a mediating role in the impact of psychological capital on the career success of R&D personnel, which is consistent with our Hypothesis 1 and previous research results [15]. As previous studies have found, employees with higher levels of psychological capital, i.e. hopeful, high self-efficacy, high level of resilience, optimistic individuals are more committed to their career [12, 20, 42]. Carless & Bernath believed that psychological capital can predict personal abilities and interests related to positive career behaviors and goals, which will cultivate employees' commitment to their careers and thus promote the success of the organization [43]. Psychological capital can guide individuals to realize their career goals by enhancing their advantages, best functions and abilities, and realize their full and efficient life by making individuals realize their potential [44]. In addition, consistent with previous studies [23, 45], this study also proved that career commitment can significantly predict subjective career success and objective career success. Career commitment can help employees adapt to the changing working environment. A person with a high level of career commitment will be more willing to accept training and practical activities, acquire knowledge and skills [46], set higher career goals, and make efforts to adhere to these goals [21], thus contributing to the progress and development of the career. Correspondingly, greater efforts and persistence usually lead to higher performance, thus bringing more promotion opportunities to individuals. In addition, many studies also point out that the level of individual career commitment is positively correlated with their career satisfaction [47-48]. Therefore, positive psychological capital strength can enhance career commitment, which is beneficial for computer information technology R&D personnel to achieve better career achievements.

The study also found that the effect of career commitment on subjective career success is regulated by person-organization fit. Compared with individuals with low level of person-organization fit, the effect of career commitment on subjective career success is stronger among R&D personnel with high level of person-organization fit. Previous studies have shown that when moderating variables moderate the first half or the second half of the mediation path, the effect of the whole mediation path can also be moderated [49]. In this study, compared with individuals with a lower degree of person-organization fit, when person-organization fit is high, employees with a high level of psychological capital are more likely to make lasting career commitment, thus promoting the realization of their
subjective career success. When people fit well with the environment, people are likely to form pro-social attitudes and behaviors (i.e. career commitment in this study) [50]. Some studies have shown that when people feel that their preferences match the actual environment, they will have a sense of responsibility [51], thus showing higher job satisfaction, job performance, organizational commitment, career commitment and less staff turnover [29]. On the contrary, when the person-organization fit degree is low, it will reduce the employee's job satisfaction and increase the turnover intention [52-53].

However, inconsistent with our hypothesis, the results did not provide sufficient evidence to prove the moderating effect of person-organization fit in the relationship between career commitment and objective career success. On one hand, we suspected that the limited sample size in this study may limit the significance of statistical effectiveness. On the other hand, it may be related to China's increasing investment in R&D over the past years, and the gradual emergence of engineer manufac. As the core talents that enterprises compete to allocate, the R&D personnel of computer information technology enterprises have market competitiveness (i.e. objective professional success) both inside and outside the organization, and therefore will not be moderated by person-organization fit. At the same time, it also gives us great management inspiration. On one hand, as a resource with large gap, computer information technology enterprises' R&D personnel must face frequent internal personnel changes under the current background of borderless career. On the other hand, no matter for enterprise organizations or individual employees, the values and needs that fit each other are not only helpful for individuals to give full play to their potential to obtain career satisfaction, but also helpful for organizations to win broader living space and future development, and ultimately enhance their competitiveness. The results of this study further confirmed the unique role of person-organization fit in obtaining suitable candidates for enterprises. Good person-organization fit is an important source for individuals and enterprises to improve efficiency and help enterprises to obtain sustainable competitive advantages.

In a word, this study is of great significance to the development of employees and organizations. First of all, for individual, career success is a measure of a person's current status and future direction of action. Information about career success predictors can help employees to develop their career abilities and skills, and select organizations that are more suitable for them to achieve greater subjective and objective career success. Secondly, for organizations, the results also bring a new insights to managers and human resources practitioners: Understanding the predictive factors of career success helps enterprises to formulate measures to select more suitable employees at the recruitment stage. Enterprise managers should create a career environment for employees to improve their psychological capital level. Provide counseling measures and practical opportunities within the enterprise to enhance the personal capacity building of employees and cultivate their career commitment. Pay attention to the matching of people and posts and the promotion of corporate cultural values. As long as employees feel that their values are in good agreement with the values of the organization, they are more likely to be satisfied with their work and achieve higher career success.

Indeed, this study focuses on R&D personnel. The sample size is limited and it is a cross-sectional study. The subjective reporting method is mainly adopted. Compared with the experimental control method, the causal effect revealed is limited. However, in the next study, we will consider conducting longitudinal follow-up research in order to obtain more powerful evidence and provide some valuable suggestions for promoting the successful career development of employees and thus improving the enterprise performance.

6. Conclusion
Psychological capital significantly positively predicted objective career success and subjective career success respectively, and career commitment played an mediating role in the relationship between psychological capital and their behaviors. A moderated mediating model of psychological capital influencing subjective career success of internet researchers was established, in which person-organization fit can play a moderating role in the influence of career commitment on subjective career
success. When the level of person-organization fit is high, individuals are more inclined to show a higher level of career commitment, thus realizing their subjective career success.

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