

Study on China University Research Teachers Psychological Problems and Strategies from the Perspective of Disruptive Technological Innovation

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Abstract—Aims: This paper mainly points out the specific problems of the psychological status of college teachers and gives corresponding solutions from the perspective of psychology and sociology. **Methods:** The paper uses semi-structured interviews with three different professors in the field of disruptive technological innovation research, and the data are transcribed with grounded theory to form specific research contents. **Results and Conclusion:** The paper concludes three typical types of psychological problems, which is scientific research ecological and economic ecological imbalance, technological ecology and group mentality unbalance, Occupational ecology and individual environment imbalance. It also gives three strategies, which is diversified scientific research environment and reasonable reward and punishment system, interdisciplinary technical training and team collaboration, career development management and individual success attribution.

Keywords—disruptive technological innovation, scientific research teachers, psychological problems, resolution strategy

I. INTRODUCTION

Since China has taken disruptive technology innovation as an important means of technological breakthrough in recent years, more and more researchers focus on the innovation of disruptive technology mode, structure, path and practice. However, most researchers ignore that university teachers, as a participatory research tool, have unique mental and psychological characteristics. So the psychological problems of university teachers are also the key problems to be broken through in technological innovation [1].

"Disruptive Technology" proposed by Clayton m. Christensen believes that disruptive technologies can replace existing mainstream technologies in unexpected ways (Christensen, 1995) [2], "They are often cut from low-end or marginal markets, characterized by simplicity, convenience and cheapness at the initial stage. With the continuous improvement and perfection of performance and function, they will eventually replace existing technologies, open up new markets and form new value systems [3] (Su peng, 2019)." Subversive technological innovation is one of the highest-level

Project support: Major bidding projects of The National Social Science Fund of China——Research on the original breakthrough mode and path of basic research oriented to disruptive technology.

innovation, which promotes the Spatial-temporal process of disruptive technology replacing mainstream technology in unexpected ways by innovative technological means, reflecting its early fragility, substitution and strong innovation. The scientific research teachers refer to the teachers who are engaged in both subject teaching and scientific research in colleges and universities, especially the natural science scientific research teachers in science and engineering. There are some close unity of value relations between them.

II. RESEARCH PROCESS

A. Sample

We selected typical literatures on disruptive technology and research teachers' psychological problems from 1995 to 2020 in web of science and CNKI, to analyze and sort out the understanding and content of relevant core concepts. We also selected three full professors in the field of disruptive technology from different regions and schools as the interview objects. (Object A is from Beijing, working in the top institute, researching disruptive technological innovation/practice. Object B is from Xian, working in the excellent university, researching disruptive technology. Object C is from Nanjing, working in the good university, researching disruptive technological path.)

B. Method

In the beginning, the paper uses literature review to understand and analysis the logical relationship with two core concept. Then, the paper uses semi-structured interview outlines to interview three professors, and interview questions consists of three perspectives, which is the macro environment level, the middle team level, the micro individual level. Finally, grounded theory is used to transcribe and recode the research contents.

III. THE CONVERGENCE OF DISRUPTIVE TECHNOLOGICAL INNOVATION AND SCIENTIFIC RESEARCH TEACHERS

Disruptive technological innovation shows early fragility, creativity and strong innovation. A scientific research by university teachers is characterized by initial inadaptability, mid-term creativity and strong transformation of late

achievements [4]. Both of them show a high degree of convergence.

1) In the early stage of disruptive technological innovation, it will develop slowly due to the oppression of existing technology and the influence of other economic funds; In the initial research process, the research progress is restricted by the solidification of thinking and the lack of existing technology. Thus, both of them have faltered in the early development.

2) With the rapid development of disruptive technology, it borders on the shortcomings of mainstream technology and creates its development path. However, the transformation of teachers' cognitive style, the transformation from trial and error results to research technology, and the satisfaction of emotional motivation lead to creative thinking and new technological attempts. So both of them have a critical period of transformation in the development process, that is creative thinking and technological breakthrough, which better matches the research purpose and development goal.

3) Disruptive technological innovation occupies the mainstream market because the main body of disruptive technology in the technical field meets the surge in demand. However, the experiment of teachers' research results has achieved initial success, but it has been tested in specific fields and replaced the original market after obtaining corresponding results. Therefore, both of them have strong innovation characteristics and occupy the mainstream market or field.

Grasp the convergence between them, and better understand the psychological characteristics and psychological problems of scientific research teachers in colleges and universities.

IV. THE PSYCHOLOGICAL PROBLEMS AND REASONS OF SCIENTIFIC RESEARCH TEACHERS

A. *Scientific Research Ecological and Economic Ecological Imbalance*

Scientific research teachers are the main personnel of scientific research in colleges and universities, but the ecological problems of scientific research in colleges and universities are unbalanced among campuses, schools and regions. School research mainly focuses on academic leaders and their teams, while other scientific research teachers undertake few or no topics. At the same time, the situation of taking up scientific research work is directly proportional to teachers' positions and ages. The higher their positions, the older they are, the more national, provincial and ministerial-level topics their researchers undertake [5] (Wang Lei, 2004). However, in the disruptive technical field of natural sciences, a small number of young scientific research teachers undertake major topics and projects. The ecological differences of scientific research between universities are not only the differences in the orientation of running schools but also the differences in academic content and tendency of academic leaders. Regional differences are reflected in the fact that there are more scientific research projects in schools of provincial capitals than other cities, and more projects in cities than remote areas, showing regional imbalance. Because the research of academic leaders in schools is limited to their

research teams, the independence of inter-school academic research and the locality of regional academic research, all researchers and teams focus on their interests, which leads to the competitive psychology of each research team being higher than the sharing psychology, resulting in the closed phenomenon of academic research. At the same time, the closed research space has brought unreasonable allocation of research funds, and the expenditure of sub-projects for major projects is sometimes more than that of other general projects, which leads to a great sense of gap among researchers. At the same time, the research of the subject is directly related to the research design or research papers, which shows the great gap between the salaries of teachers of different scientific research types and the phenomenon of deduction of salaries due to lack of scientific research, which further weakens teachers' enthusiasm and motivation for scientific research and forms the imbalance of economic ecology.

B. *Technological Ecology and Group Mentality Unbalance*

A scientific research team in colleges and universities is a group consisting of a small number of scientific research teachers who are complementary in scientific research skills and willing to bear the necessary responsibilities for the common goals, objectives and working methods of the team [6]. The technological development of groups, schools and regions is of great significance to the research of disruptive technologies (Jiang Wen, 2006) [7]. The technological environment and operation of different disciplines and perspectives are the basis of developing technological innovation. At present, in the technical university groups, the technology is more concentrated in the powerful groups, but has not been popularized to all the research teams. Meanwhile, the flexibility of technical operation and the range of proficiency need to be improved (Hsing S, 2005) [8].

The output of papers, including quantity and quality, is the window to reflect the scientific research performance of university personnel [9]. However, when establishing academic evaluation indicators and systems, some colleges and universities show the trend of "data" and "statistics" of academic achievements, which are mainly quantitative, and inappropriate academic management with too large a level has dispelled the operational efficiency of universities to some extent. With the introduction of competition mechanism in social transformation and the establishment of internal competition mechanism in universities, it also encourages utilitarianism and individualism of university researchers. Driven by interests, their members are in a state of tension, which leads to the intensification of internal interest conflicts in university research teams.

C. *Occupational Ecology and Individual Environment Imbalance*

University researchers are essentially the category of knowledge workers, and they are irreplaceable special assets with great potential in the organization. The value of their existence is how to make knowledge play a greater role [10]. At present, under the pressure of non-subject personnel, researchers in colleges and universities have some problems, such as "missing personality cognition", failing to reach a psychological contract with colleges and universities, and the

individual's career vision is inconsistent with the actual work, which makes researchers unable to share a full sense of accomplishment and belonging in their work, and affects the research and development and innovation of disruptive technologies [11]. In different degrees, colleges and universities pay more attention to the knowledge learning of classroom teaching, while neglecting management and improve the practice of experimental practice teaching. Subversive technology, as a practical discipline, needs sufficient material support and encouragement of policy ideas from universities. In the process of leaning towards teaching, many units improperly handle the relationship between teachers and researchers and give unfair treatment to researchers in some aspects such as subsidies, workload calculation and professional title evaluation. In the long run, this inequality and polarization will affect the enthusiasm and dedication of researchers. Researchers, as knowledge workers, have high independence, emphasize self-challenge and self-realization, and have a unique vision and keen insight into disruptive innovation technology and knowledge. However, in fact, universities and researchers have not established psychological contracts in the dimension of team members, and universities have failed to create opportunities for the career development and growth of researchers. Therefore, members lack the confidence to constantly improve their skills and knowledge structure, and can not engage in work and tasks outside their roles and promote the completion of team goals. The research and development and innovation of disruptive technologies need not only excellent professional skills and knowledge structure of scientific researchers but also relaxed scientific research environment and policy support from administrative personnel.

V. THE STRATEGIES TO SOLVE THE PSYCHOLOGICAL PROBLEMS OF SCIENTIFIC RESEARCH TEACHERS

A. Diversified Scientific Research Environment and Reasonable Reward and Punishment System

It is precisely because of the imbalance of scientific research environment among in-schools, schools and regions that the competitive psychology of scientific research teachers is stronger than the sharing consciousness, forming a closed academic research environment, which can not adapt to the development mechanism of disruptive technologies and other latent technologies. Diversification of the scientific research environment is an important internal research environment to promote the consistency of competition and sharing. They are all a research collective, whether in school, inter-school or region. The average distribution of research content can narrow the huge differences between schools, strengthen the connection between schools and inter-schools, and enable more research teachers and novice research teachers to devote themselves to technical research, thus creating an academic environment with academic equality. Of course, the level of scientific research content needs to be distributed according to each person's actual ability. In this way, the negative phenomenon in academic research is broken, and some small and medium-sized research enterprises can cooperate in research and practice, and at the same time, establish the psychology of active competition and sharing among scientific

research teachers. Competition should be open and fair, and open competition means the openness of scientific research literacy, scientific research requirements, teachers' opportunities and teachers' treatment; Fair competition means that excellent research and research teachers are selected to participate in scientific research projects, regardless of position, gender, etc. Sharing psychology means sharing the novelty of existing research and the main problems at the present stage, etc., conducting on-the-spot observation and exchange or online and offline interactive exchange, establishing their diverse needs levels through the "non-guiding principles" of humanistic psychology, and promoting the gradual realization of high-level needs through the satisfaction of researchers' low-level needs. The economy is not only a low-level need but also an important influencing factor of a high-level need. Therefore, it is necessary to establish a reasonable reward and punishment mechanism, encourage scientific research teachers to invest in market research, and enhance the practicability and horizontal connection between topics and projects [12]. It is also necessary to vigorously reform the project fund management mechanism and fund allocation system, and establish a scientific and accurate scientific research evaluation system. At the same time, increasing natural science youth fund, provincial and ministerial project fund or special achievement fund, such as new achievements in disruptive technological innovation field, can enhance scientific research teachers' sense of job accomplishment and motivation [13].

B. Interdisciplinary Technical Training and Team Collaboration

In the era of the knowledge economy, more and more scholars give up the original situation of fighting alone and tend to conduct group academic research. In order to solve the imbalance of group mentality caused by the lack of knowledge sharing atmosphere in scientific research teams of universities and the mutual attacks among members due to unreasonable performance appraisal, and to create a good academic ecology for disruptive technology, interdisciplinary training should be carried out and the cooperative development among teams should be emphasized. Throughout today's world, interdisciplinary reform has become a prominent feature. Through interdisciplinary research, researchers have greatly expanded their knowledge base, come into contact with a wider range of knowledge sources, and changed the original idea of "private knowledge" [14]. Interdisciplinary research enables university research teams to break through the original single structure and mode of disciplines, improve inter-disciplinary organization and coordination, realize the integration and utilization of resources, and provide good development ideas and prospects for disruptive technological innovation. Researchers become independent individuals because of their different professional backgrounds, the nature of disciplines and the stages they are responsible for. However, the original intention of the research team is to share the responsibility for the same purpose and goal. Therefore, in the process of disruptive technological innovation and development, team members should establish a good communication mechanism to ensure unimpeded information, so that they can reach consensus and complete tasks in the research process of such high-end frontier disciplines [15].

C. Career Development Management and Individual Success Attribution

According to Hyde's attribution theory, people have two needs: understanding the world and controlling the environment. The most fundamental means to satisfy these two needs is to understand the reasons for people's actions and predict how people will act. On this basis, Weiner made a systematic discussion. He believed that people tend to divide the reasons for failure into three dimensions, namely, internal and external dimensions, stability dimensions and controllable dimensions [16].

Scientific research teachers, as individuals with dual identities, exist in colleges and universities, and they should establish correct self-professional cognition. While engaging in the research and development of disruptive innovation, scientific research teachers themselves have to bear the pressure from administrative leaders and peer groups in colleges and universities, so they are required to establish a correct world outlook and outlook on life in the teaching process and technology research and development process, strengthen their grasp of their own advantages, and strengthen their professional ideas. The key for scientific research teachers is to correctly analyze the failure attribution, whether it is caused by internal reasons or external reasons, and whether the internal reasons are the level of ability, the degree of effort or the state of mind and body. Is it luck, difficulty of task or other environmental factors? Self-professional cognition refers to the correct understanding and evaluation of yourself and the work you are engaged in. Everyone has their own unique psychological factors such as personality, thinking, temperament, interest and ability. Scientific research teachers should have a correct understanding of these factors in the process of work, maintain a positive and healthy attitude, and adopt correct methods to eliminate and release them to prevent psychological fatigue.

VI. CONCLUSION

Due to the particularity of the research objects, the interview objects of this study selected three authoritative researchers of disruptive technological innovation, while highlighting the characteristics of the region. However, the small sample size is indeed a limitation of this study. Therefore, the next step of the team is to expand the number of interview subjects by three to four times, and then analyze again whether the psychological factors of college teachers overlap with the research or whether new psychological problems may arise.

In the process of research and analysis, we concludes three typical types of psychological problems and three strategies. However, these three problems are not only the expression of a phenomenon, but also the influencing factors of the psychological changes of college teachers. Therefore, the following research can set up the questionnaire scale from different perspectives and levels according to the content of the questions. For example, both scientific research ecology and economic ecology are the contents of the macro environment, which can be transformed into the scientific research environment factors of university teachers in the design of the questionnaire. In this way, the phenomenological contents can be presented in the digital form, and more precise and targeted

suggestions and measures can be put forward. At the same time, the formulation of countermeasures can also be simple communication or interview with relevant direct stakeholders and managers, which can provide a guarantee for the implementation of measures.

These contents preliminarily opened up the research on the psychological status of university teachers in the field of disruptive technology, and provided a textual material of that field. In order to conduct better empirical research, we can consider transforming the three major psychological problems we summarized into three dependent variables for factor analysis. Next, our team is inclined to transform the contents of the three parts into three dependent variables: self-efficacy, motivation and research burnout of university research teachers. The scale of self-efficacy and research motivation developed by European and American countries was revised again, so as to adapt to our next research plan. At the same time, self-efficacy, research motivation and research burnout are taken as independent variables and university teachers' pressure is taken as dependent variables to establish a model structure, which can better reveal the reality of teachers in the field of disruptive technology. Of course, there are also a lot of details that need further careful consideration.

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