

5-20-2021

Strengthen Development of Young Research Team and Accelerate Realization of Scientific and Technological Self-reliance and Self-improvement— On Development Experience and Prospect of Youth Innovation Promotion Association of CAS

Kaihua CHEN

Institutes of Science and Development, Chinese Academy of Sciences, Beijing 100190, China,
chenkaihua@casisd.cn

See next page for additional authors

Recommended Citation

CHEN, Kaihua; SHENG, Xia; LI, Boqiang; and SONG, Qi (2021) "Strengthen Development of Young Research Team and Accelerate Realization of Scientific and Technological Self-improvement— On Development Experience and Prospect of Youth Innovation Promotion Association of CAS," *Bulletin of Chinese Academy of Sciences (Chinese Version)*, 5, Article 14.

DOI: <https://doi.org/10.16418/j.issn.1000-3045.20210415001>

Available at: <https://bulletinofcas.researchcommons.org/journal/vol36/iss5/14>

This Policy & Management Research is brought to you for free and open access by Bulletin of Chinese Academy of Sciences (Chinese Version). It has been accepted for inclusion in Bulletin of Chinese Academy of Sciences (Chinese Version) by an authorized editor of Bulletin of Chinese Academy of Sciences (Chinese Version). For more information, please contact lcyang@cashq.ac.cn, yjwen@cashq.ac.cn.

Strengthen Development of Young Research Team and Accelerate Realization of Scientific and Technological Self-reliance and Self-improvement— On Development Experience and Prospect of Youth Innovation Promotion Association of CAS

Abstract

Young researchers are the pioneering force with the most innovative vitality, the main force for basic research and core technology breakthroughs, and the backbone for realizing scientific and technological (S&T) self-reliance and self-improvement. In order to strengthen the construction of national strategic S&T force, there is an urgent need to strengthen the construction of young research team and establish a talent development environment that can effectively stimulate the young researchers' creativity, innovation ability, vitality and motivation. This paper summarizes the experience and results of "Youth Innovation Promotion Association"-the main program of independent cultivation of young S&T talents of Chinese Academy of Sciences (CAS), by analyzing the important role of young researchers in the output of major scientific and technological achievements. It then puts forward the systematic thinking of optimizing the development of young research team in China, amongst our efforts towards S&T self-reliance and self-improvement, from the following three aspects: taking multiple measures to strengthen the support to young researchers, creating an institutional environment for young researchers to devote themselves to research, and building a diversified platform for academic exchanges and scientific research cooperation. Lastly, this paper proposes to further optimize and promote the construction of an innovation-oriented development community for the young S&T talents, as well as accelerate the interdisciplinary cooperation of them for integrating innovation.

Keywords

young research team; scientific and technological (S&T) self-reliance and self-improvement; development ideas; innovation-oriented development community

Authors

Kaihua CHEN, Xia SHENG, Boqiang LI, and Qi SONG

Citation: CHEN Kaihua, SHENG Xia, LI Boqiang, SONG Qi. Strengthen Development of Young Research Team and Accelerate Realization of Scientific and Technological Self-reliance and Self-improvement—On Development Experience and Prospect of Youth Innovation Promotion Association of CAS [J]. Bulletin of Chinese Academy of Sciences, 2021 (5): 589–596.

Strengthen Development of Young Research Team and Accelerate Realization of Scientific and Technological Self-reliance and Self-improvement—On Development Experience and Prospect of Youth Innovation Promotion Association of CAS

CHEN Kaihua¹, SHENG Xia², LI Boqiang³, SONG Qi²

1. *Institutes of Science and Development, Chinese Academy of Sciences, Beijing 100190, China;*

2. *Bureau of Personnel, Chinese Academy of Sciences, Beijing 100864, China;*

3. *Institute of Botany, Chinese Academy of Sciences, Beijing 100093, China*

Abstract: Young researchers are the pioneering force with the most innovative vitality, the main force for basic research and core technology breakthroughs, and the backbone for realizing scientific and technological (S & T) self-reliance and self-improvement. In order to strengthen the construction of national strategic S & T force, there is an urgent need to strengthen the construction of young research team and establish a talent development environment that can effectively stimulate the young researchers' creativity, innovation ability, vitality, and motivation. This paper summarizes the experience and results of Youth Innovation Promotion Association—the main program of independent cultivation of young S&T talents of Chinese Academy of Sciences (CAS), by analyzing the important role of young researchers in the output of major S&T achievements. It then puts forward the systematic thinking of optimizing the development of young research team in China, amongst our efforts towards S&T self-reliance and self-improvement, from the following three aspects: taking multiple measures to strengthen the support to young researchers, creating an institutional environment for young researchers to devote themselves to research, and building a diversified platform for academic exchanges and scientific research cooperation. Lastly, this paper proposes to further optimize and promote the construction of an innovation-oriented development community for the young S&T talents, as well as accelerate the interdisciplinary cooperation of them for integrating innovation. **DOI:** 10.16418/j.issn.1000-3045.20210415001-en

Keywords: young research team; scientific and technological (S&T) self-reliance and self-improvement; development ideas; innovation-oriented development community

At a meeting conflating the general assemblies of members of Chinese Academy of Sciences (CAS) and Chinese Academy of Engineering (CAE) on May 28, 2018, Chinese President Xi Jinping stressed that younger generations are the cornerstone of the country, the nation, and the innovation. Innovation will be full of hope and science & technology will have a brilliant future when younger generations develop ideals, ability, and a strong sense of responsibility. An urgent need in China's new development stage is to speed up the realization of scientific and technological (S&T) self-reliance and achieve a leap in S&T innovation ability and level^[1]. It is essential to build a new mode of independent cultivation and development of young researchers that accommodates the law of S&T development and buttresses S&T self-reliance and self-improvement. In general, young researchers refer to the researchers aged below 40^[2], who are in their prime time to reap scientific achievements. They are energetic, creative, and

open to new knowledge and methods, and thus more likely to yield innovation achievements. According to the Research Report on the Development of China's Science and Technology Human Resources (2018)—Total, Structure, and Mobility of Researchers in Science and Technology, young talents are the mainstay of China's S&T human resources, accounting for three quarters of the total. To build a key high-caliber young innovation team that can follow the global trend of S&T transformation will be the primary support and even a key move that underpins China's seizing of the commanding heights of future science and technology. Academician Hou Jianguo, President and Party Secretary of CAS, emphasized at the 2021 annual working meeting of CAS that it is imperative to build a competent young research team.

On the occasion of the 10th anniversary of the founding of the Youth Innovation Promotion Association of CAS^①, we conducted a survey toward 2 200 young researchers. Having

① In accordance with the National Medium- and Long-term Talent Development Plan (2010–2020) and the Organization and Implementation Plan for “Innovation 2020” of the Chinese Academy of Sciences (CAS), CAS announced in May 2011 the establishment of the Youth Innovation Promotion Association to promote more young researchers with potential to grow into high-level innovative talents in innovation practice. As of May 2021, 4 557 members have been selected in the Association, including 607 top-notch members.

analyzed the important role of young research teams in the output of major S&T achievements, we summarized the experience of the development of Youth Innovation Promotion Association of CAS, and put forward policy proposals to step up the development of young research teams in China from the three aspects of strengthening support, improving the environment, and expanding the platform.

1 Young research team as the main force for major S&T achievements

The young research team constitutes the backbone of human resources of science and technology, being the groundwork of S&T self-reliance and self-improvement. Young researchers play an increasingly important role in S&T innovation.

1.1 Young research team is the key force for achieving breakthroughs in core technology around the world

The young research team is the pioneering force full of innovation vitality and the main force for achieving breakthroughs in core technology. Important scientific contributions are usually made by scientists aged below 40^[3]. For example, Newton developed calculus at the age of 22; Einstein proposed the special theory of relativity at 24; Bohr proposed the quantum theory at 27; Tsung-Dao Lee at 29 and Chen-Ning Yang at 33 proposed CP violation [violation of the combined conservation laws associated with charge conjugation (C) and parity (P) by the weak force]. The statistics of 547 Nobel laureates in science from 1901 to 2003 revealed that most of them completed their most groundbreaking work before the age of 35^[4]. Recent findings suggest that Nobel Prize laureates in science were aged 44.1 on average when they made their Nobel-level discoveries, and that of winners in physics were usually even younger^[5]. Many Nobel laureates in science completed their prize-winning achievements at their PhD stage, such as Mössbauer, Lederberg, and Josephson. In addition, the awarded research achievement of Purcell was mainly conducted by his Ph.D. student. The development history of China's science and technology has also proved that young researchers have grown to be the pillar of China's S&T undertakings. For example, many scientists were aged less than 40 when elected as academicians. Most of the design directors and even chief designers of the five major systems of China's lunar exploration project are young people in their 30s and 40s. The members in the research team of Long March 5 are aged below 33 on average. Young people aged less than 35 have accounted for 80% of China's manned spaceflight research team. The average age of the winners of the National Natural Science Award in 2019 was 44.6, and that of the youngest team was only 35.

1.2 Young research team can power the S&T self-reliance and self-improvement of China

China has always valued the fostering of young researchers, remaining it a priority at different development stages. The government developed innovation policies and platforms to foster young researchers, which is regarded as a critical approach to realize S&T self-reliance and self-improvement^[6].

The Youth Innovation Promotion Association of CAS is established as an innovative measure to independently foster a team of young researchers under the age of 35. It adopts flexible and creative operation mode, and has achieved preliminary success in promoting the growth of young researchers and cultivating leading young researchers. It buttresses the China's national strategic S&T undertakings and the sustainable development of high-end talents and intellectual resources in an innovative country. It demonstrates a good model for independently training outstanding young researchers. (1) The members of Youth Innovation Promotion Association, being research backbone, chair or participate in state-level research projects as well as Strategic Priority Research Program sponsored by CAS, and have made a series of major original achievements. (2) The members of Youth Innovation Promotion Association have made contributions to the research and development of major strategic technologies and products, such as Tiangong space station, Jiaolong deep-sea submersible, Tianyan (Sky Eye, the world's largest radio telescope), Wukong (Dark Matter Particle Explorer), and Mozi (satellite for Quantum Experiments at Space Scale) as well as the national strategic projects such as the development of the islands and reefs in the South China Sea.

Furthermore, during the strategic opportunity period of rapid development of S&T innovation, increasing members of Youth Innovation Promotion Association have grown to be the mainstay of some major projects in serving major state-level demands and tackling knotty tasks. For the design of Tianzhou-1, China's first cargo spacecraft, more than 10 members of Youth Innovation Promotion Association were core participants, indicating that they are capable to constitute an independent research team. A number of members of the National Astronomical Observatories of CAS were important contributors to the construction of the Tianyan project, serving key posts such as head engineer. To fight against COVID-19 pandemic, a large number of members of Youth Innovation Promotion Association took the initiative to engage in virus traceability research, development of rapid detection technology, research and development of antiviral emergency drugs, research and development of vaccines and antibodies, and big data information support arranged by CAS. Some of them were commended by CAS and even the state.

Meanwhile, a lot of members of Youth Innovation Promotion Association have been committed to the demonstration

and commercialization of major research achievements, which facilitates the integration between innovation chain and industrial chain. For example, Cambricon, founded by Youth Innovation Promotion Association members at the Institute of Computing Technology, CAS, has become the world's first "unicorn" startup in the field of artificial intelligence chips and is listed on the Sci-Tech innovation board (STAR Market). Founded by the Youth Innovation Promotion Association members at Xi'an Institute of Optics and Precision Mechanics of CAS, Xi'an Casstar Science And Technology Incubator Co., Ltd, an investment incubation platform committed to the commercialization of research achievements, launched an angel fund mainly for key & core technology, and started a government-industry-university-institution-application-incubation system. Up to now, over 330 key & core technology enterprises have been incubated.

2 The role model of Youth Innovation Promotion Association in supporting young research team

Over the past decade, Youth Innovation Promotion Association has significantly facilitated the assembly of innovation community for young researchers. It serves as a role model in optimizing the platform for the development of young researchers.

2.1 Encouraging common development and establishing a new cultivation mode for young researchers

One of the key channels of S&T self-reliance and self-improvement is to improve the independent cultivation of young researchers so as to trigger the upsurge of young researchers with the support of S&T resource platforms in China. Youth Innovation Promotion Association admits outstanding young researchers aged below 35 from organizations affiliated to CAS. Unlike the conventional platform featuring only project funding, it integrates membership, project funding, and platform exchange, creating an innovation-oriented development community for young researchers. (1) Stepwise project funding is exercised. During their four-year project implementation, members will receive certain fund for their independent academic exchange and cooperation. Through the funded project, they will widen their vision, improve their overall caliber, and spur their peers to follow suit. Upon the conclusion of the project, some members excelling in performance, innovation, organization, and independent research will be acknowledged as the outstanding members and awarded with fund for their follow-up research. (2) A council-based platform exchange system is implemented. The council of Youth Innovation Promotion Association is subdivided into secretariat, disciplinary branches, local branches, and over 100 groups. Youth

Innovation Promotion Association has covered more than 100 research institutes of CAS. It has grown into a cross-institute and interdisciplinary academic exchange and cooperation platform. The survey on the ten-year development of Youth Innovation Promotion Association revealed that 95.2% of the respondents acknowledged the positive effect of the talent program on promoting their research.

2.2 Upholding autonomous research management geared to the need of "four orientations"

Given the complex changes at home and abroad, it becomes imperative to plan and arrange research geared to the need of national strategy. Meanwhile, research autonomy should be valued. In the selection of science topics, emphasis should be placed not only on significant frontier issues but also on basic issues meeting major national demands. Basic research should be valued to realize target application^[1]. Addressing the scientist forum in 2020, Chinese President Xi Jinping proposed that in the new era scientific research should be geared to the needs of "four orientations" (global frontier science, main battlefield of economy, major national demands, and people's health). In this context, young researchers are encouraged to autonomously select their own research topics. In this way, a demand-driven autonomous research pattern is shaped. Youth Innovation Promotion Association breaks away from the conventional management pattern in terms of both project implementation and fund management. For example, the fund endorsing members and especially those top ones can be employed for academic exchanges, training and staff expenditure of autonomous research projects. Such democratic management pattern can arouse young researchers' enthusiasm for innovation, so that they will more cherish the opportunities and honors brought by the platform and are more ready to deliver outstanding achievements and share them with other members. The survey on the 10-year development of Youth Innovation Promotion Association of CAS revealed that 80.5% of the respondents acknowledged the timely assistance of the research fund on their research and 95.2% of respondents confirmed the important role in their research.

2.3 Establishing a multi-level and cross-region academic network

Young researchers are characterized by keen thinking and strong sense of cooperation. Academic exchange is an important way for young researchers to broaden their vision and diversify their cooperation channels. Youth Innovation Promotion Association has 13 local branches located in Beijing, Hefei, Shanghai, Shenyang, Xi'an, Chengdu, Changchun, Lanzhou, Nanjing, Xinjiang, Yunnan, Guangzhou, and Wuhan, respectively. The members at the various organizations affiliated to CAS have voluntarily set up more than 100 groups. Youth Innovation Promotion Association organizes

diverse academic exchanges at the levels of the council, disciplinary branch, local branch, and organizational group. For example, the Young Scientist Forum of Earth Science, Youth Life Science Forum, and Youth Astronomy Forum led by the disciplinary branches have gradually exerted brand influences. The Young Scientist Forum of Earth Science, in particular, comprises over 2 000 delegates. It has evolved into a large-scale event for young scholars on geology to exchange with each other. Youth Innovation Promotion Association cooperates with well-known international academic organizations such as AAAS, Springer Nature publishing group, and Cell Press, providing international exchange platforms for its members. According to the survey on the 10-year development of Youth Innovation Promotion Association, 77.9% of the respondents agreed that Youth Innovation Promotion Association helped them expand human networking and 89.85% believed that it enhanced their academic exchange and cooperation.

2.4 Exploring interdisciplinary integration channels to make more breakthroughs

Amid the new wave of accelerating science and technology revolution and industrial transformation, various disciplines and fields are deeply integrating with and penetrating into each other. Multiple breakthroughs tend to spring up one after another^[7]. Interdisciplinary integration is a must to seek the golden opportunities of a new round of science and technology revolution and industrial transformation. It is also an important approach to realize S&T self-reliance and self-improvement. Youth Innovation Promotion Association pools the CAS' outstanding young researchers, and establishes six disciplinary branches of mathematical sciences, chemistry and material sciences, life sciences, earth sciences, engineering equipment, and information and management sciences. Eight major innovation fields are involved, including basic frontier interdisciplinary sciences, advanced materials, energy, life and health, ocean, resources and eco-environment, information, and photoelectric space. This measure can effectively integrate high-quality intellectual resources and nurture innovation, creating a sound environment for interdisciplinary integration. According to the survey of the 10-year development of Youth Innovation Promotion Association of CAS, 88.3% of the respondents agreed that Youth Innovation Promotion Association of CAS can widen their academic vision. In recent years, Youth Innovation Promotion Association of CAS has provided plentiful opportunities for its members to exchange and cooperate across disciplines. It has established interdisciplinary forums, such as Geology-Mathematical Sciences-Information Forum for Young Scholars and ScienceX: To Kill Cancer. By providing information and platforms for members to conduct collaborative research and project application, it has enhanced interdisciplinary cooperation among its members.

2.5 Strengthening political guidance to improve young talents's comprehensive ability

Youth Innovation Promotion Association plants patriotism and scientific spirit in the mind of its members by launching activities such as Briefing on CAS and the State and Youth Innovation Promotion Association Lecture. Since its launching three years ago, the Lecture has invited more than ten honored guests including role models of Zhang Dingyu and Hu Weiwu to share their experience in serving the country and people heart and soul. Through these events, Youth Innovation Promotion Association is building a strong sense of social responsibility in the mind of young scientists. Apart from undertaking major national strategic S&T tasks, members of the Association marvel in popularizing science and promoting scientific spirit. For example, three members were invited to serve as the image ambassadors of China Science Communication sponsored by China Association for Science and Technology (CAST). As a national youth science and technology talent association, Youth Innovation Promotion Association of CAS took the lead in releasing the Initiative on Young Researchers to Promote Scientists' Spirit and Strengthen Learning and Work Style, which has received a positive response from the public. As Youth Innovation Promotion Association has well-defined organization and open leader selection mechanism, it is an effective platform to develop young scholars' management skills. Divisions under Youth Innovation Promotion Association offer a wide range of posts involving academic exchange, science popularization for public benefit, and policy communication, which helps foster young researchers in multiple spheres.

3 Strengthening the support, improving the environment, and expanding the platform

3.1 Taking multiple measures to strengthen the support to young researchers

(1) System design should be improved for the cultivation of young talents. ① Top design and overall arrangement should be emphasized. Efforts should be made to build a system ranging from education and training to sponsorship by coordinating different governmental departments. ② Action plan should be prepared for the training of young researchers. Step-by-step measures should be taken to achieve this goal from the perspectives of educational methods, discipline training, postgraduate education, project funding, and assessment.

(2) Funding should extend to benefit more young researchers. ① Steps are taken to scale up funding by increasing its rate for young researchers. ② Science funding should advance to the postgraduate education stage. ③ Employers should be encouraged to support the growth of young researchers. For example, start-up funds can be

independently set for young researchers in support of their organization's autonomous projects, and the growth of young researchers is set as a key evaluation indicator.

(3) Talent cultivation mechanism should be optimized to support young researchers' career. ① Full play should be given to post-doctors' initiative in research activities, make post-doctoral undertaking stronger and bigger, and prioritize employing post-doctors based on science tasks. ② Campaigns should be launched for young researcher team building to magnetize top talents from home and abroad. ③ International training on young researchers should be stepped up by intensifying funding and optimizing oversea study funds.

(4) Measures should be taken to make young researchers develop a strong sense of responsibility and grow rapidly. ① Endeavors should be made to expand young researchers' participation in regional and national science and technology decision-making and planning, and develop their strategic consciousness for the implementation of "four orientations." ② The role of young researchers in tackling knotty science and technology tasks should be valued by increasing their proportion of being a leader or chief scientist in state-level major science and technology program or project.

3.2 Creating a sound institutional environment for young researchers

(1) The evaluation system is to be improved in line with the law of talent development. In this regard, young researchers' concrete realities such as few projects, low titles, and insufficient resources should be taken into full consideration. ① The evaluation should be value- and contribution-orientated, a young researcher evaluation method based on research achievement should be established, and the role of qualification, performance, and project should be downplayed for young researchers. ② A long-term mechanism for performance evaluation should be built in line with the law of the research input-output cycle. The evaluation cycle should be extended to 3–5 years or even longer. Less regard should be given to annual evaluation to weaken the negative effect of annual evaluation on young researchers who are concentrating on a certain research topic and producing original achievements. Instead, a research management pattern, in which young researchers can stay focused and resist external temptation, should be in place.

(2) Postgraduate education program should be based on the law of scientific research. Since postgraduate education is themed on scientific research, they should be integrated with each other. It is necessary that postgraduate education program should obey the law of scientific research. ① Young researchers should be given more access to postgraduate education resources, and fresh researchers should be encouraged to build their own teams. ② Supervisors for postgraduates should be selected based on research capacity. Supervisor title should not play a decisive role in postgraduate

enrollment and training. The yardstick for enrollment quota allocation shall lie in postgraduate education quality, guiding performance, and research tasks.

(3) A sound talent training program should be built. Talent program plays a positive role in the progress of young researchers. The optimization of talent program should work in tandem with a value-oriented management system. In this way, an ecosystem for talent development can be built, contributing to the sound development of talent program. Passive treatment to problems arising in the management of young researcher program is unacceptable. There are underlying systematic causes of malfunctioning talent program, which shall be immediately addressed.

3.3 Building a diversified platform for academic exchanges and scientific research cooperation: further optimizing and promoting an innovation community for young researchers

(1) A more open innovation community should be created. To realize S&T self-reliance and self-improvement, Youth Innovation Promotion Association should serve as a bridge to pool the wisdom of young researchers. It is advised to open the academic exchange activities of Youth Innovation Promotion Association to attract young talents around the globe. This will help build a cooperation and exchange platform for global young researchers and promote the construction of a community of young researchers around the world. Meanwhile, the community should value, cherish, and bring in talents holding different views. The community should encourage young researchers to be engrossed in unpopular sciences so as to stimulate significant original innovation.

(2) A more integrated innovation community should be created. One essential approach to obtain advanced innovation achievements and foster top innovative young researchers is to promote interdisciplinary practice. Youth Innovation Promotion Association is expected to take the initiative to promote interdisciplinary integration. One way is to set up an interdisciplinary youth innovation team. Another way is to launch an international youth interdisciplinary forum to pool the wisdom and knowledge of global young talent reserve. Efforts are expedited to optimize the interdisciplinary intellectual elements to inspire insights and originality.

(3) A community carrying forward innovation should be created. Emphasis is laid on building a community carrying forward innovation so that young researchers can stand out. Priority should be given to team building and carrying forward innovation. Talents should be appreciated, and a good judge of talents should be even more valued. A sound supervisor selection mechanism should be developed so that supervisors for young researchers can be evaluated more squarely and can be better spurred. Measures should be taken to optimize institutional design, value the role of young researchers in team building and institution composition, and create an atmosphere for young researchers to carry forward innovation.

References

- 1 Hou J G. Taking self-reliance of science and technology as the strategic support of national development. *Qiushi*, 2021, (6): 27–32 (in Chinese).
- 2 Oni T, Sciarrino F, Adesso G, et al. Let researchers try new paths. *Nature*, 2016, 538: 451–453.
- 3 Lehman H C. *Age and Achievement*. Princeton: Princeton University Press, 1953.
- 4 Zhao H Z. *Mathematical analysis of the history of science*. Shijiazhuang: Hebei Education Press, 2001: 67–72 (in Chinese).
- 5 Bjørk R. The age at which Noble Prize research is conducted. *Scientometrics*, 2019, 119(2): 931–939.
- 6 Yuan Y X. How to care for the growth of young scientific researchers. *Outlook Weekly*, 2021, (12): 24–26 (in Chinese).
- 7 Bai C L. Strengthening the national strategic scientific and technological force. *Qiushi*, 2021, (1): 48–52 (in Chinese).

(Translated by WEN JX)



CHEN Kaihua, Professor at the Institutes of Science and Development, Chinese Academy of Sciences (CAS), and University of Chinese Academy of Sciences. He has won the National Science Fund for Distinguished Young Scholars, and is an outstanding member of the Youth Innovation Promotion Association of CAS. His main research interests include national innovation systems, innovation development policy, science and technology talent management and strategy, innovation metrics and management, and technology foresight. E-mail: chenkaihua@casisd.cn



SONG Qi, corresponding author, Director of the Talent Projects Office of the Bureau of Personnel, Chinese Academy of Sciences (CAS). She is mainly responsible for the organization and implementation of CAS talent projects. She promotes the implementation of the system project of talent development. She is responsible for the talent project management function of the leading group of talent work in CAS, and also participates in the management policy formulation of CAS talent projects. E-mail: qsong@cashq.ac.cn