AUTHOR:
Huan Chun Chen[1]
Prof Nicholas Sun-Keung PANG[1]

AFFILIATION:
[1]East China Normal University, Shanghai, China

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# Sustaining the ecosystem of higher education in China: Perspectives from young researchers

## Abstract

*The sustainable development of higher education in China has been a key priority for the national, social, economic and political development. Responding to the severe competition in various university ranking systems, most universities in China have set aims to enhance their sustainability in research and publication. There has been a prominent conflict that young scholars are expected to be productive, with publications in academic journals, competitive in receiving national and municipal research grants, and prestigious in the national and international arenas, or they will be terminated by the 'six-year-up-or-out' policy. Recent reform in higher education that calls for a sustainable development for young researchers is a strategy to revert the side effects from global university ranking systems by nurturing young researchers in their early academic lives, enhancing their productivity in research and publication internationally, and enhancing their global competitiveness without harming sustainability in academic development. This research explored (i) the difficulties that most young scholars face in sustainable academic research development, (ii) the factors that enhance or inhibit research productivity of young researchers, and (iii) the work lives in their early-career development in China. A qualitative study was conducted with data obtained from semi-structured, in-depth interviews of 24 young university researchers from three provinces and a municipality in China. Findings show that factors that relate to sustainable research productivity are individual attributes, discipline attributes, institutional attributes and policy attributes. Lastly, suggestions for policy making in higher education and for improving sustainable research development of young researchers in China are provided and implications for future research are discussed.*

**Keywords**: *Higher education, sustainability, global competition, university ranking, academic life, China*

## 1. Introduction

In 1987, Brundtland, in *Our Common Future,* defined the concept of sustainability as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (World Commission on Environment and Development, 1987). It seeks to coordinate the relationship between economic development and the protection of social and environmental

balance. Sustainability also plays a critical role in the fields of education, knowledge and innovation. Later on, in 2015, the United Nations released *Transforming Our World: The 2030 Agenda for Sustainable Development,* which sets out 17 Sustainable Development Goals (SDGs) for achieving sustainable development in economic, social and environmental dimensions. Of these 17 SDGs, SDG 4 is related to education and seeks to "ensure inclusive and equitable quality education and promote lifelong learning opportunities for all" (UN, 2015). In addition to SDG 4, SDG 4.7 calls for the development of skills and knowledge "through education for sustainable development and sustainable lifestyles" (UN, 2015).

Higher education institutions contribute to the sustainable development and implementation of the SDGs. As institutions for knowledge production and dissemination, higher education institutions play an important role in the dissemination and promotion of sustainable development. Over the past decades, the sustainability of higher education institutions has become an issue of global concern for the public and policy makers (Stephens & Graham, 2010; Jorge *et al*., 2015). A sustainable university campus should be a healthy campus environment that achieves economic prosperity (Alshuwaikhat & Abubakar, 2008). The vision of sustainable development in higher education is to allow everyone the opportunity to benefit from high-quality education and learn the values, behaviours and lifestyles required for a sustainable future and positive social transformation (Milutinović & Nikolić, 2014).

In the past decade, many higher education institutions have advanced their sustainable development in different cultures and contexts (Ceulemans *et al*., 2011; Stephens *et al*., 2008). Moreover, it is interesting to note that researchers have begun to pay attention to the sustainability of higher education, and ways to promote and evaluate sustainability in higher education institutions have emerged (Madeira *et al*., 2011). There is also evidence that sustainable development is an innovation at universities (Leal *et al*., 2019). However, it has not been substantiated or fully permeated all disciplines, scholars and university leaders (Milutinović & Nikolić, 2014). How to move from sustainable idea to policy and curriculum practice is still under investigated (Franco *et al*., 2019).

In China, higher education development has always been a national priority. China has adopted a series of reforms to promote the sustainable development of higher education, including quality of higher education, teacher development, etc. In response to competitive national and international university rankings, most universities in China have set sustainable goals for improving scientific research and publication, expecting young researchers to publish more papers locally and internationally. At many universities and colleges in China, research productivity is evaluated by the number of papers published with Social Sciences Citation Index (SSCI), Science Citation Index (SCI), Arts and Humanities Citation Index (AHCI) or Chinese Social Sciences Citation Index (CSSCI). The research work is usually evaluated by counting the number of published articles (Xian, 2015). Most of these young researchers have graduated from top universities in China, such as the Project 985 and Project 211 universities.[1] However, these young researchers may be terminated by the 'six-year-up-or-out' policy and they encounter tremendous difficulties to meet the expectations of the universities.

1 Project 985 is the education plan implemented by the Ministry of Education of the People's Republic of China in May 1998 to build several world-class universities and a number of world-renowned, high-level research universities. Project 211 refers to the construction project of about 100 colleges and universities and a number of key disciplines in the 21st century in November 1995.

In this study, we attempted to explore young researchers' views of their personal experiences and perceptions of the effectiveness of the recent reform on the sustainability of research productivity in China. Drawing on data from semi-structured interviews with young researchers under the age of 40 from three provinces and a municipality in China, this study contributes to answer two central questions: (1) What are young researchers' personal experiences and difficulties in achieving research productivity at Chinese universities? (2) How can the sustainable development of young researchers and the sustainability of higher education in China be reinforced?

## 2. Literature review

Factors that influence research productivity have been studied for decades. Many studies have examined factors influencing the research productivity of academics. Some studies examined the research productivity at individual levels and some at institutional levels. For example, Jung (2012) summarises the factors affecting research productivity, namely individual background (e.g. age), previous experience (e.g. doctoral training), institutional characteristics (e.g. colleagueship) and the discipline context. Aydin (2017) reviewed more than 30 years of research and found 51 factors, including 27 internal factors (e.g. demographic variables and personal attributes) and 24 external factors (e.g. the features of institutional structure and the opportunities offered by an institution) that are highly correlated to research productivity. Blackburn and Lawrence (1995) classify the determinants of research productivity into four aspects, namely (i) demographic attributes, (ii) environmental attributes, (iii) institutional attributes, and (iv) personal career-development attributes.

### 2.1 Demographic attributes

Demographic productivity research has examined a wide range of factors that affect research productivity. Hesli and Lee (2011) investigated the variables that determine scholarly productivity. These variables include personal demographics (e.g. race, age and gender) and family-related factors (e.g. marital status, having dependent children, number of children). There is a significant relationship between the faculty members' research productivity and age (r=0.357) (Hedjazi & Behravan, 2011). As age and experience increase, productivity will increase to a certain extent, and then it seems to stabilise (Dundar & Lewis, 1998). However, Bland *et al*.'s (2005) findings show that there is no relationship between research productivity and age. The relationship between age and research productivity is not firmly conclusive.

The relationship between gender and research productivity has been discussed in many studies. However, these findings sometimes show contradiction and sometimes correlation. Through a gendered lens, many researchers have provided evidence that men publish more than women (Schucan, 2011; Blackburn *et al*.,1991; Hesli & Lee, 2011; Aksnes *et al*.,2011). Rørstad and Aksnes (2015) conducted a large-scale analysis of more than 12 000 Norwegian university researchers and concluded that female researchers have 20–32% lower publications than male researchers have. Naturally, female scholars often have family demands, one of the reasons for such a difference. Researchers (Suitor, Mecon & Feld, 2001) collected data from 673 faculty members at one research university to explore the relationship between household labour and academic productivity. The result demonstrated that female professors spend more time doing housework and caring for children than their male colleagues do.

Examining the impact of marital status on research productivity, it transpired that married women are more productive than single women, which may be explained by the support

that married women received from their husbands and families, and a relatively stable life (Gregory, 1999). However, some researchers found that there is no great gender difference in research productivity (Kotrlik *et al*., 2002; Teodorescu, 2000). Sax *et al.* (2002) conducted a study on a sample of 8 544 full-time teaching faculty researchers (2 384 women and 6 160 men) from 57 universities in the United States and found that factors affecting faculty research productivity are almost the same for men and women. Their study shows that family-related variables, such as number of dependent children have little or no effect on research productivity. Schucan's (2011) study found that in some disciplines, for example, social policy and psychology, women would publish articles at a lower level compared to the proportion of discipline they constitute, while Kyvik's (1990) study proves that women with children demonstrate a significantly negative effect on research productivity.

## 2.2 Environmental attributes

Environmental factors constitute the material, social and attitudinal environments where the faculty members work. Environmental factors that could have an impact on academics' productivity may include the difference between private or public institutions, ranking of the university, and availability of resources (Hesli & Lee, 2011). Ramsden (1994) found that backgrounds of a graduate school, the prestige of the department, collegiality within the unit, and the amount of freedom that encourages a pursuit of individual interest are highly correlated with research productivity.

A few studies (Fox, 2005; Hunter & Leahey, 2010; Leahey, 2006) were conducted to explore the relationship between departmental climate and research productivity. The result was a positive correlation. Sheridan *et al.* (2017) conducted two waves of faculty-wide climate surveys for 789 faculties in academic disciplines of medicine, science, and engineering at the University of Wisconsin-Madison between 2000 and 2010 to assess the longitudinal impact of departmental climate on research productivity. They measured research productivity in terms of number of publications and grants awarded, and measured departmental climate in terms of professional interactions, departmental decision-making practices, climate for underrepresented groups, and the degree of work-life balance. This study demonstrates that departmental climate is associated positively and significantly with productivity for all faculty members.

In addition to the above-mentioned environmental factors, university leadership is also an important factor that affects research productivity. Leadership plays a critical role in the creation of successful organization (Larsson & Vinberg, 2010). Leadership is a relationship between the leader and their followers. It involves the process of promoting all members to achieve common goals. Leadership at academic institutions can be understood as emphasizing intellectual stimulation, innovation and creativity that promote faculty members effectively to be successful in productivity (Allen *et al*., 2016). Bland *et al*. (2005) found that leadership characteristics within a department, a faculty and a university is an important determinant for the overall research productivity. Goodall, McDowell and Singell (2014) conducted a longitudinal study to examine the impacts of department chairpersons on the overall productivity of the related departments. They analysed the data from departmental chairpersons in 58 US universities over a 15-year period and found that departmental research productivity improved if the incoming departmental chairpersons were high in research productivity and their publications were highly cited.

## 2.3 Institutional attributes

Individuals do not exist in isolation and research productivity is strongly affected by the social and organisational context within which they work (Fox, 1983). Creswell (1985) examined the institutional factors affecting research productivity, including the institutional culture and research rewards, and confirmed that institutional characteristics do have an impact on research productivity. Other institutional factors, such as performance-based management, commercial orientation, shared governance (Jung, 2012), academic rank, research objective, facilities (Hedjazi & Behravan, 2011), recruitment and selection, clear coordinating goals, research emphasis, research experience, area of expertise, a positive group climate, mentoring, communication with professional network, resources (Bland *et al*.,2005), areas of research, availability of funding, equipment, logistic support, departmental working environment, policy on getting tenure positions (Wood, 1990), etc., are all associated with research productivity of academics.

According to the Carnegie Classification (Middaugh, 2001), there are six types of higher educational institutions, namely research universities, teaching universities, comprehensive universities, liberal arts colleges, two-year colleges and specialised institutions. Research evidence shows that faculty members at comprehensive universities may have fewer opportunities than those at research universities to integrate research activities (Colbeck 1998). On the contrary, academics at research universities are expected to have higher research productivity (Mamiseishvili & Rosser, 2010). Moreover, top researchers tend to be concentrated at a few elite universities and low performers at lesser-known universities or colleges of the system (Kwiek, 2018).

Subjects and disciplines may also lead to differences in research productivity. It is evident that natural science faculty members have a higher research productivity than those in the social sciences and humanities (Baneyx, 2008). With regard to research training, Colbeck (1998) found that faculty members in scientific disciplines (e.g. physics) may have more opportunities to integrate research than faculty members in arts disciplines (e.g. English). Additionally, postgraduate schools or faculties, which have higher numbers of research students, would have a higher degree of research productivity. A faculty with a greater percentage of PhD students means that there may be greater opportunities of teacher-student collaboration in research and jointly publishing their results (Wood, 1990). Dundar and Lewis (1998) conducted a research to examine 3 600 doctoral programs and concluded that faculty group size does enhance research productivity. A large-sized faculty or department would have greater competitiveness in gaining more resources for research, which would lead to higher research performance.

## 2.4 Personal career attributes

Personal career factors refer to the academic and qualification factors of researchers. Factors such as the highest degree, research orientation, publication habit, subscription to journals and sufficient time for research are all associated with research productivity (Finkelstein, 1984). Later on, when more research studies were conducted to investigate these issues, these factors were found to be highly associated with research productivity as well, such as working attitudes, autonomy and commitment, motivation, socialisation and self-confidence (Hedjazi & Behravan, 2011), as well as research style (Jung, 2012). In Hesli and Lee's (2011) study, they found that the variables that would determine scholarly productivity include academic rank, sub-field specialisation, frequency of conference presentation, research

experience, collaboration with others, and some attitudinal factors such as stress and desire for recognition.

Similarly, Wood (1990) investigated the views of academic staff from one Australian university on the determinants of research performance and the importance of individual autonomy in research. Wood points out that researchers are productive because of their ability, creativity, motivation, ambition and self-discipline. Another representative research was done by Bland *et al.* (2005), in which they used *t*-tests, logistic regressions and multiple regressions to analyse the data collected from a survey from the University of Minnesota Medical School in 2000. They found that research productivity is an outcome of dynamic interplay of motivation, content knowledge, advanced research skills, autonomy and commitment.

Creativity is seen as a key factor in research productivity (Kim & Choi, 2017). Iranian researchers carried out a study involving 280 academics in agricultural faculties all over Tehran Province and found that creativity was the most favourable variable related to research productivity (Hedjazi & Behravan, 2011). Besides, input in research seems to be a determining variable on research productivity. Input in research is usually measured by the time spent in research activities. Working hours by researchers were found to be increasing with the depth and breadth of the research. According to Jung's study (2012), research productivity was positively associated with variables, such as time spent in research and the percentage of instruction time for doctoral students.

## 3. Theoretical framework

The American psychologist, Urie Bronfenbrenner's ecological systems theory is one of the most famous theories regarding the impact of social environments on human development. This theory argues that the environment within which people work and live affects every aspect of their lives. These factors determine the way people think, work, feel and do research. The application of the ecological system as a theoretical approach is crucial, as young researchers do not exist in isolation, but are embedded within a large academic social structure interconnected with other social domains, such as academic environment, social culture, etc.

Extending Bronfenbrenner's ecological systems theory to the study of factors that influence research productivity of young scholars at Chinese universities, we formulated the theoretical framework for this study in terms of the three interactive sub-systems of microsystem, mesosystem and macrosystem (Bronfenbrenner, 1974; 1979; 1986). A microsystem is a pattern of activities, roles and interpersonal relations experienced by a developing person within a given setting with particular physical and material characteristics. A mesosystem comprises the interrelations among two or more settings in which the developing person participates actively, such as relations between researchers and colleagues. The macrosystem refers to consistencies, in the form and content of lower-order systems (micro- and meso-) that exist (Bronfenbrenner, 1979). There are intricate connections and interactions among different sub-systems, and it is within this connection and interaction that individuals develop. More specifically, the ecological environments can be perceived as a constellation of nested subsystems of varying sizes (Paat, 2013). Factors influencing the research productivity of young researchers cannot be comprehended effectively without investigating the interconnections between these multiple layers of social structure (Bronfenbrenner, 1979).

The recent reforms in higher education in China call for attention to the sustainable development of young researchers (Wu & Shen, 2016) to improve the research and publishing capabilities of young researchers, their competitiveness, and their sustainable career development. The theoretical framework for this study is making use of a combination of Bronfenbrenner's (1974; 1979; 1986) ecosystem theory and Blackburn and Lawrence (1995)'s classification of the determinants of research productivity (i.e. demographic attributes, environmental attributes, institutional attributes, and personal career-development attributes) to explore the sustainable research productivity of young researchers in China.

## 4. Research methodology

To fully understand the difficulties that young researchers face in sustainable research development within the context of Chinese universities, we purposely sampled 24 young researchers from three provinces and a municipality of China. These participants were specifically selected for the following reasons. Firstly, the selected participants were from an eastern province (Jiangsu), a central province (Henan), a western province (Gansu) and a municipality (Shanghai) in China. These provinces and city have great differences in economic, cultural and technological development. Secondly, participants varied in terms of demographic factors, including gender, age, teaching experience, subject, university type and province. It is believed that these diversified backgrounds would benefit our exploration into university young researchers' perspectives. Lastly, 12 young researchers were working at Double First-Class universities[2] in China, while 12 researchers were working at non-Double First-Class universities. The research facilities at the Double First-Class universities are significantly superior to the facilities at non-Double First-Class universities, because these 137 Double First-Class colleges and universities have more funding, resources, and policy support from central and local government and relevant competent authorities (Liu, Turner & Jing, 2019). This will influence researchers' research productivity and achievement. That is generally consistent with the findings that research funding and other resources affected research productivity of university research (Lee, 2020).

While the small number of universities sampled cannot be representative of all universities in China, it is believed that a purposive selection of researchers with maximised difference in university backgrounds could benefit our research into productivity of young researchers. University researchers of different subjects were also selected as participants in this study. These participants were chosen in consideration of the fact that researchers of different subject backgrounds could provide diverse lenses on the research activities taking place in the universities. Given this, we attempted to invite three researchers of different subjects from each province and municipality as our participants. Finally, a total of 24 young researchers[3] from three provinces and a municipality agreed to accept the invitation in this study. Table 1 presents the demographic information of the 24 participants. It can be inferred that these researchers had different teaching experiences, subject backgrounds and working environments. It is expected that their perspectives can thus shed light on factors related to sustainable research productivity.

2 Double First-Class universities refer to first-class universities and disciplines of the world. It is a higher education policy implemented by the People's Republic of China since 2015. The goal is to become a powerful country in higher education by the middle of the 21st century.

3 The professor series of academic rank in China includes professor, associate professor, lecturer and assistant lecturer.

**Table 1:** Demographic information of the 24 participants

| Pseudonym | Gender | Age | Academic rank | Years of work | Subject | University type | Province | Interview type |
|---|---|---|---|---|---|---|---|---|
| Aaron | M | 33 | Lecturer | 2 | STEM | Double First-Class | Jiangsu | Face-to-face |
| Bella | F | 34 | Associate professor | 3 | STEM | Double First-Class | Jiangsu | Face-to-face |
| Colin | M | 31 | Lecturer | 1 | Humanities | Non-Double First-Class | Jiangsu | Face-to face |
| Danny | M | 35 | Associate professor | 5 | STEM | Double First-Class | Jiangsu | Face-to face |
| Elvis | M | 32 | Lecturer | 2 | STEM | Double First-Class | Jiangsu | Face-to face |
| Fiona | F | 31 | Lecturer | 1 | Humanities | Non-Double First-Class | Jiangsu | Face-to face |
| Griss | F | 34 | Associate professor | 3 | Humanities | Double First-Class | Shanghai | Face-to-face |
| Haylie | F | 28 | Lecturer | 0.5 | Humanities | Non-Double First-Class | Shanghai | Face-to-face |
| Irvin | M | 30 | Lecturer | 1 | STEM | Non-Double First-Class | Shanghai | Face-to-face |
| Jenny | F | 30 | Lecturer | 1 | STEM | Double First-Class | Shanghai | Face-to-face |
| King | M | 36 | Associate professor | 6 | Humanities | Double First-Class | Shanghai | Face-to-face |
| Lewis | M | 37 | Associate professor | 7 | STEM | Non-Double First-Class | Shanghai | Face-to face |
| Martin | M | 36 | Associate professor | 7 | Humanities | Double First-Class | Henan | Online |
| Nash | M | 31 | Lecturer | 4 | Humanities | Non-Double First-Class | Henan | Online |
| Oscar | M | 35 | Associate professor | 4 | STEM | Double First-Class | Henan | Online |
| Perry | F | 31 | Lecturer | 1 | Humanities | Double First-Class | Henan | Online |
| Quentin | M | 38 | Associate professor | 8 | STEM | Non-Double First-Class | Henan | Online |
| Roberto | M | 33 | Associate professor | 3 | STEM | Non-Double First-Class | Henan | Online |
| Sammy | M | 32 | Lecturer | 2 | STEM | Double First-Class | Gansu | Online |

| Pseudonym | Gender | Age | Academic rank | Years of work | Subject | University type | Province | Interview type |
|---|---|---|---|---|---|---|---|---|
| Tina | F | 36 | Lecturer | 10 | Humanities | Non-Double First-Class | Gansu | Online |
| Upton | M | 34 | Associate professor | 3 | STEM | Non-Double First-Class | Gansu | Online |
| Vivian | F | 39 | Associate professor | 10 | Humanities | Non-Double First-Class | Gansu | Online |
| Wendy | F | 35 | Associate professor | 4 | Humanities | Non-Double First-Class | Gansu | Online |
| Xavier | M | 32 | Lecturer | 2 | STEM | Double First-Class | Gansu | Online |

## 4.1 Instrument and data collection

In-depth, semi-structured interviews were adapted in this research to collect data in December 2021. All the interviews in Shanghai and Jiangsu were conducted face-to-face. Interviews of participants from Henan Province and Gansu Province were conducted through WeChat (an online tool that has audio and video functions) because of the inconvenience to reach these distant places. All the interviews were carried out in Mandarin. Audio records were transcribed into English for further data analysis. In addition, interview transcripts were sent to the participants for checking and verification.

Generally, interviews lasted for about an hour with each young university researcher. Before the formal interviews, the researchers introduced to the participants the purpose of this research, the use of pseudonyms to protect the privacy of participants, and the rights of participants to withdraw from the research at any time. The researchers also asked the participants to sign consent forms. For the interviewed participants in Henan Province and Gansu Province, the electronic version of the consent forms was sent remotely via WeChat, and the participants were asked to sign electronically. All interviews were completed in December 2021.

## 4.2 Data analysis

Analysis of interview data was guided by grounded theory, which was designed to create theories that were empirically derived from the real-world situation (Oktay, 2012). A three-stage, systematic qualitative analysis was conducted to summarise the responses of young researchers. The first was to read the original interview material carefully and conduct opening coding. During the coding process, the authors extracted concepts from the original material and described these concepts in terms of attributes and dimensions. The second was to carry out axial coding of qualitative data, linking important concepts to one another, and then categorising and refining the coded data. Finally, selective coding was used to identify the theme of the qualitative interview materials according to the analytical framework of the research and the needs of the research question, combined with the context (Creswell, 2014). In the actual coding process, the authors needed to read through the original qualitative

materials, study the views and opinions of the interviewees, and analyse some ambiguous views in particular.

During the analysis, the necessary efforts were made to ensure the trustworthiness and credibility of the findings. The first author conducted interviews with young researchers for more than a month, and these continuous interviews helped him to understand the current status of young researchers better. Specifically, the first author narrowed the distance between the participants and him through detailed conversations and close personal relationships. This approach allowed him to be accepted by the interviewees within a short period of time and to encourage the participants to be more willing to share. At the same time, the first author's status as an outsider helped him to understand the current difficulties of the young researchers better. The second author checked the interview transcript to make sure it was accurate. The two authors of this study checked the codes with the original interview data in turn, and recoded the data to ensure interrater consistency and credibility (Miles & Huberman, 1994). Any coding difference encountered was discussed and eventually confirmed together.

## 4.3 Limitations

Several limitations should be noted in the current study. First, the sample of this study is rather limited, as the current study has involved only 24 researchers from three provinces and a municipality. Therefore, the research findings cannot be extended or generalised to all younger researchers in the population. Considering the geographical diversity in China, future research needs to engage more young university researchers to participate in this research. Secondly, it is difficult to obtain exact information about research funding and research productivity from the young researchers in this study, since privacy is a major consideration. Thirdly, the present study has adopted the theory of ecological systems traditionally used in Western contexts. Although the findings are consistent with literature, future studies to replicate the findings with a more reliable measurement in the context of China are suggested. Finally, one might argue that our research is performed in the Chinese culture; it would, therefore, be interesting to test whether our results can be realised in different cultures in the future research, in order to address the cultural differences.

# 5. Findings in microsystem

According to Bronfenbrenner (1979), a microsystem is the immediate environment surrounding an individual. It is believed that personal individuals will have direct connection with the elements included in this category. These elements of the microsystem for young researchers are research skills, research difficulty, research time, discipline research atmosphere, discipline development, difficulty of scientific research output, and research team collaboration.

## 5.1 Individual attributes

### 5.1.1 Research skill

Research productivity generally links to the research skill (Heng, Hamid & Khan, 2020). A few respondents mentioned that insufficient research skills impacted markedly upon their research productivity. These research skills may relate to personal qualification, ability to write a manuscript and time management (Bella, Danny, Griss), as well as theoretical foundation, critical reflection ability, reading time, personal academic voice and academic communication (Colin, Davi, Elvis). It is strongly related to the ability to conceptualise problems (Aaron,

Oscar), the ability to define research questions (Fiona, Irvin), research methods, and research significance (Jenny, Tina).

> *I think personal qualifications and abilities to do scientific research are important, especially the ability to do quantitative data analysis. Other important skills include: the ability to write an academic manuscript, and overall management of time. For example, after my manuscript is rejected, I don't like to revise it immediately, but some people will be able to revise it promptly, so it is different. (Griss)*

> *I think the mastery of research methods and a clear research perspective are more important for engaging in scientific research. I feel that my ability in this area is average, and I still need to learn more. (Tina)*

### 5.1.2 Research difficulty

Many young researchers agreed that the difficulties in scientific research include how to identify a research area (Irvin, King, Xavier), and difficulty in publishing manuscripts, especially in CSSCI[4] journals (Martin, Tina). In China, good journals, especially those with CSSCI, generally have higher preference than those by scholars from famous double first-class universities. Such preference will increase the citation rate of their journals and ensure that their journals have a higher academic status. A few young researchers reported that some journals restricted the publication of their manuscripts, because the universities they worked for were non-double first-class universities.

> *There are some difficulties in doing scientific research. I have some research ideas that I cannot put into practice. I think the root cause of these difficulties is that there is no money or funding support. (Griss)*

> *It is difficult to apply for national scientific research projects, and it is difficult to publish scientific manuscripts in CSSCI journals. The main reason is that the number of projects is limited, while the number of applicants is far too many. (Martin)*

> *The most difficult is to publish manuscripts in CSSCI journals. On the one hand, the level of my manuscripts needs to be improved; on the other hand, my university is not in "Project 985" and "Project 211". (Tina)*

### 5.1.3 Research time

Many studies show that the availability of time on research activities has great impacts on research productivity (Finkelstein, 1984; Jung, 2012). Many young researchers agreed that teaching time was taking up most of their time, and limited their time input on research. After long hours of teaching, they have no more time and energy to do scientific research (Aaron, Griss, Irvin, Lewis, Tina, Upton).

> *There are always various administrative meetings that take up a lot of time. I think heavy teaching is currently the most important factor affecting my research time. I basically teach three or more course every semester, and I have no energy to do research after finishing the teaching. (Griss)*

It is common that most young researchers have a relatively high teaching workload. In this case, young researchers do not have time to work on their projects and therefore produce fewer research results. High workload leads to lower academic productivity of young researchers. In

4 CSSCI is Chinese Social Sciences Citation Index, which is an interdisciplinary citation index programme and important tool to evaluate manuscript quality in China.

addition, some young researchers have to set time aside for administrative duties, which also means that their time for research is further limited.

> *Now we are under very great pressure of scientific research assessment, while the evaluation of teaching duties has taken much time too. Now, I am also the Secretary of a branch of the Party. There are many party affairs activities, that have used up most of my times as well. In addition, I have been engaged in other daily administrative work in the department. So, all these have occupied me for a lot of time and I don't have more free times for scientific research. Even further, I need to spare times for my family! Therefore, my productivity of scientific research is indeed greatly affected. (Nash)*

> *Only can good research be done when you have sufficient funding and times. However, I am in great shortage of both. I can only tinker with the past research work and rush to come up with something. These rushed outcomes have been a result at the expense of my sleeping times and health! (Irvin)*

It is good to see that some universities and faculties do now understand that the impact of high workload leads to low research productivity of young researchers. According to some interviewees' responses, although universities recognise their difficulties of not having enough time to do research, there are not many effective measures that help to revert their adversities. It is still general practice that young researchers at many universities should bear with more teaching and administrative duties than senior researchers.

## 5.2 Discipline attributes

### 5.2.1 Discipline research atmosphere

Working environment has a powerful effect on research productivity (Sheridan *et al*., 2017). The atmosphere of a department or discipline is important in promoting research productivity. During the interviews, some young researchers expressed that the research atmosphere in their disciplines was not very good, and there were relatively few academic activities (Irvin, Martin, Perry, Upton).

> *The research atmosphere is not very strong here, the number of academic salons and seminars related to the discipline is relatively less, and the main duties of the discipline is currently on the assuring the quality of undergraduate teaching duties. (Martin)*

> *The academic research atmosphere in the department is not strong, and it used to be more like a "teaching unit." (Irvin)*

### 5.2.2 Discipline development

For any discipline, there should be no difference in the research productivity. A common perception is that the development of a discipline markedly impacted the researchers' performance (Jung, 2012). One young researcher said:

> *At present, here is a strong development momentum. Our university is ranked first in Henan Province and eleventh in China. The number of newly enrolled PhD graduate is increasing year by year, the number of senior professorial titles is increasing year by year, and our young teachers have accounted for a large proportion. (Martin)*

In such an environment, young researchers have a stronger motivation to apply for scientific research projects, and also have a greater chance to obtain scientific research funding. The result is that scientific research is very active there and research productivity is higher too.

However, if the prospect of the discipline is not good or not the State's priority, it will be difficult to obtain sufficient funding and resources to carry out scientific research.

> *The prospect of my current discipline in the national agenda is not very optimistic, due to the low employment rate of graduates and the support from the university for the discipline development is not strong. (Tina)*

### 5.2.3 Difficulty in scientific research output

Research output is an important indicator to assess the performance of researchers. Most young researchers believe that scientific research output is difficult, while high-level scientific research results are even more difficult (Aaron, Griss, Irvin, Martin, Nash, Upton).

> *Easy to produce simple research result, but more difficult to produce high-quality research. (Aaron)*

A young researcher said that it was very difficult to obtain high-level research results from a local non-key university.

> *High-level results are difficult, because high-level results are basically impossible to produce from local colleges and universities like ours. Many journal editors have strong preference for manuscripts from prestigious universities only. (Nash)*

### 5.2.4 Research team collaboration

In the STEM area, there are many opportunities of scientific research cooperation, while in the humanities and social sciences, especially in non-key universities, there is relatively little cooperation.

> *Production of an influential research output may demand much efforts and needs team-work. New researchers who are just fresh graduates need more team assistance from senior researchers. However, it is hard to just fumble on your own. (Martin)*

> *In scientific research, we have interdisciplinary cooperation in physics, chemistry, biology, information technology, but seldom in humanities and social science. (Aaron)*

> *Local colleges and universities like ours have less teamwork and cooperation and not like those in "Project 985" and "Project 211" universities. Because those famous professors in these key universities have more research resources and are really productive. Our local colleges and universities have fewer resources. Even if some professors have got some research resources, they will not share with us, and there is less teamwork. (Nash)*

## 6. Findings in the mesosystem

The mesosystem is the next level beyond the microsystem and is defined by Bronfenbrenner (1979) as the interconnection of two or more microsystem elements. In this subsystem, the main elements that directly affect the research productivity of young researchers are scientific research management system, training and mentoring, supervision and incentive, and scientific research evaluation system.

## 6.1 Institutional attributes

### 6.1.1 Scientific research management system

Double first-class universities generally have more sophisticated scientific research management, with differently categorised evaluation and rewards (Aaron, Martin, Quentin, Wendy).

> *I think the current research management system is not good enough. The university managers only rely on the number of articles published in journals to judge the performance of scientific research. They may not know the quality of each of these journals and there are no universal criteria for fair judgement. It may be due to the fact that those in charge of research management at the university level do not have much substantive knowledge of many research areas. (Griss)*

> *Our university has its own points accumulation system to evaluate research productivity. The point system only regards that those top journals in each professional field recognized by the university, such as SCI and SSCI journals, with some points, while others are none. In addition, there are corresponding points for obtaining scientific research competitive grants. Then, the performance of a researcher is comprehensively evaluated according to the points obtained. (Aaron)*

Further, the research management systems of some non-key universities are also not good. One young researcher said,

> *The assessment system of research performance is really poor! The assessment criteria, rules and regulations are a mess. The university's policies on the assessment of research productivity are always changing and frequently revised. (Nash)*

### 6.1.2 Training and mentoring

Some respondents mentioned that insufficient research experience and skills impact markedly upon their research productivity. These young researchers are still novices and need experienced guidance on how to conduct their research. Many universities also recognised the importance of improving the research skills of young researchers and they have started offering research training programmes to assist their junior staff. For example, a few departments have organised experienced professors to work with young researchers and help them to apply for research funding.

> *The Department has organised training workshops on scientific research every year, such as, application for research grants, writing English manuscripts and publishing in international journals, etc. There are some of these workshops, but not many. (Martin)*

> *When applying for some national high-level competitive projects, the university will invite some external experts to provide specific guidance. (Tina)*

> *Basically, everyone is work on their own research, individually. Sometimes their successful experience in the application for projects offered by the National Natural Science Foundation of China is shared online. (Aaron)*

However, a few young researchers said that the training was not very helpful and did not help them to solve the significant problems.

> *There are some trainings offered by the Faculty, which invited external experts for helping us. Each seminar lasted for around 1 to 2 hours. However, they were not much helpful and I think it was a waste of time in attending these seminars. (Nash)*

### 6.1.3 Supervision and incentive

Many young researchers responded that the universities where they worked did have strong supervision mechanisms, but there were no incentives.

> *At our university, we do have strong supervision mechanisms on research productivity, but they are mainly for summative purposes, not formative. (Nash)*

> *The university awards only those who have publications in top journals, but not for the local or professional journals. (Irvin)*

### 6.1.4 Scientific research evaluation system

Quite a few young researchers agreed that the current scientific research evaluation system is unreasonable and should not rely solely on the number of manuscripts published. More consideration should be given to the quality of publications. Scientific research results of young researchers should be judged by related experts in the field. It is impractical to allow administrative staff who do not understand scientific research to manage research assessment.

> *The university's scientific research evaluation system expects that, on the one hand, we should focus on quantity in productivity, but at the same time should also emphasize quality. However, the research assessment exercise is taken annually, so many young researchers may not be able to meet the requirements and there will follow some penalty measures. This practice will discourage young researchers and no motivation is built. While the University expects young researchers to have high research productivity, they also allocate young researchers with heavy teaching loads and lots of administrative work. After all, young researchers are really exhausted with limited energy and time. So, I think it is not appropriate to evaluate research productivity within a short time frame and so frequently (Griss).*

> *The evaluation cycle for scientific research is three years, and the time span is a bit short and tight, maybe, five years is a more reasonable measure (Bella).*

Universities in China should be evaluated based on the missions of talent cultivation and knowledge creation, rather than mainly on international rankings and other quantitative measures. Recently, the Ministry of Education (MOE) in China has implemented a new policy to advise that the University Evaluation System should not only emphasize the number of manuscripts published, the number of external competitive research projects granted, the number of high-rank professorial titles, and the academic backgrounds of the universities (whether in the 211-Project or 985-Project). Other criteria, such as the quality of teaching, the graduates' employment rates, and the sustainability of disciplines and the degrees of knowledge transfer should also be consideration (MoE, 2020). A more holistic university evaluation would be implemented in the coming future.

> *Scientific research evaluation system is relatively reasonable at present. The reasons are that our university has been overemphasizing just the number of manuscripts published, the number of high-rank professional titles, and the number of competitive research projects. I think, different criteria and standards in scientific research evaluation should be adopted, according to the nature of the disciplines. The assessment of research productivity in natural science, social science and humanities should be distinguished. (Martin)*

### 6.1.5 Research funding

All the young researchers from the double first-class and non-double first-class universities interviewed in this study agreed that the research funding was insufficient. The young researchers from the non-double first-class universities in particular reported that the funding was seriously insufficient (Irvin, Roberto, Vivian). A young researcher even used his salary as a source of research funding (Colin). The shortage of research funding impacts their research productivity, and research funding is an important enabler for research productivity (Wood, 1990). Young researcher Tina highlighted the importance of research funding for researchers' enthusiasm:

> *At present, due to the shortage of research funding in our university, the amount of scientific research grants has been greatly reduced from this year. I think this change has seriously affected the enthusiasm of researchers in scientific research. (Tina)*

Research funding of Chinese universities mainly comes from the national, provincial and local governments as well as from the universities themselves and some enterprises, such as Huawei, etc. Researchers majoring in STEM can carry out some scientific research with enterprises and can obtain some funding support, while researchers in the field of humanities and social sciences are difficult to cooperate with enterprises and rarely receive funding from them. Moreover, it is found from the interviews that it is more difficult for young researchers from local non-double first-class universities to obtain research funding. It is very difficult for them to apply for national key projects at these non-key universities due to fierce competition. At most, they can only apply for some provincial-level projects. Moreover, provincial-level project funding gradually becomes less, due to too many applications. These difficulties seriously restrict the development of research projects, let alone high-quality scientific research.

> *Research funding is insufficient, and the research funding investment should be increased. Especially research funding for local non-key colleges and universities must be increased. Most research funding is now concentrated in the key universities. Local non-key colleges and universities have a large number of researchers, who need to teach a large number of students. If there are insufficient research projects and funding, they would have no way to carry out scientific research and guide students. It is impossible for "non-Project 985" and "non-Project 211" universities to undertake the teaching loads of the whole country, so the funding for local non-key colleges and universities must be changed and increased. (Nash)*

## 7. Findings in macrosystem

The macrosystem in Bronfenbrenner (1979)'s model is much more abstract than the previous levels, which is defined as the layers of relationships surrounding the young researchers. The interview data revealed that policy was an important part.

### 7.1 Policy attributes

The Chinese government has introduced reinforcements to motivate young researchers to do research. The Chinese Ministry of Education has required of universities and colleges to rectify the problems of overemphasising just the number of manuscripts in academic appraisals (MoE, 2020). The quality of manuscripts should not be judged by the journals in which the articles are published and where they are published. It is advised that over-reliance on publications in international journals should be avoided. What is more, the number of manuscripts in SCI, SSCI and CSSIC, citation rate and impact factor should not be connected to resource

allocation, material incentives and performance-based salary. Responding to the government policy, one young researcher said this new policy would have some positive impact:

> *The country has recently begun to implement the policy which calls for that the academic evaluation of universities should not overemphasize the number of manuscripts published, the number of top-rank professorial titles, the number of competitive granted projects, or their academic backgrounds. This new policy has some good impacts on us and has gradually begun to focus on the quality of manuscripts rather than the quantity of manuscripts, in the research assessment exercises (Colin.)*

Nonetheless, some respondents argued that in fact their universities did not implement the policy practically. *Oscar* shares that,

> *Although the policies on scientific research management have begun to change, the number of scientific research publications is still highly valued by our University. Most people still look at the number of manuscripts published, where the manuscripts published, or whether with SSCI or CSSCI indices, in the annual research assessment exercise. (Oscar)*

It can be concluded that both the MOE and most universities' policies create different impacts on research productivity of young researchers, because the definitions of quality research and a good piece of publication in journals are not well understood. It is advised that each university put the national policy into practice, and there should be some measures that enforce the effectiveness of policy implementation. The MoE has to check whether the policy has changed the assessment culture effectively throughout universities at the macrosystemic level. Otherwise, these young researchers may be confused and are driven to pursue just the number of published manuscripts in research assessment exercise.

## 8. Discussion

Bronfenbrenner's (1979) theory of ecological systems provides a framework that categorises the interview data, and allows for the interactions among the individual, institutional and national levels be examined and analysed. This qualitative analysis is based on the ecosystem theory that provides a systematic perspective and new approach to understanding the scientific research status of young researchers in China.

The young researchers involved in this study formed the individuals at the core of a set of ecosystems that determine their long-term scientific research development. The most obvious manifestations of the microsystem are the personal and disciplinary attributes that would be directly related to the young researchers.

The scientific research management system and evaluation system, together with the opportunity of professional development and involvement in mentorship, and the supervision and incentive schemes belong to an outer circle that forms the scope of the mesosystem. The context of education reform and the policy formulated will form a typical macrosystem, which is at the utmost circle. The influence of the policy will penetrate the mesosystem and microsystem, and then be reflected back to the macrosystem. The interaction among the microsystem, mesosystem and macrosystem is the ecology in which young researchers grow and develop.

Thus, the ecological systems theory provides us with a logical and systematic framework for analyses of the issues and enables us to recognise that the personal development of young

researchers is the result of the combined effects of these systems. The inspiration of this point of view is that young researchers should strive to exert their initiatives, demonstrate their personal values, and have a positive and open attitude to interact with the new environments around them in order to promote self-development, rather than passively emphasising how the external factors hinder their scientific research.

From the perspectives of young researchers, the process of research integration is a comprehensive and complex transformation, from microsystem to mesosystem to macrosystem, and systems at each level must be adjusted according to the actual situation. For example, in the fundamental change of policy in the macrosystem and in the change from independent scientific research to teamwork in the microsystem, the processes themselves are full of twists and turns. Problems such as the lack of research funding found by young researchers, the difficulty of publishing papers locally or internationally, the heavy workloads and the lack of research time would ultimately determine the fates of the young researchers in sustainable career development.

The scientific research evaluation system is an important part of the scientific research management system at universities. First of all, it is necessary to clarify the process orientation of evaluation and the growth orientation of scientific researchers. The determination of evaluation indicators for scientific research achievements should reflect the inherent laws of scientific research development, and attention should be paid to the transformation of scientific research achievements and application assessment, as well as the service function of scientific research results to the society. Secondly, the setting of the assessment cycle at universities can be improved to overcome the mentality of quick success and quick profit that are common among scientific researchers. The research assessment period can be appropriately extended or agreed upon by both parties, so that teachers can carry out research activities without worries. Besides, young researchers should keep an open attitude in the new ecosystem, learn and communicate actively, and try their best to integrate into the research ecosystem to promote their own sustainable development by promoting the development of scientific research capabilities. To some extent, the sustainable development of young researchers also promotes the sustainability of higher education in China.

## 9. Conclusion

Higher education can also be regarded as an ecosystem. Many scholars have carried out in-depth analysis and research on the macro-, meso- and microlevels of higher education from the aspects of political economy and academic ecology. Academic researchers not only provide a new field of research, but also guide the practice and research process of higher education with a sustainable and coordinated ecological concept. The sustainable development of higher education not only contains a variety of different subjects and organisations, but also nests with the entire organizational environment and cooperates with other systems to maintain the consistency of university-running goals and objectives. The academic evaluation system centres on scientific research and production plays an important role in the research capability and sustainable development of young researchers.

As the main producers of the higher education ecosystem, young researchers' research productivity is critical to the stability, circulation and sustainability of the higher education ecosystem. In this ecosystem, institutional ecology and organisational ecology jointly empower young researchers' academic output. Conversely, academic participation of young

researchers is constantly optimising, adjusting and improving the entire higher education ecosystem. This study examined the research productivity among Chinese young academics and explored the factors that determined their research productivity. Our findings indicate that the research productivity of young researchers is determined by a number of factors, including personal characteristics and institutional characteristics. This study shows that there is still much improvement in the research management system by university leaders. Leaders who provide young researchers with the necessary research support create a good research culture, and establish feasible evaluation and effective reward programmes to help them solve difficulties encountered in the processes of scientific research. They have a significant role to play in promoting the overall research productivity and sustaining the development of higher education in China. In the future, the focus of research should take care of the entire university evaluation system from the perspective of education ecology, and deeply analyse the ecological effects, ecological advantages and institutional ecological construction in the institutional field.

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