

# MOOC Alliances of China: Organization and Practices

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**Abstract.** In 2013, MOOC were introduced to China, instigating the formation of MOOC alliances among various colleges and universities. The MOOC alliances have significantly contributed to the promotion of online education and the development of MOOC worldwide, establishing a unique ecosystem for MOOC with Chinese characteristics. Despite their significance, comprehensive literature on the MOOC alliances remains scarce. This paper offers an exhaustive analysis of the evolution of MOOC alliances in China, drawing upon both documents from the Ministry of Education of China and data from 27 distinct MOOC alliances. Grounded Theory is employed to analyze the organization and operational practices of the MOOC alliances. The study highlights the significant changes in higher education precipitated by the initiatives of MOOC alliances. It concludes that the MOOC alliances in China have evolved into a systematic institutional system of work. The paper further proposes that the next phase for the MOOC alliances should be to support the digital transformation of higher education.

**Keywords:** MOOC Alliances of China; organization; practices; qualitative study

## 1 Introduction

The present study shows the impact of Massive Open Online Courses (MOOC) on global higher education since 2012. It is noted that MOOC entered China in 2013 and have since received significant attention from the Ministry of Education (MOE) and active response from Chinese universities. The development, application, learning, and management of MOOC and online education in China have been vigorously advanced. Over the past decade, China has taken the lead in terms of the number of MOOC constructions and their application scale worldwide. MOOC are now considered the new business card of China's higher education[1]. During this period of rapid development, universities have collaborated to share courses, educational resources, and teaching experiences. Several national, regional, and professional MOOC Alliances of China (MAC) have emerged, forming a MOOC education ecosystem with unique Chinese characteristics[2]. MAC have effectively promoted the renewal of higher education concepts and changes in teaching practices to achieve the goal of shaping China's new online education ecosystem with new technologies and models. This is reinforced by the Highlights of the Work of Higher Education Department of MOE in China in 2023[3]. It emphasized that,

The aim is to successfully hold the Global MOOC and Online Education Conference in 2023 and create a Chinese brand in the reform and development of online education worldwide. The

Global MOOC and Online Education Alliance will be promoted to enhance China's MOOC and online education's international influence.

The organization and practices of MAC are of strategic significance for state agencies due to their increasing impact on China and the world. MAC aim to establish a co-construction and sharing mechanism for high-quality MOOC resources through the construction and application of MOOC, and to promote the reform of teaching models in colleges and universities, ultimately improving the quality of teaching. This paper aims to explore the organization and practices of MAC. It first overviews the development process of MAC and outlines the methodology used in the study. It then focuses on the measures are taken by 27 MAC, and how this translates into national practices. This is followed by the discussion before presenting the conclusion.

## **2 Objectives of the study**

Since the inception of MOOC in 2012, MOE has closely monitored the global trend in MOOC development. It was decided from the outset that China's MOOC development should keep pace with the rest of the world while also reflecting Chinese characteristics[4]. In 2013, several renowned Chinese universities began experimenting with MOOC development and online teaching reforms. Tsinghua University, Peking University, Hong Kong University, and The Hong Kong University of Science and Technology have joined edX, and many courses have been launched online. Additionally, Peking University, Shanghai Jiao Tong University, and Fudan University have joined Coursera. In 2014, the Online Education Research Center of the Ministry of Education was established at Tsinghua University to conduct research on MOOC theory, teaching models, learning methods, and course sharing applications.

When constructing and using MOOC, colleges and universities recognize the importance of forming alliances to jointly build and share them. MAC have been established one after another. The researches on MAC in China mainly focus on the various factors that affect the development of the MOOC alliances, such as the platform, sharing mode, and course quality assurance system. Additionally, researches have been conducted on the operational mechanism and development strategy of certain MOOC alliances[5].

Although some researches have been conducted on MAC, little is known about their common organization and the practices. This study has two objectives: firstly, to summarize the development process of MAC from a lot of government documents and materials from 27 MOOC alliances, and secondly, to identify their general organization and practices, with a view to thinking about how can MOOC and online education efficiently empower the digital transformation of higher education in the context of digital transformation.

## **3 Materials and methods**

This study aims to explore the organization and practices of MAC. However, due to their diversity and complexity, it is challenging to measure them using specific technologies. Therefore, we adopted a qualitative approach, specifically Grounded Theory. The methodology contrasts with the hypothetical-deductive model used in traditional scientific research. It

involves the construction of hypotheses and theories through the collecting and analysis of data[6]. Researches who rely on Grounded Theory do not design conceptual frameworks in advance. Instead, they collect information on the research field with an open attitude and aim to exclude existing theories and understandings.

This study analyses 16 official documents from Chinese government, comprising 9 notices and 7 news reports, which were obtained from the government website. These documents offer background and supporting information for tracing the development process of MAC. Additionally, other data were obtained through document analysis. The study team consists of the secretariat staff of GDHKMOOC, who hosted the annual meeting of The Association in May 2023. Before the meeting, we collected information from 27 member unites into a booklet, which was printed and distributed to the meeting attendees. This ensures reliable and comprehensive data sources. The information helps to summarize the experiences of MAC.

Following the principles of Grounded Theory, we conducted open coding, axial coding, and selective coding to analyze the organization and practices of MAC. Our analysis was facilitated by the qualitative analysis software Nvivo. Following the process of open coding, initial concepts are derived by generalizing and refining from related statements. The similar concepts are subsequently grouped to form categories. In this study, 53 concepts were identified, resulting in a total of 12 categories, including organization structure, rule formulation, execution of MOOC research, construction of MOOC resources, professional class MOOC development, convergence of MOOC resources, MOOC Go West, mutual credit recognition, teacher training, seminar and exchange activities, selection of exceptional cases and teachers. Table 1 displays the two categories resulting from the open coding: 'organization structure' and 'rule formulation'.

**Table 1.** Open Coding(Example)

Categories	Information Text (Initial Concepts)
organization structure	It is guided by the National University Steering Committee on Teaching Informatization and Teaching Method Innovation.
	It is established under the guidance of the Department of Education of Guangdong Province with universities in the Guangdong-Hong Kong-Macao Greater Bay Area.
rule formulation	It formulates the constitution of the alliance.
	It develops the standards, guidelines and specifications for computer-based MOOC.
	It develops accreditation rules and a scheme for accrediting both online and offline courses.

Following axial coding, these concepts were further refined, summarized, and compiled into higher-level categories. This ensures that all known concepts are covered, such as organization structure and rule formulation being summarized under higher-level organization mechanisms categories. Adopting this approach allowed for the integration of the 12 categories into five primary categories: organizational mechanisms, MOOC research, co-construction and shared application of MOOC, mutual recognition of credits, and cooperation, as shown in Table 2.

**Table 2.** axial coding

Primary Categories	Categories	Connotation
organizational mechanisms	organization structure	To promote the development of the alliance, collaboration with the government, universities, and the community is necessary.
	rule formulation	To govern the conduct of university members and to oversee the construction of MOOC. The aim is to ensure the effective operation and growth of the alliance.
MOOC research	various standards	To ensure the quality of MOOC development and application, researches are conducted on MOOC construction standards, online standards, and implementation methods for credit recognition.
	MOOC development	To investigate the challenges associated with using MOOC and promote their innovative application by studying their development.
co-construction and shared application of MOOC	MOOC application model	To meet different educational concepts, teaching objectives and learning needs, different modes of MOOC application have emerged.
	MOOC Go West	To promote the sharing of MOOC and educational equity, high-quality MOOC will be continuously delivered from eastern colleges and universities to the western regions.
mutual recognition of credits	credit recognition	To earn credits by taking MOOC offered by other colleges and universities.
	credit bank	To certify and store the learning outcomes of MOOC learners.
cooperation	teacher training	To enhance teachers' educational concepts and improve their pedagogical skills.
	MOOC Going Global	To enhance cultural exchange and understanding by offering international students a wider range of study options and opportunities.

A selective coding was then performed on three randomly selected alliances. The theoretical saturation test analysis revealed no new concepts or genera. Based on the three levels of coding, the organizational structure and practices of the MAC were essentially established.

## 4 The development process of mac

The establishment and development of MAC can be divided into four stages.

### 4.1 The initial stage was the follow-up and exploration phase, which lasted from 2013 to 2014.

During this stage, MOOC was mainly developed and utilized by pioneers and explorers who actively explored and shared their experiences in promoting teaching reform. This laid the foundation for the development of MOOC. Additionally, various MOOC platforms such as

xuetangX and iCourse have emerged in China, along with regional and professional MOOC alliances, which have accelerated the development of MOOC.

In 2013, the Eastern and Western University MOOC Sharing Alliance (EWMOOC) was formally established as the first regional MOOC alliance in China. EWMOOC carried out various tasks, including course construction, teacher training, and MOOC Go West, with the aim of promoting equity of higher education.

In 2014, the first professional MOOC alliance, the MOOC Alliance for Computer Education in Chinese Universities (CMOOC), was established. Its purpose is to advocate, lead, and promote the construction of MOOC, innovative reforms, and teaching quality in computer education. CMOOC takes the lead in implementing a series of reform and innovation actions of Internet + Computer Education. In the same year, the first MOOC alliance of local universities, called the University Open Online Course (UOOC), was established. It integrated high-quality teaching resources from local universities, constructed and applied MOOC, forming a mechanism for co-construction and sharing of high-quality courses.

#### **4.2 The rapid development stage lasted from 2015 to 2019.**

A group of MAC were established under the leadership and strong support of MOE, showcasing the rapid development and vitality of MOOC in China.

In 2015, MOE issued the Opinions on Strengthening the Application and Management of Online Open Course Construction in Colleges and Universities (The Opinions) [7]. The Opinions proposed building a batch of high-quality MOOC, creating a public service platform for MOOC, promoting the widespread application of MOOC, and innovating the credit recognition and management system for MOOC. The Opinions provided guidance for the construction, application, and management of MOOC, which accelerated their development and adoption in China, leading to a surge in their popularity from 2015 to 2019. During this period, 19 MAC were established across the country, categorized into three main types, the regional MOOC alliance, the professional MOOC alliance, and the cross-university MOOC alliance.

The regional MOOC alliance is a type of MOOC learning community formed among universities in the same region or province. An example of this is the University Open Online Courses Alliance of Guangdong-Hong Kong-Macao Greater Bay Area (GDHKMOOC), which aims to create a community for MOOC construction and application among universities in the Guangdong Hong Kong Macao Greater Bay Area. Regional MOOC alliances are mainly distributed throughout various provinces of China, including Fujian, Zhejiang, Hubei, Chongqing, Jilin, Heilongjiang, Shanxi, and Beijing. These alliances focus on the construction and application of MOOC, creating an integrated mechanism for MOOC planning, construction, application, and management.

The professional MOOC alliance is the second type, which primarily focus on universities in the same professional field, such as foreign language majors, physics disciplines, electrical and electronic fields, library science, finance, agriculture and forestry, among others. An example of this type is the China MOOC for Foreign Studies (CMFS), the first national MOOC alliance for foreign language disciplines initiated by Beijing Foreign Studies University. The aim is to develop highly skilled individuals with a comprehensive understanding, responding proactively to The Belt and Road Initiative, and contributing to the global promotion of Chinese culture.

The cross-university MOOC alliance is composed of specific types of universities. There are two alliances of this kind: the Applied Curriculum Construction Alliance (ACCA) and the The Financial MOOC Alliance of University (FMAU). ACCA was initiated and established by applied colleges and universities. It is driven by market demand and aims to translate applied education concepts into practical solutions that address the region's and university's specific challenges. This includes addressing issues such as a focus on teaching over learning, prioritizing theory over practices, prioritizing the training of cadres over teachers, and prioritizing hardware construction over software.

In 2019, MOE issued the Implementation Opinions of the Ministry of Education on the Construction of First-class Undergraduate Courses[8] to establish a first-class undergraduate course system with Chinese characteristics and global standards. Over the next three years, approximately 4,000 national online first-class courses will be completed and certified, forming a high-quality national MOOC system with a more comprehensive range of categories and a more reasonable structure. This guidance document elevates the development of MAC to a new level. In April 2019, the China MOOC Conference released the China MOOC Declaration of Action (The Declaration), which comprehensively summarized China's MOOC's importance experience and construction. The Declaration proposed to establish cross-regional and cross-university MOOC alliances to build a community of high-quality interests and enhance the vitality of MOOC applications[9]. The Association of the University MOOC Alliances (The Association) was officially established at the conference, becoming the largest and most influential MOOC community. The Association is directly guided by the Department of Higher Education of MOE and was established by the National University Steering Committee on Teaching Informatization and Teaching Method Innovation (Teaching Instruction Committee).

#### **4.3 The third stage of the project is the popularization and deepening phase, which took place from 2020 to 2022.**

There are two main ways in which this is reflected. Firstly, MOE has utilized MOOC to implement unprecedented online teaching practices, ensuing suspending classes without stopping learning[10]. Secondly, MOOC have been extensively implemented in the western universities with MOOC Go West, leading to the exploration of various teaching methods, including online and offline hybrid teaching and virtual simulation experimental teaching. MOOC Go West improves the teaching level of western universities in China and promotes educational equity with Chinese characteristics.

During the epidemic, colleges and universities implemented online teaching under the guidance of MOE, with MOOC playing a significant role. In the spring semester of 2020, a survey conducted by the Teaching Instruction Committee among nearly 6 million teachers, students, and administrators at more than 1,000 colleges and universities found that the online course offering rate was 91%, teachers' recognition of online teaching was 80%, and students' satisfaction with online learning was 85%[11]. MAC coordinated various teaching instruction committees, universities, teachers, and online education companies to make full use of MOOC teaching resources for online teaching. MAC played an important role in integrating, coordinating, promoting, supporting, guiding, and leading. During the epidemic prevention and control period in 2020, MAC organized 37 major online course and technology platforms to provide free access to 41,000 MOOC, virtual simulation experimental courses, and other online courses. This initiative encouraged over 110 social and university online course platforms to

participate actively. Millions of students, tens of millions of teachers, and thousands of universities came together in the cloud to conduct large-scale online teaching practices.

During the epidemic prevention and control period, two international online teaching platforms for colleges and universities were launched: xuetangX international version and iCourse's international platform. These platforms have been selected for inclusion in UNESCO's Global Education Coalition and offer over 1,000 online courses in 14 languages to students and learners worldwide. As of 2023, the cumulative number of students worldwide has reached 670,000[12]. China's high-quality MOOC serve global learners, sharing Chinese experiences and achievements with higher education institutions around the world.

The emergence of MOOC and online education has led to increased access to higher education and has propelled a learning revolution in China's higher education sector. Since the establishment of EWMOOC, it has actively encouraged participating universities to develop high-quality online education resources. Currently, 179 courses have been rated as national first-class online courses, including 32 courses from 16 western universities. Over the past decade, there has been a steady increase in the number of online courses offered, as well as the number of colleges and universities that have adopted them. Additionally, there has been a rise in the number of students enrolled in these courses. The alliance platform has played a significant role in this trend, with over 13 million college students from more than 2,300 institutions across the country having taken over 10,000 courses and earned credits. Over 700 colleges and universities are located in the western region, with a total of 39.3 million students having studied through the alliance platform. The students' satisfaction rate is high, with an average score of 95. The academic performance of students in western colleges and universities has significantly improved, resulting in positive social benefits[13].

China's MOOC has developed its own unique characteristics in terms of development concepts, promotion methods, learning models, and management mechanisms, creating a distinct Chinese experience. In December 2020, the Global MOOC Conference was held in Beijing, and the Global MOOC Alliance was established. MOE has widely disseminated online education propositions that adhere to both Chinese characteristics and world standards. This has contributed Chinese experience, solutions, and wisdom to the development of higher education worldwide[14].

#### **4.4 The integration application stage began in 2022 and continues to the present.**

MAC implement national educational digital strategic actions and actively use MOOC and online education to explore new models, methods, and ideas for integrating digital technology with education and teaching.

In 2022, MOE launched the National Education digitization Strategic Action (Education digitization Action). MOE has proposed the Education digitization Action to enhance the availability of digital educational resources, establish an extensive and inclusive learning environment, expedite the sharing of diverse learning platform resources, and facilitate the integration of new technologies and educational learning. This will accelerate the digital transformation of education [15].

In March 2022, Smart Education of China (SEC) was launched. The aim of SEC is to provide a national resources platform for convenient teaching and learning services for teachers, students,

and social learners in China. This will solve the problems of resource dispersion, data inaccessibility, and irregular management encountered by various types of learners. As of June 2023, SEC has accumulated 26 billion views and over 1.92 billion visitors from more than 200 countries and regions[16].

SEC•Higher Education (SEC•HE) is a national and comprehensive higher education teaching resources service platform sponsored by MOE. It is committed to gathering high-quality online courses and resources in China, which are free and open to teachers, students and social learners. SEC•HE connects in-class and extra-curricular, undergraduate and postgraduate education, and covers the entire process of talent training to promote the digital transformation of higher education in China[17].

MAC are actively participating in the national digital transformation. They are expanding the in-depth application of MOOC resources in teaching reform, promoting online and offline hybrid teaching, and new paradigms of smart teaching. They are using new technologies to provide students with personalized learning paths and resources, monitor teaching quality, and carry out teaching evaluations. MAC aim to enhance the operation and development mechanism of the alliance. They also aim to explore mutual recognition of credits across alliances to accelerate the co-construction and sharing of MOOC in China. This will assist in the digital transformation of higher education.

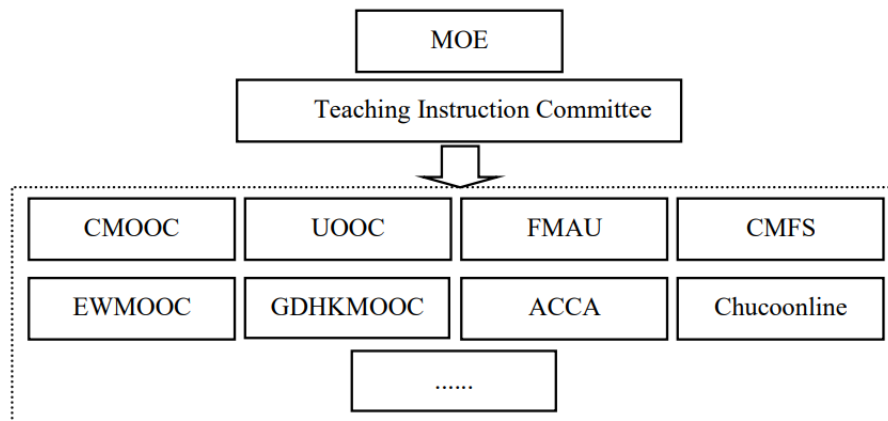
## **5 The development process of mac**

### **5.1 Organizational mechanisms**

MAC are the MOOC construction and application communities, typically guided by MOE, various teaching instruction committees, provincial education departments, or professional research associations. They are supported by government or academic institutions and work in conjunction with universities, institutions, enterprises, and social organizations. Figure 1 illustrates the organizational structure of MAC. The structure follows a similar organization, with the government providing support, the university serving as the subject, and society participating. MAC combine these units into a joint force, providing a solid organizational base for the rapid development of MOOC and online education. MAC usually formulate the alliance's charter, a series of rules and regulations, management methods, and systematic work plans to construct and develop the alliance community. Alliances typically construct a course platform, integrate and develop course resources, promote the shared application of MOOC, provide teacher training, and engage in international cooperation.

For instance, GDHKMOOC is overseen by the Department of Education of Guangdong Province. It brings together universities from Guangdong-Hong Kong-Macao Greater Bay Area (GBA) and 10 course platforms. The alliance's charter outlines its function, members' rights and obligations, organizational structure, operating mechanism, and main activities[18]. GDHKMOOC has established rules and regulations for MOOC construction, online operation, and credit recognition. The website of GDHKMOOC provides MOOC courses, information about the activities of the alliance, and other relevant information[19]. GDHKMOOC has established an educational community for MOOC with a comprehensive governance system, focusing on the construction and application of MOOC.





**Figure 1.** Organizational structure of MAC

## 5.2 MOOC research

MAC conduct comprehensive researches on MOOC, including platform construction, MOOC constructing, MOOC application, MOOC-based teaching models, and MOOC development tracking. These researches provide theoretical support and methodological guidance for the standardized and high-quality development of MOOC.

The Association and Teaching Instruction Committee established the standards, certification norms, and application guidelines for MOOC in Chinese universities. These guidelines propose a system framework of standards and specifications that conform to the characteristics of MOOC in China. They aim to assist teachers in effectively utilizing MOOC and innovating teaching methods to improve the quality of education.

Other MAC carry out various research projects, such as tracking the global development of MOOC, exploring and applying MOOC-based teaching models in higher education, developing guidelines for constructing online and offline courses for foreign language majors, and creating an overall construction plan and series of activities for the alliance. Additionally, there are related publications, such as the World MOOCs Development Report[20] and From MOOC to Golden Course: A Collection of High-Quality MOOC Construction and Application in Chongqing[21]. These publications present researches and teaching reform results on innovative teaching models, characteristic measures, and educational improvements.

## 5.3 Co-construction and shared application of MOOC

MAC place great importance on constructing high-quality MOOC. They aim to create a range of MOOC, including basic, professional courses, micro-professional, and regional specialty courses. They collaborate with various universities and high-quality teachers to develop first-class courses and establish a large-scale, standardized, and high-quality MOOC system. They also integrate industry-university-research forces and incorporate advanced technology into MOOC resources to develop various applied practices of MOOC. CMOOC actively promotes the construction of computer-based MOOC, and a total of 175 Alliance-Built Courses and 102 Alliance Excellent MOOC have been selected. Among them, 73 courses have been recognized

as National Quality MOOC[22] Alliance of Hubei's University Online Courses (Chuconline) has developed a series of MOOC that showcase the unique cultural characteristics of Jingchu[23].

MAC actively promote the sharing and application of MOOC, explore the use of MOOC to promote the reform of teaching and learning methods from the levels of universities, platforms, teachers and students. Through sharing MOOC, MAC solve the dilemma of colleges and universities working individually and having a single path of teaching reform, so as to form a programme for the implementation of MOOC and on-line and off-line teaching. In the process of promoting the application of MOOC, the differences between different universities in terms of university orientation, teaching plan, teacher status, student source are taken into full consideration. Therefore, various adaptive teaching models based on MOOC are introduced to carry out MOOC teaching and management at the different levels, such as course level, speciality level, and university level, advancing the deepening application of MOOC, and promoting higher-quality education equity. eMOOC Alliance (eMOOC) is China's first electronic information MOOC platform, which has obvious advantages in curriculum resources, teaching methods, simulation experiments, automatic translation, etc. eMOOC takes MOOC Go West as an opportunity to launch a high-quality demonstration course observation workshop for first-line teachers of colleges and universities nationwide, aiming at strengthening the exchange of teaching and research among different majors, universities and regions. The aim of the workshop is to strengthen inter-disciplinary, inter-school and inter-regional teaching and research exchanges, and to realize the radiation and sharing of high-quality course resources across the country[24].

#### **5.4 Mutual recognition of credits**

Since the outbreak of the epidemic, online teaching resources have developed rapidly, disrupting traditional classroom-based teaching and learning. After the world's largest online teaching experiment in higher education, MOOC has transformed teaching methods, learning approaches, university management, and educational patterns[25]. Additionally, MAC are actively promoting the development of a mutual recognition system for credits, which aims to change teaching methods and paradigms and cultivate new forms of higher education.

GDHKMOOC releases notices and lists of selected MOOC. Member universities confirm the selected courses and add them to the educational administration system for student course selection. Once selected, students study on the course platform and receive credits upon completion. During the learning process, GDHKMOOC provides technical support for online learning and assessment[26]. GDHKMOOC continuously improves the platform's MOOC selection mechanism and promotes mutual recognition of credits among member universities to form a regional demonstration effect. The co-construction and sharing mechanism of GDHKMOOC has achieved remarkable results, leading to its recognition as a recipient of the National Teaching Achievement Award for 2022[27].

#### **5.5 Cooperation**

MAC generally provide teacher training to launch reforms such as online learning, flipped classroom, and hybrid teaching based on MOOC. The alliances also facilitate discussions and exchanges to promote education reform, with a focus on MOOC. Shanxi MOOC

Consortium(Shanxi MOOC) organized and convened the "Golden Course" construction training, lectures on regular offline teaching in epidemic situations, first-class course declaration training and other teacher training activities, and carried out hot spots and difficulties in the construction of online open courses, drawing on the experience of teaching reforms under the new situation, transforming the teachers' teaching concepts, and improving the informatization teaching ability of university teachers[28].

MAC support MOOC Going Global by establishing an international exchange mechanism with the Global MOOC and Online Education Conference and the Global MOOC and Online Education Alliance as the core. CMFS has participated in the Global MOOC and Online Education Conference for three consecutive years to share their experience. In 2022, CMFS was invited to participate in the hosting the conference that year and was responsible for translating the English version of Infinite Possibilities: Report on the Digital Development of Global Higher Education[29].

## **6 Discussion and conclusion**

This paper summarizes the development of MAC over the past decade through analysis of national government documents. It also analyzes the work of the 27 member units of The Association and summarizes ten years of development experience of MAC. The research shows that MAC have developed into an institutionalized system with universities as promoters, government as supporters, and society as contributors. MAC have established a construction system consisting of platforms, courses, mechanisms, and research. Through this system, MAC actively build high-quality MOOC resources, promote the sharing and application of teaching resources, innovate teaching models, strengthen talent training cooperation, and provide practical reference for MOE to serve national strategies. According to our analysis, MAC have made significant progress in the development, use, learning, and management of MOOC and online education. This is highlighted by MOE,

Over the past decade, China has utilized MOOC and online education to lead its universities and social forces in carrying out a comprehensive digital reform of higher education. This has resulted in remarkable improvements in the quality of education, the promotion of a learning revolution, and the response to the challenges posed by the epidemic[30].

Currently, a new scientific and technological revolution and industrial transformation are driving a significant change in higher education. The world is experiencing unprecedented changes, coupled with the pandemic of the century. In this context, digitization has become a strategic support and the only way for many countries to promote high-quality and sustainable development of higher education. The digital transformation of education has become a consensus[31]. African countries have recognized the importance of digitization in higher education, elevated it to the level of national strategies, and issued a series of policy reports to promote the process of digitization in higher education[32]. Many European countries have developed strategies and introduced incentives to integrate digital technologies into higher education in all aspects. North America represents countries that have digitally reshaped education infrastructure, curriculum and teaching, and deepened the study of core literacy to bring education change to a deeper level. The countries of South America are actively pursuing digital development strategies, with increasing digitization and the use of digital technologies in

a variety of fields. Oceania represents one of the world's leading countries in terms of digitization of education, with high levels of educational information infrastructure and digital skills among students. Some countries in Asia have responded to the trend of the digital era by developing a digital education concept and launching strategic digital initiatives to promote the overall transformation of higher education[33]. The 20th National Congress of the Communist Party of China stated the need to promote the digitization of education and build a learning society and country with comprehensive lifelong learning[34]. Currently, China is implementing the national education digitization strategic action, promoting educational reform and innovation, and building a networked, digital, personalized, and lifelong education system[35].

Academics have widely explored the connotation of digital transformation in higher education from two perspectives. The first perspective is based on technology and focuses on the application of digital technology in higher education. For instance, Bendik et al.[36] explored the digital transformation of higher education from dual digitization to digital learning space. Mikheev et al. [37] discovered that the implementation of digital technologies can improve the management activities of university administrators, the quality of teaching of university teachers, and the learning experience of students. Secondly, research based on the model perspective suggests that the digital transformation of higher education involves innovating and changing the education model. This change affects all elements, processes, and operations of higher education. After a systematic literature review and in-depth interviews with experts in the discipline, Gkrimpizi et al. [38] defined digital transformation as an evolutionary process involving a series of profound and coordinated changes characterized by the strategic adoption and integration of emerging technologies to significantly improve the efficiency of educational activities and operations with the aim to change the educational model, strategic direction, and value proposition of higher education institutions. Additionally, Benavides et al. [39] argued that digital transformation of higher education not only implies technological advances but also affects the culture, management, and activities of universities.

Through the use of modern information technology, higher education institutions continues to innovate in their educational methods, university management models, and guarantee mechanisms. This constant process of reengineering, structural reorganization, and cultural reconstruction has led to changes in the power structure of development, research and practice paradigms, and has promoted the comprehensive development of individuals. Higher education improves the adaptability of individuals and human society in an uncertain future world[40]. MOOC, MAC, and online education have played an important role in promoting changes in higher education and educational equity over the past decade. The next step of research aims to address the question of how MOOC, MAC, and online education can effectively contribute to the digital transformation of higher education.

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