Research on the transformation from international exhibition to “cloud” exhibition in the post COVID-19 era: A case study of China International Fair for Investment & Trade

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Abstract

By exploring the China International Fair for Investment and Trade’s development process, this study analyzes its absolute advantages in future development, gradually lost comparative advantages, and potential crises. Through the data envelopment analysis model, the study analyzes its resource allocation efficiency based on two cooperation modes: traditional “Offline” investment mode and “Online + Offline” investment mode. Then we use vector autoregressive model to comprehensively investigate the impact and causality of the two input factors on output. We find that its comprehensive allocation efficiency presents a “U” shape that reflects the characteristics of its three stages: the first stage, 2001–2005; the second stage, 2006–2012; and the third stage, 2013–2020. The main factors affecting resource allocation efficiency are then deduced from the results: exhibition scale utilization, booth design innovation, project strength of participating enterprises, and the signing rate of overseas customers. The number of industrial and commercial groups (X₄) and participating countries and regions (X₆) have an important impact on the output indicators: signed contract projects (Y₁). The empirical results verify that the “Online + Offline” investment mode is an effective and suitable mechanism to solve the problem of cooperation and investment constrained by the COVID-19 pandemic. Based on the results of empirical analysis, this study posits the path and countermeasures of realizing the transformation to “cloud” exhibition in the post-pandemic era. Especially, we should focus on building new mechanisms of business environment that will promote the active participation of national, regional, and international industrial and commercial groups. The purpose is to continuously strengthen the foundation of cooperative trust and innovate a new trust model of online cooperative trading.
1. Introduction

The convention and exhibition industry is not only a “barometer” reflecting the development of a city but also a critical window showcasing the city’s image. Globally, cities such as Frankfurt, Zurich, and Barcelona are not only important business centers but also famous international convention and exhibition centers. Convention and exhibition economy is a new economic growth point [1, 2]. In 1987, China International Fair for Investment and Trade (CIFIT) set the stage for China’s opening to the outside world and government investment attraction created by Fujian. In 1993, it formed its own “golden key,” the earliest gateway for Chinese investment to the world market and world capital to the Chinese market. In 1997, CIFIT (held on September 8 every year; hereinafter also referred to as “9·8”) was upgraded to the first China investment and trade fair, becoming the largest international investment and trade conference in China.

The improvement of international exhibition competitiveness is conducive to the improvement of city competitiveness. The convention and exhibition industry can stimulate and drive the development of local cities (clusters). As a new industrial economy, it can optimize urban industrial structure and promote urban functional positioning. It has a strong radiation effect and urban marginal incremental effect [3, 4].

President Xi Jinping gave a great deal of affirmation in the congratulatory letter of the 20th CIFIT: The CIFIT, committed to building three platforms, two-way investment promotion, authoritative information release, and investment trend research, has developed into one of the most significant international investment events in the world [5]. While differing from Child Hill and Kim [6], Sassen [7] believes that the primary basis for the formation of global cities is investment globalization and financial securitization, which can create advanced production sites with high-level business services [6, 7]. This is the main function of the international exhibition platform. From the dynamic perspective of Taylor (2016) and O’Neill (2003), Su Ning (2010) proposed that the development process of China’s international cities should be distinguished from that of European and American countries, and innovation should be carried out according to the characteristics of regional cities [8–10]. As an international exhibition platform, CIFIT has the function of providing high-end services and investment globalization. From the perspective of historical development and practical development needs, it is an innovative economic platform for Fujian, a stage for investment cooperation among countries worldwide, and a world-class economic and trade incubator. It is an important platform for high-level opening to the outside world and plays a positive role in building an open world economy [5].

In 2020, the pandemic interrupted the orderly growth of the global economy. As a major international economic and trade activity held during the normalized pandemic prevention and control period, the 2020 CIFIT was held safely, orderly, and smoothly. While the offline scale was slightly reduced, its exhibition area still reached 110 000 square meters, and the conference still attracted 1018 business groups. The three-dimensional (3D) exhibition hall of “Cloud Investment Fair” made an outstanding appearance. During the conference, more than 2300 projects reached cooperation agreements, with a total investment of more than 800 billion RMB [11]. As an international investment and trade platform, this reflects CIFIT’s appeal and significant contribution to the regional economy.

In summary, scholars at home and abroad have performed a great deal of research and analysis on the promotion of regional economic growth through the convention and exhibition industry, mainly focusing on the qualitative analysis of the economic radiation of the exhibition. There is less quantitative analysis on the development mode and mechanism of the exhibition itself and its resource allocation, especially under the background of the pandemic
situation. CIFIT has more than 20 years of history and has established a new pattern for world exhibitions. Therefore, this study focuses on the sustainable development mechanism resulting from its resource allocation efficiency. In particular, as a platform for international investment and trade, CIFIT has made notable contributions to the global economy against the background of the pandemic. There is no research on the resource allocation of the "Online + Offline" investment and trade model or the impact of this innovative model on the transformation and upgrading of international exhibitions during the pandemic. Therefore, this study focuses on this value of CIFIT.

2. CIFIT background
2.1 Analyzing absolute advantages of CIFIT

On June 25, 1985, Xiamen Fushan International Exhibition City was completed and held the "Xiamen International Exhibition," ensuring that a modern economic and trade exhibition officially entered the historical stage of Fujian. On September 6, 1987, the “South Fujian Triangle Foreign Investment and Trade Fair” was hosted by the People’s Government of Fujian Province. In 1988, it was renamed “Fujian Investment and Trade Fair,” becoming a symbol of Fujian’s opening up and an important platform for mobilizing foreign investment. In 1997, the “Fujian Investment and Trade Fair” was upgraded to the “China Investment and Trade Fair” hosted by the Ministry of Commerce of the People’s Republic of China, leading to the rise and development of the exhibition industry in Fujian Province. Therefore, CIFIT has been held from 1997–2020. It has been called the “China Xiamen International Fair for Investment and Trade” since 2015, depending on the “big and small years.” In the big year, it is called the “China International Fair for Investment and Trade,” and in the small year, it is called the “China Xiamen International Fair for Investment and Trade.”

It can be observed from the development process of its 20th session that CIFIT still has the following absolute advantages:

First, from a world-class perspective, CIFIT is not an ordinary international exhibition but also a stage for global investment and trade cooperation. It is a world-class platform, which has changed the mode of world exhibitions and formed a comprehensive world-class investment and trade platform integrating exhibitions and conferences, a two-way investment mode. CIFIT, jointly sponsored by six major international economic organizations—including United Nations Conference on Trade and Development, United Nations Industrial Development Organization, World Trade Organization (WTO), Organization for Economic Co-operation and Development, International Finance Corporation of World Bank, and World Association of Investment Promotion Agencies—is not only the gateway of China’s opening to the outside world but also the largest international investment exhibition in the world. This makes its host city fully qualified to become an international urban center.

Second, from the perspective of uniqueness, CIFIT has introduced a new exhibition mode. Mr. Rubens Ricupero asked why so many international economic organizations jointly hold CIFIT—it has built a “harmonious platform” for the sustainable growth of the world economy [12]. This world-class platform established a new pattern for world exhibitions because, before CIFIT, there was no world-class comprehensive exhibition, no cooperation platform for trade and investment, and no cooperation platform for two-way investments from all countries in the world. This platform fully realizes the new mode of convention and exhibition, integrating exhibition and conference, and creates a “golden key” for a win-win situation.

Third, in terms of scale, more than 100 countries, industrial and commercial groups, and 31 provincial and municipal government investment delegations participated in CIFIT, which is the only fair in the country or even in the world with such scale of involvement. It can be
said that during the CIFIT held in September, half the world was in Xiamen, Fujian, China. Countless agreements were signed, and more than 1000 billion RMB of global capital was prospected for projects. It is a world-class platform that innovates new international and regional cooperation mechanisms, such as international multilateral cooperation, regionally coordinated development, and volunteer service.

2.2 Analyzing the potential crises of CIFIT

2.2.1 Not fully utilizing the advantage of “Xiamen-double high city”. According to the regulations of the international metropolis association, having a perennial world economic and trade exhibition is a necessary condition for being an international metropolis. Xiamen is not an ordinary international city. In 2016, Xiamen became the only Chinese city to host the Brazil, Russia, India, China, and South Africa (BRICS) summit. To this end, President Xi Jinping personally hosted the BRICS summit in Xiamen and highly appreciated Xiamen as a “two high” city (known as a high-quality and beautiful city). This is not only the “international business card” of the convention and exhibition city but also an important relationship between the “international convention and exhibition city” and the development of “world cities.” This “two high” comparative advantage of Xiamen city is both a new business mode and driving force for the future development of world cities. What role does Xiamen actively play in the division of labor in world economic growth? How can Xiamen play its due role as an international city with higher quality? Using a world-class exhibition to promote Xiamen’s development into a world-class city in the new era is, thus, a strategic choice.

2.2.2 Facing the catch-up problem of other major domestic exhibitions. In order to realize the leap to an international metropolis, Xiamen should make use of the world-class stage of CIFIT as a necessary condition, open this public service platform to the world to a much greater extent, and work with the six major economic organizations to build more and more key mutual projects. In this regard, both Xiamen and CIFIT have great development potential. However, it can be seen from the current development situation that the exhibitions in neighboring provinces have many advantages and strong characteristics: strong integration, a considerable pace of internationalization, and a high level of systematization, which virtually weakens the absolute advantage of CIFIT and brings immense catch-up pressure. If the existing “absolute advantage” is not consolidated, it could face the problem of “abandonment of the market.” Simultaneously, the administration of the endogenous organization, the flattening of the endogenous mechanism, and the normalization of the endogenous power of CIFIT, have held a double-edged sword to its further development, which is not only the current double pressure but also the driving force of subsequent innovation.

2.2.3 Five mismatches of CIFIT. In the 20-year span of the development process, CIFIT has had several mismatches in its status and role: urban positioning and regional integrated development; the scale of regional GDP and the positioning of the world’s largest investment exhibition; the international investment functions and the degree of platforms into the six international organizations; the efficiency of expected resource input and expected output; and the pattern of coordinating management institutions and a world-class investment service platform. Particularly, there exists the problem of organizational flattening, the fact that local enterprise groups cannot absorb and digest the resources of international organizations in coordination, and the imbalance between the level of international organizations and local coordination institutions. This needs to be further improved and innovated through the government’s macro-control to gradually form endogenous new advantages and provide new momentum for CIFIT. It could promote Xiamen to achieve higher quality development and gradually develop into a world-class city.
2.3 Using the advantage of the Maritime Silk Road core area

Fujian is not an ordinary coastal province. As early as the Song and Yuan Dynasties, Fujian Erythrina port was the world’s largest trade port and the starting point of the ancient Maritime Silk Road. In the Qing Dynasty, Xiamen and Fuzhou became part of the five trading ports. During the reform and opening-up period, Fujian and Guangdong became special zone provinces that “adopted special opening and flexible measures.” In 2015, Fujian Province was approved as the “core area of the 21st century Maritime Silk Road.” Nowadays, the international urban belt and bay area are booming. As the core area of the Maritime Silk Road, the new Fujian gets a second chance by taking advantage of the international economic and trade stage of CIFIT. Transforming the sustainable growth mechanism of the world economy into the belt and road investment and trade public service platform is another strategic choice.

According to the analysis of the development status, potential crises, and mismatches of CIFIT, although CIFIT has innovated a new cooperation mechanism of international multilateral cooperation, its potential crises and several major mismatches are important factors hindering the sustainable development of this world-class international convention and exhibition platform.

This study makes a quantitative analysis of its internal resource allocation efficiency by constructing a data envelopment analysis (DEA) model and proposes some suggestions to promote the transformation and development of CIFIT in the post-COVID-19 pandemic era.

3. Methodology

3.1 Construction of the DEA model

DEA is a method proposed by Charnes, Cooper, and Rhodes [13] to evaluate the output. It involves the use of linear programming methods to construct a non-parametric piecewise surface or frontier over the data to enable the calculation of efficiencies relative to the surface. It is mainly used to evaluate the relative efficiency model of the multi-factor productivity of homogeneous decision-making unit (DMU) groups. Coelli and Rao and Zuniga González used DEA to derive Malmquist productivity indices [14, 15]. González (2011) applied frontier production function analysis to small farms in Nicaragua during 1998–2005. In their case, an average firm was an agricultural production unit [16]. Coelli and Rao proposed that the two measures provided the same technical efficiency (TE) scores when a constant returns to scale (CRS) technology was applied but are unequal when variable returns to scale (VRS) was assumed. They believed that the choice of orientation was not a big issue in this case. An output orientation was selected in their study because it would be fair to assume that, in agriculture, one usually attempted to maximize output from a given set of inputs, rather than the reverse [14]. The CCR model is based on the assumption of CRS, and the BCC model is based on the assumption of VRS. Charnes et al. defined “relative efficiency” as “the ratio of output to input” in the form of “ratio” [17, 18]. Dios-Palomares proposed that the assessment of environmental efficiency was also related to productivity and measured efficiency with frontier methods including environmental variables [19]. This study applies two main DEA models: CCR and BCC. An input orientation is chosen in this study and for every year of its production unit.

This study uses the DEA model to determine the effective production frontier by analyzing sample input and output data and determining whether each DMU is DEA effective according to the distance between each DMU and the production frontier. The advantage of the DEA
method is that it can deal with multi-input and multi-output problems. It can not only judge whether the corresponding point of DMU is located on the effective production frontier by linear programming but also obtains a lot of valuable management information. Therefore, this study analyzes the efficiency between the input and output of CIFIT with the help of the DEA method and searches the path that can improve the efficiency of resource allocation and promote the transformation of the International Exhibition innovation platform to a “Cloud Exhibition” platform.

It is assumed that there are \( t \) similar parts evaluated, which are called decision units:

\[
h_j = \frac{u^T y_j}{v^T x_j} = \frac{\sum_{i=1}^{n} u_i y_{ij}}{\sum_{i=1}^{n} v_i x_{ij}}, \quad j = 1, 2, \ldots, t
\]

\[
x_j = (x_{ij}, \ldots, x_{mj})^T, \quad y_j = (y_{ij}, \ldots, y_{nj})^T, \quad j = 1, 2, \ldots, t \quad h_j \leq 1, j = 1, 2, \ldots, t
\]

The slack variable is introduced in the following model:

\[
\text{(D}_{\text{CCR}}) \quad \begin{cases} 
\min \theta \\
\text{s.t. } \sum_{j=1}^{t} \lambda_j x_j + S^- = \theta x_0 \\
\sum_{j=1}^{t} \lambda_j y_j - S^+ = y_0 \\
\lambda_j \geq 0 \\
S^+ \geq 0, S^- \geq 0
\end{cases}
\]

\( x_0 \) and \( y_0 \) represent input and output vectors for each year, respectively; \( x_j \) and \( y_j \) represent the input and output vectors produced in year \( j \); \( S^- \) refers to the slack variable of output, and \( S^+ \) is the residual variable of input; \( \lambda_j \) represents the weight of each DMU; \( \theta \) represents the overall efficiency under the assumption of fixed scale income, which is between 0 and 1, reflecting the input-output efficiency of the exhibition’s annual production. If \( \theta = 1 \), it means that the DMU is DEA effective and indicates that the input-output is completely effective; that is, both TE and scale efficiency (SE) are effective. TE means that the exhibition platform can completely use current resources to achieve maximum output and optimal operating conditions. The efficiency of scale means that the production of the exhibition platform is in the stage of fixed returns to scale; that is, the output and input are expanded or reduced in the same proportion. If \( \theta < 1 \), DMU and DEA are invalid, it means that the existing use of technology and production factor allocation are not in the best state.

In 1988, Banker, Charnes, and Cooper decomposed TE into pure technical efficiency (PTE) and SE, and \( \text{TE} = \text{PTE} \times \text{SE} \). By adding constraints on weight, they established the following
The conversion relationship between PTE and SE can further measure the SE of each DMU. It can also estimate whether the annual production scale is best under the condition of fixed input. The CCR model is applied to measure the total efficiency when DMU is in a fixed returns to scale. Fixed scale compensation is the efficiency evaluation of all DMUs compared together. The BCC model is applied to DMUs in the case of VRS, which is used to measure pure technology and SE and compare the VRS with rated units with equivalent conditions.

3.2 Index system

In the specific selection of DMU indicators, the number must be larger than the product of the number of input and output indicators and at least twice the sum of the two [2]. The establishment of the index system in this study is shown in Table 1. The DMU is the CIFIT session. The output indicators are $Y_1$ and $Y_2$. $Y_1$ represents the signed contract projects, and $Y_2$ represents the amount of contracted foreign capital. These two indicators directly and intuitively reflect the effectiveness of the international platform function of CIFIT in stimulating investment and trade. There are six input indicators of the relevant absolute advantage variables extracted from the development history of the 20th CIFIT: $X_1$ represents the exhibition area, $X_2$ represents the exhibition booths, $X_3$ represents the number of participating enterprises, $X_4$ represents the number of industrial and commercial groups, $X_5$ represents the number of media participants, and $X_6$ represents the number of the participating countries and regions.

Table 1. Allocation efficiency index system of CIFIT.

| Variable | Variable description | Unit |
|----------|----------------------|------|
| Output indicators | $Y_1$ | Signed contract projects | Individual |
| | $Y_2$ | Amount of contracted foreign capital | USD100mn |
| Input index | $X_1$ | Exhibition area | square meter |
| | $X_2$ | Exhibition booth | Individual |
| | $X_3$ | Number of participating enterprises | Individual |
| | $X_4$ | Number of industrial and commercial groups | Individual |
| | $X_5$ | Number of media participants | Individual |
| | $X_6$ | Participating countries and regions | Individual |

https://doi.org/10.1371/journal.pone.0267455.t001
3.3 Data source

The data for this study are mainly from official websites such as the China Statistical Yearbook, China Exhibition Yearbook, CIFIT, the release of previous achievements, invitations, conference guidelines of CIFIT, Xiamen Daily, and other authoritative media units. Some missing data are interpolated, and the final data used for model analysis are obtained through sorting and calculation. In 1997, CIFIT was upgraded from the provincial to the national level, becoming the first national-level fair. In 2001, the fifth CIFIT successfully held 30 two-way investment seminars. This provided a convenient way for Chinese enterprises to understand the overseas investment environment and a suitable environment for investment negotiations. The year 2001 was an important turning point for China to integrate into the world and for the world to understand China. In the process of data verification, this study mainly observes the investment and trade situation of the CIFIT platform after China acceded to the WTO.

This study primarily selected data after 2000. At the same time, due to the lack of some variable data of the four sessions from 1997 to 2000, the data for these four years were excluded. Finally, the 20 year data from 2001 to 2020 were used in the model. In particular, 2020 is a special year: all offline activities were mostly suspended due to the pandemic, which created great difficulties for data collection. Therefore, the output index data mainly came from CIFIT’s official data. The input index $X_3$ (the number of participating enterprises) is calculated from official statistics. The data of the previous sessions are mainly calculated by sorting out the relevant data, such as the number of multinational enterprises participating in the conference, the number of enterprises participating in the negotiation, and the number of successful docking enterprises published in the official media. The data on some indicators are extracted from the information released by the official media, and the missing years of some indicators are interpolated. Specifically, the variable $X_3$ of the number of participating enterprises has two missed data instances in 2002 and 2006. The data cannot be collected from the official website, report, or newspaper during these 2 years. We used interpolation by averaging these 2 years. Then, we interviewed the relevant professors of government departments who took part in organizing the CIFIT before. We obtained an approximate number that is similar to interpolation in Table 2. All data are listed as shown in Table 2.

4. Results and discussion

Based on the DEA model above, the resource allocation efficiency of CIFIT is analyzed based on the empirical results. From the input indicators, it can be directly seen that during the pandemic period in 2020, the offline exhibition area of CIFIT reached 110 000 square meters. At the same time, the 3D exhibition hall of “cloud CIFIT” made a significant appearance in time, which opened a new model. In terms of input indicators of the year 2020, the number of $X_1$ area, $X_2$ booth, $X_3$ participating enterprises, $X_4$ participating media, and $X_6$ participating countries and regions decreased sharply compared with 2019, especially the number of $X_6$. Since the pandemic is global, it directly reduces exchanges between countries. It can be seen from the output indicators that the amount of foreign capital used in contracts ($Y_2$) decreased, but the number of contract projects signed ($Y_1$) increased, as shown in Table 2 [21–25]. In theory, most indicators should fall, but why did contracts increase? After an increased online investment, we assume that the offline area can be more optimized, and a better new format of digital exhibition should be designed. This study takes 2020 as a watershed and divides the empirical analysis into two parts to illustrate the efficiency of allocation of CIFIT: (1) select 2001–2019 as DMUs to estimate the resource allocation efficiency of CIFIT under the traditional “Offline” investment trading mode and (2) select 2001–2020 as DMUs to estimate the
resource allocation efficiency of CIFIT under the “Online + Offline” investment cooperation mode spawned under the COVID-19 pandemic.

4.1 Traditional “Offline” investment cooperation mode

According to the above model, the study selected 19 DMUs each year from 2001 to 2019 and estimated the resource allocation efficiency of CIFIT using the DEAP 2.1 software on the input and output data in Table 2. The results are shown in Table 3.

Crste is the TE (comprehensive efficiency) without considering the returns to scale; Vrste is the TE (PTE) when considering the returns to scale; scale refers to the SE when considering the returns to scale. PTE and SE are the subdivision of comprehensive efficiency. When the crste evaluation value is 1, the DMU in this year is scale effective and technology effective [26].

In terms of comprehensive efficiency, the average resource allocation efficiency of 19 years from 2001 to 2019 was 0.834, of which 9 years had comprehensive efficiency of one and were technically effective. Except for these nine DMUs, the comprehensive efficiency in other years did not reach the best. The lowest year was 2009, whose comprehensive technical efficiency is 0.447 (as shown in Table 3). Even the comprehensive allocation efficiency in 7 years from 2006 to 2012 presents a U-shape, falling first and then rising.

In terms of PTE, the average PTE in 19 years from 2001 to 2019 is 0.964, of which 14 years, whose PTE is one, are technically effective. This shows that the pure DEA technology of CIFIT is effective. It also means that CIFIT basically runs effectively, and the management level is also relatively effective. The PTE is greater than SE, which shows that SE is the main reason for

| Year | Signed contract projects | Amount of contracted foreign capital | Exhibition area | Exhibition booth | Number of participating enterprises | Number of industrial and commercial groups | Number of media participants | Participating countries and regions |
|------|-------------------------|-------------------------------------|----------------|-----------------|-------------------------------------|--------------------------------------------|-----------------------------|-----------------------------------|
| 2001 | 1027                    | 47.98                               | 28000          | 2500            | 500                                 | 117                                        | 1100                        | 97                                |
| 2002 | 1151                    | 51.91                               | 28000          | 2500            | 460                                 | 141                                        | 1032                        | 96                                |
| 2003 | 1259                    | 66.52                               | 28000          | 2500            | 421                                 | 240                                        | 1200                        | 102                               |
| 2004 | 1110                    | 81.22                               | 33000          | 2500            | 520                                 | 300                                        | 1296                        | 118                               |
| 2005 | 1053                    | 122.43                              | 33000          | 2500            | 474                                 | 350                                        | 1393                        | 125                               |
| 2006 | 752                     | 76.17                               | 33000          | 2500            | 731                                 | 383                                        | 1389                        | 113                               |
| 2007 | 669                     | 96.2                                | 33000          | 2500            | 1053                                | 414                                        | 1385                        | 119                               |
| 2008 | 517                     | 80.99                               | 52000          | 2500            | 1246                                | 445                                        | 1392                        | 126                               |
| 2009 | 515                     | 75.3                                | 60000          | 2800            | 1157                                | 492                                        | 1400                        | 125                               |
| 2010 | 484                     | 99.6                                | 65000          | 3214            | 1378                                | 627                                        | 1439                        | 144                               |
| 2011 | 339                     | 104.6                               | 65000          | 4000            | 1600                                | 636                                        | 1478                        | 112                               |
| 2012 | 355                     | 154.2                               | 100000         | 4000            | 2200                                | 650                                        | 1500                        | 132                               |
| 2013 | 1386                    | 321.6                               | 100000         | 4000            | 2870                                | 556                                        | 1500                        | 118                               |
| 2014 | 1455                    | 336.4                               | 100000         | 4000            | 3000                                | 603                                        | 1500                        | 126                               |
| 2015 | 1571                    | 352.9                               | 100000         | 4000            | 4000                                | 650                                        | 1500                        | 105                               |
| 2016 | 1502                    | 349.34                              | 138000         | 6000            | 5000                                | 707                                        | 1300                        | 104                               |
| 2017 | 1577                    | 366.73                              | 120000         | 5000            | 4040                                | 700                                        | 1000                        | 107                               |
| 2018 | 1982                    | 365.2                               | 130000         | 6000            | 5000                                | 1005                                       | 1500                        | 128                               |
| 2019 | 2100                    | 375.4                               | 130000         | 6000            | 3000                                | 1008                                       | 1500                        | 130                               |
| 2020 | 2300                    | 307.5                               | 110000         | 5000            | 2000                                | 1018                                       | 700                         | 69                                |

https://doi.org/10.1371/journal.pone.0267455.t002
the low comprehensive efficiency, and the problem is that the resource allocation scale does not match the optimal scale.

In terms of SE, the average SE in 19 years from 2001 to 2019 is 0.856. Similarly, the lowest year is 2009, with an SE of 0.501 and PTE of 0.893 (as shown in Table 3). These are the dual reasons for the low comprehensive technical efficiency in 2009. Although the scale of resource allocation does not match the optimal scale, the return to scale is increasing.

Table 3. Resource allocation efficiency of CIFIT from 2001 to 2019.

| Year | Comprehensive efficiency (crste*) | Pure technical efficiency (vrste*) | Scale efficiency (scale*) | Returns to scale |
|------|----------------------------------|----------------------------------|--------------------------|-----------------|
|      | Value   | Effectiveness | Value   | Effectiveness | Value   | Effectiveness | Returns to scale |
| 2001 | 1.000   | √            | 1.000   | √            | 1.000   | √            | -               |
| 2002 | 1.000   | √            | 1.000   | √            | 1.000   | √            | -               |
| 2003 | 1.000   | √            | 1.000   | √            | 1.000   | √            | -               |
| 2004 | 0.930   | √            | 1.000   | √            | 0.930   | √            | Increasing      |
| 2005 | 1.000   | √            | 1.000   | √            | 1.000   | √            | -               |
| 2006 | 0.687   | √            | 1.000   | √            | 0.687   | √            | Increasing      |
| 2007 | 0.788   | √            | 1.000   | √            | 0.788   | √            | Increasing      |
| 2008 | 0.505   | √            | 1.000   | √            | 0.505   | √            | Increasing      |
| 2009 | 0.447   | √            | 0.893   | √            | 0.501   | √            | Increasing      |
| 2010 | 0.491   | √            | 0.820   | √            | 0.599   | √            | Increasing      |
| 2011 | 0.488   | √            | 0.870   | √            | 0.561   | √            | Increasing      |
| 2012 | 0.553   | √            | 0.769   | √            | 0.719   | √            | Increasing      |
| 2013 | 1.000   | √            | 1.000   | √            | 1.000   | √            | -               |
| 2014 | 1.000   | √            | 1.000   | √            | 1.000   | √            | -               |
| 2015 | 1.000   | √            | 1.000   | √            | 1.000   | √            | -               |
| 2016 | 0.980   | √            | 1.000   | √            | 0.980   | √            | Increasing      |
| 2017 | 1.000   | √            | 1.000   | √            | 1.000   | √            | -               |
| 2018 | 0.968   | √            | 0.973   | √            | 0.994   | √            | Increasing      |
| 2019 | 1.000   | √            | 1.000   | √            | 1.000   | √            | -               |
| Mean | 0.834   | √            | 0.964   | √            | 0.856   | √            | -               |

*Crste = technical efficiency from CRS DEA.
*Vrste = technical efficiency from VRS DEA.
*Scale = scale efficiency = crste/vrste.

The overall resource allocation of CIFIT can be divided into three stages (as shown in S1 Fig).

The first stage is 2001–2005, the second stage is 2006–2012, and the third stage is 2013–2019. It can be seen directly that the comprehensive efficiency of 2001–2003, 2013–2015, 2017, and 2019 are effective, the resource allocation efficiency of these nine sessions is much higher, and the output capacity is stronger given the input resources. In the first stage, the comprehensive efficiency is basically effective, the PTE is effective, and the SE is above 0.93.

The second stage is the year group with a large range. The comprehensive efficiency of the years 2006–2012 is not effective. The basic problem is the SE. The overall resource allocation of CIFIT showed a U-shaped trend from the effective, comprehensive efficiency in 2005 to the lowest comprehensive efficiency in 2009, and then to the effective basic comprehensive efficiency after 2013. From 2006 to 2008, the technical efficiency is effective, and the return to scale is not effective, but the return to scale of resource allocation is increasing. From 2009 to 2012, both technology efficiency and SE are not effective, but the returns to scale of resource
allocation are increasing. The result shows that the SE of CIFIT has been rising, meaning that the whole CIFIT international exhibition is in the state of SE.

The third stage, 2013–2019, presents the effective results of comprehensive efficiency every other year. Except for 2018, the PTE of all years in this stage is effective, and the SE is above 0.98 (as shown in Table 3). This is related to the alternating holding of “CIFIT” and “Xiamen CIFIT” and the implementation of the system of large and small years; the overall efficiency fluctuates in the same direction with a lag. Comprehensive inefficiency occurred in 2016 and 2018; however, for the former, this was not true for scale. In 2018, both technology and scale were not effective, so the scale had to be expanded accordingly.

From the solution of the BCC model, the slack variables and redundant variables of each DMU in the second stage, 2006–2012, can be obtained. The situation was similar in 2006, 2007, and 2008. The PTE of CIFIT resource allocation was effective, but the SE was ineffective. This mainly reflected that the output $Y_1$ (the number of contracted projects) did not achieve the expected benefits, and the slack variable values were 471.445, 480.644, and 609.845, respectively (see data in S1 Text). It is related to the mismatch between the current situation of the sudden increase in the exhibition area of $X_1$, the number of participating enterprises in $X_3$, and the decline in the number of contracted projects in $Y_1$.

The situation of the years 2009, 2010, 2011, and 2012 is similar. The PTE was invalid, and the SE was also ineffective. The slack variable values are 646.391, 676.082, 874.180, and 937.697, respectively (see data in S1 Text). It is related to the mismatch between the exhibition area of $X_1$, the exhibition booth of $X_2$, the number of participating enterprises of $X_3$, the sudden increase of $X_4$ industrial and commercial groups, and the decline in the number of contracted projects in $Y_1$. Accordingly, there were non-zero redundant variables in these 4 years. In order to make DEA effective, under the condition that the output indicators remain unchanged, outstanding indicators were extracted for observation from the results. For instance, 300 booths should be reduced in 2009. In 2010, about 579 booths should be reduced, and the number of participating media should be reduced by about 259 (see data in S1 Text). In 2011, the scale of participating countries and regions did not match the output. Based on the existing output, 97–98 participating countries and regions should be matched. However, the actual situation is that 112 participating countries and regions participated in CIFIT. Since the resource conditions of this variable input were not fully explored, the output of the actual number of signed contracts and the amount of contracted foreign capital utilization was less than expected. In 2012, the exhibition hall area expanded from 65 000 square meters to 100 000 square meters (as shown in Table 3). Under the condition of unchanged output indicators, about 923 booths should be reduced, and the number of domestic and foreign media participants should be reduced by 346 (see data in S1 Text). However, this does not mean reducing the scale. It can be obtained from the increasing return on the scale of resource allocation from 2006 to 2012. Instead, the results mean that various innovative measures should be taken to improve efficiency and increase output.

The development of phase III, 2013–2019, is consistent with China’s Belt and Road Initiative. Many forums were held in CIFIT around the theme of the Belt and Road Initiative. Compared with the input indicators in the second stage, in addition to the sharp increase of $X_4$ industrial and commercial groups, $X_1$ exhibition area, $X_2$ exhibition booth, $X_5$ number of participating media, and $X_6$ participating countries and regions, these indicators exhibited little change, and all investment indicators tended to be stable; even the domestic and foreign media institutions decreased slightly. However, compared with the output index $Y_1$ of the second stage, the average growth rate of the third stage is 2.57 times that of the second stage. Compared with the output index $Y_2$ of the second stage, the average growth rate of the third stage is
2.76 times that of the second stage. This presents the effective result of the overall comprehensive efficiency of the third stage.

The most significant feature of the third stage was that comprehensive efficiency was effective every other year, which is related to the alternating holding of CIFIT. In these years, the comprehensive efficiency evaluation is not one, but the SE value is still increasing, which shows that CIFIT should make full use of the existing invested resources to increase output, establish a mechanism of investment without big or small years, innovate the function of fixed normalization platform, and realize the optimal allocation of resources.

### 4.2 “Online + Offline” investment cooperation mode

According to the above model, this study selected 20 DMUs each year from 2001 to 2020 and used DEAP 2.1 software to estimate the resource allocation efficiency of CIFIT based on the input and output data in Table 2. We added the 2020 data to observe whether the pandemic had a profound impact on CIFIT. We also attempted to assess whether online cooperation and investment mode affect CIFIT. The results are shown in Table 4.

As shown in Table 4, in the second estimation, the overall resource allocation of CIFIT can still be divided into three stages. Similar to Table 3, the comprehensive efficiency is effective in 9 years.

| Year | Comprehensive efficiency (crste) | Pure technical efficiency (vrste) | Scale efficiency (scale) | Returns to scale |
|------|----------------------------------|----------------------------------|-------------------------|-----------------|
|      | Value | Effectiveness | Value | Effectiveness | Value | Effectiveness | Value | Effectiveness | Returns to scale |
| 2001 | 1.000 | √            | 1.000 | √            | 1.000 | √            | -     |              |
| 2002 | 1.000 | √            | 1.000 | √            | 1.000 | √            | -     |              |
| 2003 | 1.000 | √            | 1.000 | √            | 1.000 | √            | -     |              |
| 2004 | 0.917 | √            | 1.000 | √            | 0.917 | Increasing  |         |
| 2005 | 1.000 | √            | 1.000 | √            | 1.000 | √            | -     |              |
| 2006 | 0.687 | √            | 1.000 | √            | 0.687 | Increasing  |         |
| 2007 | 0.788 | √            | 1.000 | √            | 0.788 | Increasing  |         |
| 2008 | 0.488 | √            | 1.000 | √            | 0.488 | Increasing  |         |
| 2009 | 0.429 |              | 0.893 |              | 0.481 | Increasing  |         |
| 2010 | 0.485 |              | 0.820 |              | 0.592 | Increasing  |         |
| 2011 | 0.480 |              | 0.793 |              | 0.606 | Increasing  |         |
| 2012 | 0.540 |              | 0.769 |              | 0.702 | Increasing  |         |
| 2013 | 1.000 | √            | 1.000 | √            | 1.000 | √            | -     |              |
| 2014 | 1.000 | √            | 1.000 | √            | 1.000 | √            | -     |              |
| 2015 | 1.000 | √            | 1.000 | √            | 1.000 | √            | -     |              |
| 2016 | 0.971 |              | 0.981 |              | 0.989 | Increasing  |         |
| 2017 | 1.000 | √            | 1.000 | √            | 1.000 | √            | -     |              |
| 2018 | 0.868 |              | 0.939 |              | 0.924 | Decreasing   |       |
| 2019 | 0.947 |              | 1.000 | √            | 0.947 | Decreasing   |       |
| 2020 | 1.000 | √            | 1.000 | √            | 1.000 | √            | -     |              |
| Mean | 0.830 |              | 0.960 |              | 0.856 |              |       |

aCrste = technical efficiency from CRS DEA.
bVrste = technical efficiency from VRS DEA.
cScale = scale efficiency = crste/vrste.

https://doi.org/10.1371/journal.pone.0267455.t004
The first stage is 2001–2005, the second stage is 2006–2012, and the third stage is 2013–2020. The mean value of comprehensive efficiency and PTE decreased, but the SE remained unchanged.

As shown in S2 Fig, there are three main differences between these two estimates. In the first estimate, the DEA is effective in 2019 (the Crstes is 1), but in the second estimate, the comprehensive efficiency and SE decline in 2019, and the DEA in 2019 is invalid. This shows that in the traditional model, the resource allocation in 2019 is DEA effective, but it does not achieve effective resource allocation in the innovative model.

Second, under the comparison of the "Online + Offline" innovation mode, the SE showed a decreasing trend in 2018 and 2019. In particular, the PTE in 2018 was 0.939 (as shown in Table 4), which did not achieve the optimal management mode and the optimal use of innovative technologies.

Third, in the second estimation, the PTE and SE are generally lower than the first estimation. This shows that the DEA of resource allocation efficiency in 2020 is effective despite the pandemic’s impact. The resource allocation of the "Online + offline" investment and trading mode is better than the traditional one. To some extent, this is a paradigm shift.

As shown in Table 4, from the solution of BCC model, in order to make DEA effective, for instance, in 2018, the exhibition hall area should be reduced by 7985.602 square meters, about 368 booths should be reduced, and the number of domestic and foreign media and participating countries and regions should be reduced by 92 and 8, respectively, under the condition that the output index remains unchanged(seeing data in S1 Text). This shows that under the conditions of constant input, the media at home and abroad and the resources of participating countries and regions were not fully utilized, resulting in less output. The SE decreases in 2018 and 2019, which is related to the alternating holding of “CIFIT” and “Xiamen CIFIT.” In addition to the mismatch between the resource allocation scale and the optimal scale, there are also reasons for insufficient optimization in technology and management, which makes the comprehensive efficiency ineffective. It further shows that the transformation and upgrading of CIFIT should have been achieved starting from 2018 to achieve better efficiency of scale.

Under different development modes, CIFIT has expanded from the exhibition era of 1.0 in the initial stage to the exhibition era of 2.0 in the medium term. The current "Online + Offline" mode has opened the “digital era” of the exhibition; especially during the pandemic, cooperating with the tech giant Alibaba Group, the new online CIFIT App is the most up-to-date online international investment promotion platform built by the CIFIT Organizing Committee. The Organizing Committee opened the “Cloud Investment Fair,” creating a new investment promotion service mode. “Cloud CIFIT” has fully adopted 3D, artificial intelligence, cloud computing, big data, and other technologies; launched cloud display, cloud docking, cloud negotiation, cloud discussion, and cloud signing (five clouds), and set up cloud exhibition halls and 3D exhibition halls for 37 provinces, cities, autonomous regions, province-level municipality, and 38 countries and regions in China. The objective is to enable global businesses to overcome time and space constraints and negotiate and interact on a wider range and at a deeper level. At the same time, through platform data specialization, refined analysis, and intelligent algorithms, “Cloud CIFIT” could accurately match the investment and financing parties such that investors at home and abroad can obtain investment information with one click [11]. In 2020, the PTE reached DEA effectiveness, and the advanced technology and management system had been fully adopted such that the investment transactions that cannot be realized in offline space can be realized through a new digital model. Therefore, from the output data $Y_1$, the number of contracts in 2020 did not decrease but instead increased because the demand for cooperation could be realized and completed online. However, the amount of
Based on the analysis of DEA, the contracted foreign capital $Y_2$ needs to be implemented offline, so the amount is slightly less than that of the previous year.

Although the “cloud mode” of the exhibition is passively held due to the pandemic, it is also an innovative interpretation of the “Online + Offline” mode. Through DEA data analysis, this mode is DEA effective, which provides a good theoretical basis for exploring the “Cloud Exhibition” of various offline international exhibitions.

### 4.3 Results of the VAR model

Based on the analysis of DEA, the number of participating enterprises ($X_3$), industrial and commercial groups ($X_4$), and participating countries and regions ($X_6$) has an important impact on the two output indicators: signed contract projects ($Y_1$) and amount of contracted foreign capital ($Y_2$). During the pandemic, the two variables ($X_4$ and $X_6$) had a direct and significant impact on the number of offline trading contracts. The vector autoregressive (VAR) model uses endogenous variables to regress the lag term of all endogenous variables of the model to estimate the dynamic relationship of all endogenous variables.

$$Y_t = c + \Pi_1 Y_{t-1} + \Pi_2 Y_{t-2} + \ldots + \Pi_k Y_{t-k} + u_t,$$

where

$$Y_t = (y_{1,t} \ y_{2,t} \ \ldots \ y_{N,t})', \quad c = (c_1 \ c_2 \ \ldots \ c_N)'$$

is the column vector of endogenous variables, $Y_{t,k}$ is the lag term of $Y$, $k$ is the lag order of endogenous variables, $t$ is the number of samples, $\Pi_k$ is the coefficient matrix, $u_t$ is the disturbance term, and $c$ is the constant term.

$X_4$ and $X_6$ are important variables of offline exhibitions, but we should pay attention to and understand the impact on $Y_1$ in the future after the combination of online and offline. This is very important for improving the “Online + offline” exhibition mechanism. Therefore, this study chooses $Y_1$, $X_4$, and $X_6$ to enter the VAR model and uses the VAR model to further empirically analyze the impact of the change of $X_4$ and $X_6$ on $Y_1$. Then, $Y_t = (Y_1, X_4, X_6), t = 1, 2, \ldots, T$.

We used Eviews 8 for regression analysis of the model. In order to avoid pseudo regression in regression analysis, it is necessary to test the stationary position of the following three variables: $X_4$, $X_6$, and $Y_1$. Here, the unit root (ADF) of the three variables is tested.

It can be seen from Table 5 that $Y_1$, $X_4$, and $X_6$ are stable after taking the first-order difference. We then built a three variable VAR model. The AR roots table is used to test the stability of the model. As shown in S3 Fig, the characteristic roots of all sequences are located in the unit circle, and the whole model is stable.

Next, we determined the lag order and model stability test. The optimal lag order of the model was determined according to LR, FPE, AIC, SC, and HQ [27]. It can be seen from Table 6 that the order selected by most information criteria is 4. The VAR model adopts lag order 1 for modeling.
The purpose of the Granger causality test is to verify that there is not only a trend correlation between the two sequences, but also that the independent variable has a certain ability to explain and predict the future changes of the dependent variable. If the value of the test statistic exceeds the critical value at a certain significance level, the explanatory variable should be included in the model. It is called the Granger causality of the explained variable. This study focuses on whether \( X_4 \) and \( X_6 \) have the ability to explain and predict \( Y_1 \). Also, we should know whether \( Y_1 \) greatly influenced \( X_4 \) and \( X_6 \). Table 5 shows the results of the Granger causality test.

As shown in Table 7, \( X_4 \) and \( X_6 \) are Granger causality for \( Y_1 \). It means that \( X_4 \) and \( X_6 \) are very important to \( Y_1 \). However, it is easier to sign a contract successfully offline, which shows that “Online + Offline” mode should focus on how to establish a strong contact trust mechanism to strengthen the signing rate of online exhibitions. \( X_6 \) and \( Y_1 \) are not Granger causality for \( X_4 \). \( X_6 \) and \( Y_1 \) could not affect \( X_4 \). \( X_4 \) is not a Granger reason for \( X_6 \), but \( Y_1 \) is a Granger reason for \( X_6 \). The results show that the rate of signed contract projects will further affect the participation of countries and regions.

In order to further study the dynamic relationship between \( X_4 \), \( X_6 \), and \( Y_1 \) against the background of the pandemic, the study attempts impulse response to analyze the short-term dynamic relationship between the two systems. The impulse response results are shown in S4 Fig.

The impact of \( X_4 \) on \( Y_1 \) shows a wave rise. The impact of \( X_6 \) on \( Y_1 \) shows the characteristics of the cycle. After reaching the maximum in phase 5, it gradually decreases. The impact of \( X_4 \) and \( X_6 \) on \( Y_1 \) does not show an immediate response. The response value in phase 1 was 0, and then decreased and increased slowly. The response value of \( X_4 \) to itself shows a downward

### Table 5. ADF unit root test results.

| Variable | Trend and intercept (P value) | Intercept (P value) | None (P value) | Result |
|----------|-------------------------------|---------------------|----------------|--------|
| \( Y_1 \) | 0.8370                        | 0.7675              | 0.8010         | Unstable |
| \( X_4 \) | 0.1871                        | 0.0427              | 0.9980         | Unstable |
| \( X_6 \) | 0.8594                        | 0.1202              | 0.4989         | Unstable |
| \( \Delta Y_1 \) | 0.0425                        | 0.0163              | 0.0010         | Stable  |
| \( \Delta X_4 \) | 0.0376                        | 0.0294              | 0.0135         | Stable  |
| \( \Delta X_6 \) | 0.0105                        | 0.0158              | 0.0007         | Stable  |

https://doi.org/10.1371/journal.pone.0267455.t005

### Table 6. VAR lag order selection criteria.

| Lag | LogL | LR | FPE | AIC | SC | HQ |
|-----|------|----|-----|-----|----|----|
| 0   | -10.89140244 | NA | 0.001029 | 1.634283 | 1.78132 | 1.648898 |
| 1   | 24.46079663 | 54.06807\(^*\) | 4.76e-05\(^*\) | -1.146976 | -0.877825\(^*\) | -1.407513 |
| 2   | 33.96455652 | 11.18089 | 5.10E-05 | -1.525242\(^*\) | -0.495978 | -1.422931\(^*\) |
| 3   | 42.94717587 | 7.397451 | 7.36E-05 | -1.523197 | -0.052821 | -1.377039 |

\(^*\) Indicates lag order selected by the criterion.

LR: sequential modified LR test statistic (each test at 5% level).
FPE: Final prediction error.
AIC: Akaike information criterion.
SC: Schwarz information criterion.
HQ: Hannan-Quinn information criterion.

https://doi.org/10.1371/journal.pone.0267455.t006
trend. The impact of $X_6$ participating countries and regions on itself fell rapidly in the first phase, and then fluctuated around 0. The response of $X_4$ on to $X_6$ gradually weakened. The response of $X_6$ to $X_4$ rose rapidly in the first period then fluctuates repeatedly and gradually tends to 0.

Above all, the impact of $X_4$ and $X_6$ on $Y_1$ is obvious. Among them, the impact of $X_4$ on $Y_1$ increases gradually. This shows that in the “Online + Offline” mode, we need to pay full attention to the power of $X_4$ and the participation of countries and regions.

In order to analyze the importance of different variables in the process of variable prediction, we further decompose the variance.

As shown in Table 8, the contribution of $X_6$ participating countries and regions to $Y_1$ is 0 in phase 1, then slowly increases and then decreases, reaching a maximum of 32.25056% in phase 7. The contribution of $X_4$ to $Y_1$ is lower than that of $X_6$, up to about 3.235723% in phase 2, and then decreases gradually. This shows that $X_6$ plays a very important role in the signing rate of contract. This provides important theoretical support for how to improve countries and regions’ online participation and improve the cooperation-signing rate. Due to the natural advantages of offline signing, how to improve the “Online + Offline” mode and online cooperation system is of positive significance and role in improving the online signing rate and promoting the incubation of CIFIT platform.

As shown in Table 9, the contribution of $Y_1$ to $X_4$ is increasing year by year, and the contribution is as high as 68.45528%. The contribution of $X_6$ to $X_4$ also shows an upward trend year by year, but the impact range is not as large as $Y_1$ and the highest contribution is 25.34571%. This shows that the better the domestic business environment, the greater the attraction to $X_4$. More and more business groups will participate in the CIFIT platform. The more business groups participate, the greater the impact on the contract-signing rate.

In Table 10, the contribution of $Y_1$ to $X_6$ is increasing year by year, with a contribution of 40.00174%. The contribution of $X_4$ to $X_6$ is relatively flat, and the impact range is not as large as $Y_1$. The highest contribution is 6.365912% of phase 3. Similarly, the better the domestic business environment, the higher the cooperation signing rate of the platform, the greater the attraction to $X_6$ the more countries and regions take part in CIFIT. $Y_1$ contributes more to $X_4$ than $X_6$. This shows that the cooperation and signing rate of CIFIT is more attractive to $X_4$.
Table 8. Variance decomposition of Y1.

| Period | S.E.    | Y1     | X4     | X6     |
|--------|---------|--------|--------|--------|
| 1      | 0.310843| 100.000000 | 0.000000 | 0.000000 |
| 2      | 0.438929| 95.770292  | 3.235723 | 0.993985 |
| 3      | 0.660536| 65.572743  | 2.184326 | 32.242931|
| 4      | 0.704772| 65.188024  | 2.739865 | 32.072111|
| 5      | 0.735739| 67.619737  | 2.899229 | 29.481034|
| 6      | 0.799377| 69.100253  | 2.570230 | 28.329516|
| 7      | 0.886019| 65.637921  | 2.111524 | 32.250555|
| 8      | 0.924179| 66.381294  | 1.954633 | 31.664072|
| 9      | 0.962972| 68.164447  | 2.116027 | 29.719526|
| 10     | 1.029932| 68.450853  | 1.980420 | 29.568727|
| 11     | 1.101562| 67.530983  | 1.748621 | 30.720396|
| 12     | 1.152137| 68.276642  | 1.692196 | 30.031161|
| 13     | 1.208908| 69.368694  | 1.749991 | 28.881315|
| 14     | 1.285572| 69.417293  | 1.657397 | 28.925310|
| 15     | 1.362485| 69.230825  | 1.536867 | 29.233080|
| 16     | 1.431090| 69.803429  | 1.514458 | 28.682113|
| 17     | 1.508378| 70.388089  | 1.521512 | 28.090399|
| 18     | 1.599284| 70.410526  | 1.459322 | 28.130152|
| 19     | 1.690791| 70.451924  | 1.396596 | 28.151481|
| 20     | 1.781367| 70.833883  | 1.383948 | 27.782169|

Cholesky ordering: Y1 X4 X6

https://doi.org/10.1371/journal.pone.0267455.t008

Table 9. Variance decomposition of X4.

| Period | S.E.    | Y1     | X4     | X6     |
|--------|---------|--------|--------|--------|
| 1      | 0.310843| 7.294194 | 92.705806 | 0.000000 |
| 2      | 0.438929| 5.968136 | 86.218793 | 7.813070 |
| 3      | 0.660536| 8.849093 | 82.184154 | 8.966754 |
| 4      | 0.704772| 16.938220| 73.269744 | 9.792036 |
| 5      | 0.735739| 26.875023| 58.932638 | 14.192339|
| 6      | 0.799377| 34.490993| 47.054780 | 18.454228|
| 7      | 0.886019| 41.069409| 39.461173 | 19.469418|
| 8      | 0.924179| 46.977395| 33.021889 | 20.000716|
| 9      | 0.962972| 51.264537| 27.161726 | 21.573737|
| 10     | 1.029932| 54.434319| 22.750964 | 22.814717|
| 11     | 1.101562| 57.359997| 19.545032 | 23.094970|
| 12     | 1.152137| 59.812557| 16.838818 | 23.348625|
| 13     | 1.208908| 61.548843| 14.478318 | 23.972839|
| 14     | 1.285572| 62.992076| 12.592252 | 24.415672|
| 15     | 1.362485| 64.382395| 11.086714 | 24.530891|
| 16     | 1.431090| 65.524198| 9.784208  | 24.691594|
| 17     | 1.508378| 66.370698| 8.645765  | 24.983537|
| 18     | 1.599284| 67.131994| 7.696085  | 25.171922|
| 19     | 1.690791| 67.861390| 6.899000  | 25.239610|
| 20     | 1.781367| 68.455275| 6.199013  | 25.345712|

Cholesky ordering: Y1 X4 X6

https://doi.org/10.1371/journal.pone.0267455.t009
and industrial and commercial groups favor the project incubation of CIFIT platform. Therefore, the effect of $Y_1$ on $X_4$ and $X_6$ is significant. This also provides theoretical support for us to take various measures to improve the “Online + Offline” mode and facilitate a sustainable development of CIFIT in investment, trade, and project incubation.

5. Conclusions and policy recommendation

From the empirical analysis results, it can be concluded that the average comprehensive resource allocation efficiency of CIFIT is 0.83, showing phased characteristics in 20 years. There are both differences and similarities in each stage, reflecting the characteristics of high PTE. There is also a mismatch between the phased resource allocation scale and the optimal scale, resulting in low allocation efficiency and low comprehensive efficiency. However, the overall resource allocation efficiency of CIFIT is well. Although it does not fully reach DEA efficiency, the overall trend shows increasing efficiency of scale. Through analysis, this study finds several main factors affecting its resource allocation efficiency.

First, the utilization of exhibition scale and the innovation of booth design affect the efficiency of resource allocation. From several site expansions, it can be seen that the market demand and the scale of the platform show increasing benefits, but in the transition year of capacity expansion, it is easy to have ineffective comprehensive efficiency. The main reason is that the scale benefits are also ineffective. Redundant investment occurs, but the scale benefit increases, mainly due to the low scale utilization rate of the site. Especially during the pandemic, there is a great deal of redundancy in investment. The utilization rate of site scale is closely related to the innovation of booth design. If the site scale is used as a necessary input, the booth design innovation is soft power. Through the corresponding systematic, innovative

| Period | S.E.   | Y1        | X4        | X6        |
|--------|--------|-----------|-----------|-----------|
| 1      | 0.310843| 20.375836 | 2.123086  | 77.501077 |
| 2      | 0.438929| 16.861601 | 5.150779  | 77.987621 |
| 3      | 0.660536| 20.298197 | 6.365912  | 73.335891 |
| 4      | 0.704772| 22.710791 | 6.023095  | 71.266114 |
| 5      | 0.735739| 22.293347 | 6.121465  | 71.585188 |
| 6      | 0.799377| 21.991342 | 6.031304  | 71.977354 |
| 7      | 0.886019| 23.773661 | 6.228288  | 69.998051 |
| 8      | 0.924179| 24.799465 | 5.738091  | 69.462445 |
| 9      | 0.962972| 25.225710 | 5.638480  | 69.135810 |
| 10     | 1.029932| 25.827747 | 5.716818  | 68.455435 |
| 11     | 1.101562| 27.569414 | 5.684192  | 66.746395 |
| 12     | 1.152137| 28.623317 | 5.355440  | 66.021243 |
| 13     | 1.208908| 29.537032 | 5.226514  | 65.236454 |
| 14     | 1.285572| 30.810098 | 5.248141  | 63.941761 |
| 15     | 1.362485| 32.550556 | 5.109527  | 62.339171 |
| 16     | 1.431090| 33.819846 | 4.851787  | 61.328367 |
| 17     | 1.508378| 35.143696 | 4.718495  | 60.137809 |
| 18     | 1.599284| 36.809072 | 4.658185  | 58.532743 |
| 19     | 1.690791| 38.542697 | 4.479649  | 56.977655 |
| 20     | 1.781367| 40.001745 | 4.260828  | 55.738187 |

Cholesky ordering: Y1 X4 X6

https://doi.org/10.1371/journal.pone.0267455.t010

and industrial and commercial groups favor the project incubation of CIFIT platform. Therefore, the effect of $Y_1$ on $X_4$ and $X_6$ is significant. This also provides theoretical support for us to take various measures to improve the “Online + Offline” mode and facilitate a sustainable development of CIFIT in investment, trade, and project incubation.

5. Conclusions and policy recommendation

From the empirical analysis results, it can be concluded that the average comprehensive resource allocation efficiency of CIFIT is 0.83, showing phased characteristics in 20 years. There are both differences and similarities in each stage, reflecting the characteristics of high PTE. There is also a mismatch between the phased resource allocation scale and the optimal scale, resulting in low allocation efficiency and low comprehensive efficiency. However, the overall resource allocation efficiency of CIFIT is well. Although it does not fully reach DEA efficiency, the overall trend shows increasing efficiency of scale. Through analysis, this study finds several main factors affecting its resource allocation efficiency.

First, the utilization of exhibition scale and the innovation of booth design affect the efficiency of resource allocation. From several site expansions, it can be seen that the market demand and the scale of the platform show increasing benefits, but in the transition year of capacity expansion, it is easy to have ineffective comprehensive efficiency. The main reason is that the scale benefits are also ineffective. Redundant investment occurs, but the scale benefit increases, mainly due to the low scale utilization rate of the site. Especially during the pandemic, there is a great deal of redundancy in investment. The utilization rate of site scale is closely related to the innovation of booth design. If the site scale is used as a necessary input, the booth design innovation is soft power. Through the corresponding systematic, innovative

| Period | S.E.   | Y1        | X4        | X6        |
|--------|--------|-----------|-----------|-----------|
| 1      | 0.310843| 20.375836 | 2.123086  | 77.501077 |
| 2      | 0.438929| 16.861601 | 5.150779  | 77.987621 |
| 3      | 0.660536| 20.298197 | 6.365912  | 73.335891 |
| 4      | 0.704772| 22.710791 | 6.023095  | 71.266114 |
| 5      | 0.735739| 22.293347 | 6.121465  | 71.585188 |
| 6      | 0.799377| 21.991342 | 6.031304  | 71.977354 |
| 7      | 0.886019| 23.773661 | 6.228288  | 69.998051 |
| 8      | 0.924179| 24.799465 | 5.738091  | 69.462445 |
| 9      | 0.962972| 25.225710 | 5.638480  | 69.135810 |
| 10     | 1.029932| 25.827747 | 5.716818  | 68.455435 |
| 11     | 1.101562| 27.569414 | 5.684192  | 66.746395 |
| 12     | 1.152137| 28.623317 | 5.355440  | 66.021243 |
| 13     | 1.208908| 29.537032 | 5.226514  | 65.236454 |
| 14     | 1.285572| 30.810098 | 5.248141  | 63.941761 |
| 15     | 1.362485| 32.550556 | 5.109527  | 62.339171 |
| 16     | 1.431090| 33.819846 | 4.851787  | 61.328367 |
| 17     | 1.508378| 35.143696 | 4.718495  | 60.137809 |
| 18     | 1.599284| 36.809072 | 4.658185  | 58.532743 |
| 19     | 1.690791| 38.542697 | 4.479649  | 56.977655 |
| 20     | 1.781367| 40.001745 | 4.260828  | 55.738187 |

Cholesky ordering: Y1 X4 X6

https://doi.org/10.1371/journal.pone.0267455.t010
design, the site utilization can be improved accordingly, and the hard power can be improved through soft power.

Second, the project strength of participating enterprises and the signing rate of overseas customers affect the efficiency of resource allocation. CIFIT is an international investment and trade stage and an international project incubation platform. The level of participating enterprises and the scale of declared projects determine the signing rate of projects to a certain extent, while the signing rate of overseas customers directly affects the external funds used by the platform. These two factors not only have a direct impact on output indicators but also cross-affect each other. Under the background of China’s Belt and Road Initiative, exchanges between China and other countries along the Belt and Road coastal areas have been deepening. It needs to improve the quality of projects to improve efficiency and achieve high-quality development step by step.

At the same time, the study uses a VAR model to perform empirical analysis, and the following conclusions are drawn: the number of industrial and commercial groups and participating countries and regions are Granger causality for $Y_1$; the effect of $Y_1$ on $X_4$ and $X_6$ is significant; the “Online + Offline” mode should focus on these two aspects.

Based on the above conclusions, this paper puts forward relevant policy suggestions in the post pandemic era:

Firstly, strengthen the integration of the “Online + Offline” mode to improve resource utilization efficiency. Especially during the pandemic, many offline problems can be solved online, and the effects that cannot be achieved offline can be filled through online digitization and scale. This is not only to solve the problem during the pandemic but also to explore “Online + Offline” after the pandemic is over. The pandemic situation brings both challenges and opportunities. The combination of “Online + Offline” is also the best transition from traditional international exhibitions to online. On the one hand, offline is an important traditional mode for CIFIT from the perspective of traditional efficiency and effect, it still needs the offline mode, reflecting more humanistic factors. Significant project investments also need face-to-face communication, exchange, and sustainable trust. On the other hand, the online mode is cost-effective and fast. The “cloud” is the superposition of 3D space. The value of the exhibition is to save transaction costs. The SE of the site cannot be matched offline, and “Cloud Exhibition” can be used to make up for the SE of the site. This is an innovation of the transaction mode. Cloud exhibition borrows the platform’s value, saves transaction costs, and provides a new path to improve the utilization of offline resources.

Second, the optimization of the business environment of online exhibitions and an improved design of cooperation system to broaden the path of online exhibition further. The exhibition is a mode to save transaction costs. Cloud exhibition is the best transaction mode during the pandemic, and it is also a new path to expand the high-quality development of “Online + Offline” in the future. The innovative development space of “Cloud Exhibition” can be explored from four aspects. First, the problem of brand and intellectual property rights, and how much transaction costs the exhibition saves; that is, the intangible assets of the exhibition. Second, technological innovation and strong technical security must be implemented to prevent hacker intrusion and the spread of malicious and inappropriate software. Third, continuous iterative innovation of technology must be ensured to prevent the problem of login collapse when the platform is at its peak and tens of thousands of merchants are online. Finally, an automatic emergency mechanism must be established to prevent major political, economic, and technological risks. Therefore, through the combination of online and offline modes, the offline efficiency can be better, giving CIFIT a new path to realize the high-quality development of the international convention and exhibition platform.
Third, the continuous annual exhibition and strengthen the incubation function of the platform must be restored. From the perspective of increasing returns to scale, CIFIT can be held continuously every year to achieve comprehensive optimal efficiency. On the contrary, holding them in alternating years will have the lag effect on optimal comprehensive efficiency. Further, it can restore the annual mechanism, strengthen the incubation function of the platform, drive the establishment of incubation base and industrial park through the project landing, and promote the in-depth cooperation between the project and financial capital. Finally, according to the exhibition’s space-time characteristics, industrial characteristics, and cultural attributes, it can be divided into online and offline exhibitions, changing the traditional mode of special and single industry exhibitions. Professional exhibitions can be mainly offline, and some overseas exhibitions can be mainly online. This transforms the CIFIT into a 3D exhibition, becoming a kind of “Composite International Exhibition” combining domestic and overseas, online and offline, and investment and trade.

Overall, the resource allocation efficiency of CIFIT is good, which promotes the regional economic growth in Xiamen to a large extent. This is a solid foundation for Xiamen to become an international city. Also, under the background of the Belt and Road Initiative, the core area of the Maritime Silk Road provides Xiamen with the support of global city development. Xiamen’s upgrading of soft and hard facilities is not only to accelerate the city’s future development but also to gradually consolidate the core area of the Maritime Silk Road and become a regional engine of the “global city” driving the world economy. Through the annual incubation and transformation of the CIFIT platform, Xiamen has gradually formed a unique solid foundation, good business environment, and hard strength for investment services throughout the country and around the world.

Supporting information

S1 Fig. Resource allocation efficiency of CIFIT 2001–2019 under BCC mode. (DOCX)

S2 Fig. Comparison of resource allocation efficiency of CIFIT between 2001–2019 and 2001–2020. (DOCX)

S3 Fig. Stability test of VAR model. (DOCX)

S4 Fig. VAR pulse function diagram. (DOCX)

S1 Text. (DOCX)

S2 Text. (DOCX)

S1 File. (DOCX)

S2 File. (DOCX)
Acknowledgments

I have to express great gratitude to professor Chen Qingfu for his strong support and contribution. He worked in the government department. He was the former head of the planning and exhibition departments of the CIFIT and has rich experience in CIFIT operation. He participated in the whole research of this subject. The evaluation of the intangible asset “Golden Key” mentioned in this paper is based on saving transaction costs. It is from the intangible asset evaluation report of Fujian Investment and Trade Fair in 1996, which was jointly sponsored by the China Patent Office, the State Trademark Office, the State Administration for Industry and Commerce, the intellectual property leading group of the National People’s Congress, the asset appraisal office, and the asset appraisal expert group of large international exhibitions. I cannot express enough gratitude to him and all my friends who have helped me for a long time.

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