The Construction and Empirical Study of the Maker Space Input-Output Model Under the Perspective of Resource Sharing

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Abstract: Maker space is a shared network platform that brings together many social entities to innovate and start businesses. It has new features such as openness, resource sharing, and social subject diversity. The traditional methods of input factors measured by the organization's original human, financial, material, research and development are no longer suitable for the development of today's era and economic application. Input-output model needs to be redefined and re-explored. This paper defines the diversified social subject structure of maker space under the perspective of resource sharing. According to the measurability standard of input variables, crowd-sourcing, public support, crowds, crowd-funding, and public research are used as new input variables. A nonlinear input-output model embodying the characteristics of resource sharing is constructed, and through the method of empirical analysis, the output effect of the new input variables is empirically studied. In order to improve the output of the maker space, this paper formulates the input-output path diagram in the field of resource sharing based on the output effect coefficient, and proposes countermeasures and suggestions for how to effectively invest in the innovative space, start up business, policies and public research. The input-output graph of this paper can better reflect the characteristics of the space, and the method is also applicable to other fields of empirical analysis.

Keywords: Maker Space, Social Subject, Input Factor, Effect, Resource Sharing

1. Introduction

The report of the 19th National Congress of the Communist Party of China proposes: Encourage more social entities to participate in innovation and entrepreneurship. Social subjects include political organizations (governments), economic organizations (enterprises), and social organizations. [1] Maker space is a shared network platform that brings together many social entities to innovate and start businesses. Since the "mass innovation, the public entrepreneurship" officially proposed and implemented as a national strategy, the maker space has shown a momentum of development. In terms of quantity, the maker space has surpassed the incubator to become an important carrier of innovation and entrepreneurship. According to the National Science and Technology Work Conference, there are 4,298 people in the current national Torch Program, and according to the Torch Statistical Yearbook, there are 863 national-level

incubators in the country. In terms of speed of development, maker space has developed in an over speed manner in recent years. Taking Beijing as an example, the total operating area, number of employees, and settled enterprises have increased by 310%, 320%, and 235% year-on-year. [2]

Although the concept of maker space was officially proposed by China in 2015, there are a large number of public space types in the world, including five kinds: Hackers pace, Maker space, Tech Shop, production workshop (Fablab), and joint office (We Work). There are 1,900 foreign creative spaces, with the United States and Europe accounting for 40% respectively, and the typical of Europe is Amsterdam virtual maker space. It uses the commercial maker website to provide entrepreneurial services. The typical of the US is the Portland Start-up Park. It uses innovative competitions, seed funds, etc. to provide entrepreneurs with various types of support. The

maker space is the product after the development stage of private garage space, interest club space, innovative laboratory space, etc. Open sharing is the common feature of this kind of space, that is, sharing office space for ideological exchange collision and achieve creative sharing through creative resources sharing. [3, 4]

In view of the fact that maker space has become an important carrier for the country to implement the innovation-driven strategy, foster new development momentum, and promote supply-side structural reforms, thus it is of great significance to study the input and output of the maker space. The innovation of this paper lies in: First, variable construction innovation. According to how to define the social subject under the shared conditions, the input variables are constructed in combination with the characteristics of the "public" characters in the maker space, while the previous input-output indicator system is divided by the perspective of organization's own human, financial and material. The second is research method innovation. Under the background of "Internet+", the complexity of the shared space resource sharing network is increased, and the relationship between the various elements presents a nonlinear relationship. For this reason, the research method of the paper will be based on the resource sharing network to study and construct a nonlinear programming model, and to change previous linear programming model methods such as Data Envelopment Analysis (DEA).

2. Literature Review

With the rapid development of domestic and foreign-like maker space, it is accompanied by a research boom in the academic space. The related research on the creation space in China and abroad is mainly divided into the following categories:

The first is the study of network relationship characteristics. Wang Liping (2017) believes that maker space is a space limitation that breaks through the resource organization, and promotes the optimal allocation of the creative elements mobility through the "four crowd" integration. The "four crowd" are maker space, crowd-sourcing, crowd-funding and crowd-supporting. [5] Zhang Shaoli et al. (2017) believe that colleges and universities maker space through organizing "crowd-constructing", project "crowd-sourcing", capital "crowd-funding", and resources "shared", through college automation, government promotion, and industry pull to achieve operations. [6] Zhang Yuli et al. (2017) analyze the operation mechanism of Haier maker space, and proposed that it consists of maker incubation, resource aggregation, user interaction and value exchange, which reflects the unique characteristics of maker space. [7]

The second is index research. The classification of index for science parks and incubators can be used for reference. Bigliardi (2006) proposes to evaluate the performance of science parks in four dimensions: economics, finance, human resources and networks. [8] Schwartz (2008) shows that the German incubator leases an average of 5,964

square meters, with an average infrastructure space of 900 square meters, with an average of 33 start-ups, and each start-up employs an average of seven people. [9] Michael (2011) conducts long-term performance data studies on 324 independent graduates who graduate from five incubators in Germany and find that these companies show rapid growth after graduation, but average performance after 7 years compared with graduation. The level is the same or even weaker. The contribution of graduated enterprises to regional employment is quite limited in the long run. [10] Barbero (2012) evaluates performance from five dimensions: research input, research output, employment cost, participation in research projects, and corporate growth. [11] Wann (2017) has set up eight key performance indicators (KPI), three of which relate to the establishment and operation aspects, and five of which are functional and service aspects. [12] The research on index of maker space includes: Chen Su et al. (2015) believe that maker space is a space for incubation technology innovation, business creativity and promotion of entrepreneurship. Its performance evaluation can learn from the evaluation method of incubator. The entrepreneurial ecosystem of maker space consists of four aspects: the spirit of innovation, the creation of the circle, the basic platform, the policy of creation, and the resource circle. These evaluations can be considered from these four aspects. [13] Wen Meirong et al. (2017) believe that the KPI indicators of maker space are divided into seven categories: entrepreneurship financing, gather of innovative entrepreneurs, entrepreneurship education training and activities, entrepreneurial growth services, entrepreneurial tutors, business coaching, and technical innovation services. [14] Li Yanping et al. (2017) believe that the influencing factors of inter-regional development and cooperation synergy, the influencing factors of integrating resources and constructing professional management teams, and the influencing factors of internal network and external social network structure, etc. Still not clear. [15] Jia Tianming et al. (2017) believe that the revenue channels of maker space include venue rent, member income, service income (including coffee and other food, supporting facilities, shared venue fees, professional services), investment income (including angel investment)., venture capital and equity investment), self-designed capital operation income (including self-designed special activity funds, self-designed investment funds, etc.). [16]

The third is the quantitative method. In view of the fact that the concept and the thing are completely new. At present, the concept, connotation, characteristics, model, evolution and comparative research at domestic and abroad are the main ones. The published quantitative research and empirical research literature are still few. In the empirical research part, it is necessary to take example by the empirical study of the incubator closest to the function of crowed-creating space. Documents that can be used include: Grimaldi (2005) uses the "Silr Index" to measure differences and concentrations between different incubators. [17] Wang Jing et al. (2012) use

the structural equation method to measure, and conclude that economic status, regional innovation, government expenditure, and intellectual support have an impact on the technical effects of the incubator. Zhang Yuli (2017) studies the evolution and optimization of the maker space based on the theory of dissipative theory, analyzes the entrepreneurial ecosystem and the dissipative structure, and proposes two-stage evolution model of the entrepreneurial ecosystem and self-organization level, but needs to be further completed empirical analysis. Yin Qun et al. (2010), Dai Bibo et al. (2012), Yang Wenzhao et al. (2017), Zhang Jianqing et al. (2017) use the data envelopment analysis (DEA) when calculating the operation effect of the incubator. Sun Kai et al. (2013) improve the method and propose an improved DEA method, but it is still based on the DEA method.

In summary, this paper believes that for the research on the social subject, input and output of the maker space. First, the new research entry points of different scholars combine the characteristics of the maker space, and start from the word of "crowd". This article will also highlight the word of "crowd", based on shared resources from the perspective of crowds, crowd-sourcing, crowd-funding, and public support. Second, the selection of quantitative index can refer to the relevant research results of the technology incubator. Third, in terms of quantitative methods, the DEA method is the most commonly used quantitative research method in current related research. Since its basic principle is to express the input with $x=(x_1, x_2,...x_m)$, the output uses $y=(y_1, y_2,... y_n)$, and then use the linear programming model to find the optimal solution, but the drawback of this method is that the linear solution method is beneficial to the calculation, but in the context of "Internet +", the relationship between input and output should be a non-linear relationship. Setting the hypothesis as a linear relationship is not realistic, and its logic has problems. This method can only find the relative output effect of multiple target objects, but cannot find the output effect of a single target object.

3. Model Construction and Assumptions

3.1. Model Construction

According to the social subject network relationship of the maker space based on resource sharing, the "Internet +" and sharing economy make the maker space have the characteristics of borderless and open sharing. Changes in social subject have changed the traditional mode of co-construction. People and wealth are no longer confined to the same one organization, they can be shared, and the path of research and development innovation has also undergone fundamental changes. The input variables need to be redefined. This paper believes that from the input-output perspective, the attributes of input variables of maker space have not changed, and still can be classified according to things, people, finance, and research and development, and the new input variables can be matched with one-to-one.

From the perspective of things, resource openness and space collaboration enable start-ups to break through the limitations of traditional internal space, sharing the use of various open factories, workshops, laboratories, 3D printing facilities, and various external support forces. The fundamentals of innovation have changed radically, forming a situation of crowd-sourcing and crowd-supporting. Due to the openness of resources, this article replaces the above-mentioned "input amount C of the object" with "resources", which is represented by the word "Sources", and mainly includes variables such as crowd-sourcing and public support. [15]

From human perspective, social subjects have changed. Global innovators, creators, entrepreneurs, including designers, makers, users, and business owners can all be diversified social subjects in the context of the Internet and create services and products that can meet new needs. The factors related to "maker" in the maker space have surpassed the traditional category of internal employees. Because the innovation group forms "Maker Space" situation, this article replaces the above-mentioned "human input volume--code L" with "crowd group" and uses the word "crowd". [19]

From the perspective of wealth, "Internet +" has changed the financial support conditions, and new financing methods such as crowd-funding, venture capital funds, financing guarantees, and financial leasing have been widely used, and the threshold for entrepreneurial financing has been greatly reduced. Due to the change of financing conditions, then informs "crowd-funding" situation. This article replaces the above-mentioned "finance input--code M" with "crowd-funding" in a broad sense, and uses the word "funds".

From the perspective of research and development innovation, researchers from external universities, research institutes and intermediaries are integrated into the research of entrepreneurs on the shared platform, participating in research and development or transfer of scientific research results, serving entrepreneurs and forming a "public research" situation, expressed by the word "RD".

Input variables must be measurable. In this paper, the above-mentioned social subjects are reclassified and reduced dimensionin terms of material, people, finance, and research and development. The input variables are defined as crowd-sourcing, crowd-supporting, crowd group, crowd-funding, public research, and output variables are measured as entrepreneurial income, service income and intellectual property. The research model of this paper is shown in Figure one.
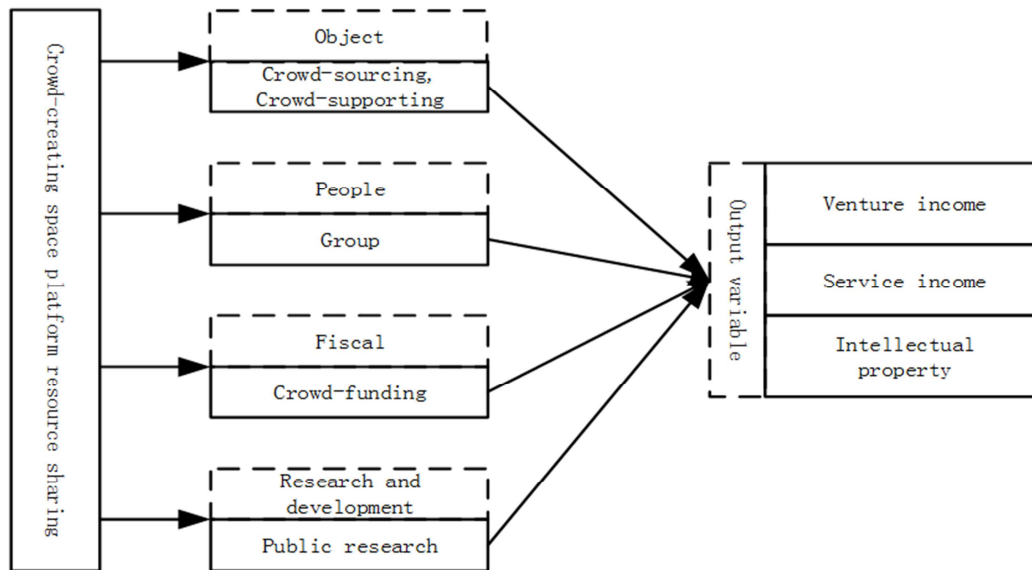
Figure 1. Input-output model based on resource sharing.

Output refers to the benefit of social entities using input resources, usually expressed by the ratio of input to output or cost-benefit ratio. The optimal output refers to the best state of input and output of the social entity. [20]

The output effect is expressed by OE, the input resource is represented by Input, and output benefit is represented by Output. According to the relationship of output effect, the input variable X is made by the object, the person and the wealth, and the output effect $OE=e^\lambda$, and then based on the Cobb-Douglas function formula: [21, 22]

$$Y_i = e^\lambda C_i^\alpha L_i^\beta M_i^\gamma RD_i^\varphi e^{\varepsilon_i} \quad (1)$$

Where Y is the output variable; C is the input of the object, such as fixed assets; L is the labor input of the person, such as the number of employees; M is the input of the financial, such as cost; RD is the input of research and development, such as research and development cost of enterprise.

Substituting each new variable of the created space in the table into the formula (1), can gives:

$$Y_i = e^{\lambda_i} Sources_i^\alpha Crowd_i^\beta Funds_i^\gamma RD_i^\varphi e^{\varepsilon_i} \quad (2)$$

For ease of calculation, take the ln value on both sides to get the new formula:

$$\ln Y_i = \lambda_i + \alpha_i \ln Sources_i + \beta_i \ln Crowd_i + \gamma_i \ln Funds_i + \Phi_i \ln RD_i + \varepsilon_i \quad (3)$$

Among them is the output variable of the maker space; i means the individual; Sources stands for crowd-sourcing, crowd-supporting, that is the material condition for the support and guarantee of the maker space under the open resources; Crowd stands for crowd, that is, the pluralistic social subject; Funds on behalf of crowd-funding, it refers to the channels for providing funds for crowd-funding and venture capital; RD still represents the public research; λ_i is the output effect coefficient; α, β, γ respectively are the output

effect coefficient of Sources, Crowd, Funds, RD; ε_i indicates random error. By comparing the output effect coefficient λ_i, we can judge the output difference of the common space; and study the random error influence by ε_i.

3.2. Variable Selection

In the selection of indicators, the following literature research is mainly used: Zhang Jiao (2010) and Yang Wenzhao (2015) are divided into two categories: input and output. Inputs include material, human and financial resources; Output index are divided intoability of incubation, innovation benefit, social benefit, economic benefit. [23, 24] Wang Liping (2017) believes that the input index include the total area, the number of service personnel, the number of activities, the situation of training, the number of entrepreneurial tutors, etc. The output indicators include the number of service enterprises, the number of entrepreneurs, the number of entrepreneurs, and entrepreneurship number, number of employed people, number of overseas students returning to school, etc. The output index includes the number of service enterprises, the number of entrepreneurship, the number of entrepreneurs, and entrepreneurship number of college students, number of employed people, number of overseas students returning to school, etc. [25] Considering the impact of crowd-sourcing, public support, crowds, crowd-funding, and public research on the effect of space creation, combined with Bigliardi (2006), Schwartz (2008), Michael (2011), Barbero (2012), Chen Yu (2015), Wann (2017), Wen Meirong (2017), Li Yanping (2017), Jia Tianming (2017) and other indicators design research results, according to the principle of measurable and investigable, this paper finally selects the number of crowd-sourcing partners, the public Supporting business area, number of public assistance activities, number of employees in crowds, number of people in crowd services, crowd-funding financing, crowd-funding service investment, crowd-funding

government subsidies, public research and development investment, total venture capital of start-ups, and space of maker. The income and the number of intellectual property rights are measured as output indicators. As shown in Table 1.

Table 1. Variable table.

Variable	Category	Dimensionality	Index	Description	Code
Input variables	Sources	Crowd-sourcing	Numberofpartners	Number of partners supporting	X_1
		Crowd-supporting	Area of operation	Actual available operating area	X_2
			Number ofactivities	Number of large-scale events such as training and roadshows	X_3
	Crowd	Crowd group	Number of employees	Number of employees in start-ups	X_4
			Number of servicing	The number of people working in the maker space	X_5
	Funds	Crowd-funding	Venture financing	Start-up financing	X_6
			Service investment	The input of the maker space	X_7
			government subsidy	Various government subsidies	X_8
	R&D	Public research	Research input	Research and development investment amount	X_9
Output variables	Start-up company		Total income of start-up	Total income of start-ups	Y_1
	Maker space		Total income of operation	Total income of maker space	Y_2
	Knowledge output		Intellectual property	Invention patents and software copyrights, etc.	Y_3

3.3. Relevance Hypothesis

According to Table 1, the general assumptions are as follows:

Let $Y_i=\{Y1, Y2, Y3\}$; $X_i=\{X1, X2, X3, X4, X5, X6, X7, X8, X9\}$, Y_i and X_i have correlation, that is, maker space operation income Y_2, the number of intellectual property maker space Y_3, and the number of input variable crowd-sourcing partners X_1, the area of business public support X_2, the number of activities public support X_3, the number of crowd groups' employees X_4, the number of people crowd service X_5, public entrepreneurship financing X_6, crowd-funding service input X_7, crowd-funding government subsidy X_8, public research and development investment X_9 have nonlinear correlation.

4. Empirical Analysis

4.1. Data Collection and Statistics

This paper selects Beijing, the largest and fastest growing area in China, as the sampling area. As of 2017, Beijing has a total of 424 maker space, [26] including 125 nationally-created space and 141 "Beijing Maker Space". According to the variable index system design questionnaire, according to the accessibility of the address, 350 questionnaires were issued mainly through the issuance of questionnaires, and 313 valid questionnaires were collected. Excluding the actual output is 0 or there are obvious contradictions. The actual effective questionnaires are 301. According to the statistical results, of these 301 maker space, the number of average crowd-sourcing partners is 7, the average public support area is 1,260 square meters, the average number of public activities is 7 times, the average number of employees in the incubator reaches 864, the average number of service personnel of maker space is 39. The total amount of crowd-funding venture financing for each of the maker spaceis 101.42 million RMB, and the average service input of maker space is 650,000 RMB. The governments at all levels create an average of 390,000 RMB for each group. The average total revenue of start-up enterprises in each maker spacewas 391.8 million RMB, The average income of maker space operation is 1.37 million RMB, and the average number of intellectual property rights of maker space is 72.

From the distribution situation, each original variable conforms to the normal distribution law; Since the standard variable has a wide range of values, the standard deviation fluctuates greatly, so it should be normalized in the regression analysis of the output effect coefficient.

Table 2. Raw variable description statistics table.

Code	Name	Minimum	Maximum	Average value	standard deviation
X_1	Number of crowd-sourcing partners	2	30	7	6.4
X_2	Area of business public support	300	200000	1253	9,733.6
X_3	Number of activities public support	2	100	7	6.9
X_4	Number of employees in crowds	9	7034	864	642.9
X_5	Number of people crowd group service	1	400	39	43.7
X_6	Crowd-funding venture financing	0	231240	10142	15,006.3
X_7	Crowd-funding service investment	10	1857	65	180.9
X_8	Crowd-funding government subsidy	0	368	39	27.3
X_9	Public research and development investment	10	31500	2350	3,390.8
Y_1	Total income of start-up business	63	350000	39180	35,350.3
Y_2	Maker space operation income	4	36200	137	4,131.6
Y_3	Number of maker space intellectual property	9	703	72	66.4

4.2. Regression and Inspection

Y_1, Y_2, and Y_3 are used as dependent variables, and the database is established with $X_1 \sim X_9$ as independent variables. The reliability test of the database shows that the clone Bach coefficient is 0.946, and the cloned Bach coefficient based on the standardized project is 0.946. Both coefficients are greater than 0.9, indicating high internal consistency, high data reliability, and regression analysis. Substituting Stata software for regression analysis, the heteroscedasticity test results of all three were Prob=0.0000, all passed the significance test, indicating that there is no heteroscedasticity. The regression results are compiled as shown in Table 3.

***Table 3.** Regression and test results table.*

Variable	Code	Total income of start-up business ln Y_1		Maker space operation incomeln Y_2		Number of maker space intellectual property lnY_3	
		Output effect coefficient	Standard deviation	Output effect coefficient	Standard deviation	Output effect coefficient	Standard deviation
Number of crowd-sourcing partners	LnX_1	0.221***	0.036	0.285***	0.079	-	-
Area of business public support	LnX_2	0.179***	0.051	0.758***	0.104	0.323***	0.078
Number of activities public support	LnX_3	0.235***	0.057	0.378***	0.131	-	-
Number of employees in crowds	LnX_4	0.600***	0.055	-	-	0.196***	0.085
Number of people crowd group service	LnX_5	0.080***	0.035	0.096**	0.071	-	-
Crowd-funding venture financing	LnX_6	0.002*	0.018	-0.054**	0.036	0.341***	0.028
Crowd-funding service investment	LnX_7	0.268***	0.033	0.347***	0.076	0.115***	0.051
Crowd-funding government subsidy	LnX_8	0.039**	0.029	0.274***	0.056	0.230***	0.044
Public research and development investment	LnX_9	0.138***	0.019	0.098***	0.044	0.042**	0.030
Coefficient	λ	1.234***	0.338	-4.562***	0.581	-3.057***	0.533

Note: ***, **, * indicate the statistical significance level of 1%, 5%, and 10%, respectively.

4.3. Empirical Analysis

4.3.1. Analysis of the Output Effect of Start-ups

The statistically significant results show that the output variable enterprise entrepreneurial total income Y1 has a correlation with the input variables X1 $\sim$ X9, and the hypothesis is verified. Substituting the regression effect coefficient into the formula (3) gives:

$$\ln Y_1 = 1.234 + 0.221\ln X_1 + 0.179\ln X_2 + 0.235\ln X_3 + 0.6\ln X_4 + 0.08\ln X_5 + 0.002\ln X_6 + 0.268\ln X_7 + 0.039\ln X_8 + 0.138\ln X_9 + \varepsilon_1 \quad (4)$$

According to the output effect coefficient in formula (4), it can be known that:

First, the most influential variable on the total entrepreneurial income Y_1 is the number of employees in the crowded enterprise X_4. This shows that for start-ups in the maker space, human capital is the most important input factor, which also verifies the formulation of "innovation creates the key to people" in the government work report.

Secondly, the number of public assistance activities X_3, crowd-funding service input X_7, and the number of crowd-sourcing partners X_1 constitute the main supporting force of the maker space ecosystem. The number of public assistance activities X_3 refers to organizing all kinds of training, roadshows and financing activities the by maker space, which has a direct and important effect on the ability of start-ups to increase their ability and increase their income. Crowd-funding service input X_7 refers to investing funds to provide professional services for start-ups, including accounting sharing, intellectual property transformation, talent recruitment, legal affairs consulting, etc., which helps start-ups to reduce the burden on non-core businesses and concentrate on the core business. The number of crowd-sourcing partners X_1 refers to important partners including industries, funds, research institutes and other formations formed with start-up companies. It can provide start-ups with entrepreneurial resources to meet the needs of producing product or providing service in the entrepreneurial process.

Third, the public support operation area X_2, public research and development investment X_9 is essential for the maker space ecology. Based on the business area of the public support X_2, including the open or independent work spaces provided by the maker space, shared meeting rooms, etc., this is the activity place and carrier of the start-up business, although the operating area under the "Internet +" is no longer the biggest item of expenditure, and virtualized operation does not need to occupy the site in theory, but in reality it still needs to occupy a certain physical business area.

In addition to the traditional R&D investment, the research and development investment X_9 refers to the sharing of scientific research facilities and equipment provided by maker space under the "Internet +", and the free research condition provided by the open laboratory through the network alliance. The research and development investment X_9 contribute to the total income is not high, mainly because the start-ups are mostly teams or enterprises newly established. They are currently in the R&D investment period, and their contribution to the total revenue of the start-ups has a certain lag period. This situation should be reflected in the future.

Finally, the number of crowd service X_5, crowd-funding government subsidy X_8, crowd-funding venture financing X_6 also contributed to the total income of start-ups. The number of crowd service X_5 mainly refers to the service personnel of maker space. They are mainly providing new entrepreneurial services for start-ups. In theory, it should include comprehensive online and offline services including membership services, information, investment and other resources. Given that the current online service is

in the incubation stage, the output effect coefficient of this variable is still low. Crowd-funding government subsidy X_8 refers to the government's various types of cash subsidies, tax reductions and other policy support, the current main subsidies to the maker space, the proportion of direct subsidies to start-ups is still low. Crowd-funding venture financing X_6 refers to the financing provided by venture capitalists and maker space's own funds. In view of the fact that many start-ups are currently in the investment period, the amount of financing is greater than the amount of income, so its effect on the income of start-ups cannot be fully realized. The output effect coefficient is also relatively low.

4.3.2. Analysis of the Output Effect of the Maker Space

The empirical results show that the variable that has not passed the significant verification is the number of employees in the crowded enterprise $\ln X_4$, indicating that the original hypothesis is not established, that is, the number of employees in the startup is not related to the income of maker space. The main reason is that the operating rental income of maker space is charged according to the practical area of the station or independent office, rather than the number of employees of the startup. Under the condition of shared resource network, employees can have flexible office hours and work in mobility. The number of employees in each startup is very different. The remaining variables are related to maker space operation income $\ln Y_2$, and the original relevant assumptions are established. Substituting the regression effect coefficient into equation (3) is available.

$$\ln Y_2 = -4.562 + 0.285\ln X_1 + 0.758\ln X_2 + 0.378\ln X_3 + 0.096\ln X_5 - 0.054\ln X_6 + 0.347\ln X_7 + 0.274\ln X_8 + 0.098\ln X_9 + \varepsilon_2 \tag{5}$$

From the comparison of the output effect coefficient, we can see that:

First of all, the most influential variable of maker space operation income $\ln Y_2$ is the public support area X_2, indicating that rent collection by operating area is the most important income component of maker space.

Second, the number of public assistance activities X_3, the number of crowd-sourcing partners X_1, the crowd-funding service input X_7, and the crowd-funding government subsidy X_8 constitute a secondary variable that affects the maker space's operating income $\ln Y_2$. The number of public support activities X_3 refers to the organization of road shows, training and other activities, to collect a certain amount of fees of renting conference room and servicing, which constitute a source of income for the space. The crowd-sourcing partner number X_1 can lead bridge and bring service costs to the space. The crowd-funding service input X_7 refers to the coffee, catering, printing and other inputs provided by maker space, and also brings service benefits while investing. For the crowd-funding government subsidy X_8, the survey sample statistics found that only 50% of the maker space claimed to enjoy the cash subsidy support, and is limited by the subsidy quota, so there is a certain impact, but the output effect coefficient is not high.

Third, the public research and development investment X_9, the number of crowd service X_5 has a certain impact on the public space operating income $\ln Y_2$. Public research and development investment X_9 is mainly used by start-ups. Only a small proportion is converted into maker space revenue through service fees. This small proportion also indicates that maker space does provide a certain amount of service and support for start-ups. It is only the income value of this service converted into value-added services is still very low. The number of crowd service X_5 mainly refers to the number of service people in the maker space. In theory, the larger the number, the greater the income generated, but the contribution to the space revenue of the public is not great, indicating that the professional service level of the maker space needs to be improved. It is not feasible for maker space to increase the income of service personnel. It should improve the ability to generate income through professional services. Finally, the output effect coefficient of crowd-funding venture financing X_6 is negative, which means that when this output effect coefficient is converted into the power value of exp as the base, its value is much less than 1, that is, crowd-funding venture financing X_6 The impact of space operation income $\ln Y_2$ is small. The reason is that about 50% of maker space is still unable to achieve profitability during the investment

period, and the value of crowd-funding venture financing X_6 is relatively large, which is caused by the large difference in quantity comparison.

4.3.3. Analysis of the Output Effect of Maker Space Intellectual Property

The empirical results show that there is no correlation between the number of maker space intellectual property number lnY_3 and the number of crowd-sourcing partner LnX_1, the number of public assistance activity LnX_3, and the number of crowd service LnX_5. The three null hypotheses are not valid. The rest of the variables are tested, and the regression effect coefficient is substituted into the following formula:

$$lnY_3 = -3.057 + 0.323lnX_2 + 0.196lnX_4 + 0.341lnX_6 + 0.115lnX_7 + 0.230lnX_8 + 0.042lnX_9 + \varepsilon_3 \quad (6)$$

The number of intellectual property rights lnY_3 is a measure of intellectual property output. The empirical results of the number of crowd-sourcing partners X_1 and its non-correlation show that the number of crowd-sourcing partners of the startup in the maker space is mainly the financing channel and intelligent platform. Or the relationship between media, parent company, outsourcing service or production cooperation, and universities and scientific research institutions that reflect scientific research cooperation are still few. The number of public assistance activities X_3 mainly refers to financing, training, product promotion and other activities. Due to the large heterogeneity of scientific research in the enterprises that have settled in the maker space, there are still few scientific research activities organized by the collective space. No correlation is shown. The number of crowd service X_5 also does not reflect the correlation, indicating that the services provided by service personnel of maker space are mainly based on non-scientific research services.

By comparing the output effect coefficients of each variable, we can see that:

First of all, crowd-funding venture financing X_6, public support business area X_2 has the greatest impact on the number of intellectual property rights lnY_3, indicating that thelarger the crowd-funding venture financing X_6, the more favorable to increase R & D investment, and more output of intellectual property. At the same time, the larger the business area X_2, the more start-up enterprises are settled, it is more favorable to form a resource sharing network for scientific research, such as Beijing Youke Workshop, which introduces 208 enterprises, 32% of which belong to technological innovation enterprises, 21% are engaged in creative design, 20% are engaged in information technology intelligent hardware, 17% are financial investments, and the remaining 10% are cultural media and financial law consulting companies. These enterprise groups also form a resource sharing network, which is conducive to scientific research

sharing.

Secondly, the crowd-funding government subsidy X_8, the number of employees in the crowded enterprise X_4, and the crowd-funding service input X_7 have the second influence on the number of intellectual property rights lnY_3. Crowd-funding government subsidies X_8 have played a positive role in promoting intellectual property incentives. The number of employees in crowded enterprises X_4 is the main part of scientific research. The more researchers, the greater the number of intellectual property rights. The crowd-funding service input X_7 also played a positive role in promoting the number of intellectual property.

Finally, the research and development investment X_9 has an impact on the number of intellectual property rights lnY_3, but the impact is small. The reason for this result may be that, on the one hand, the output of intellectual property rights has a certain lag. At present, the R&D investment is in the input stage, and the input and output are not proportional; on the other hand, the research and development funding startup invest in the maker space is not high. At present, it is more inclined to invest in direct construction of the platform, product market, promotion and other aspects, which restricts the amount of output of intellectual property. A typical example is the competition of shared bicycles. The billion-dollar financing is mainly used for the construction, manufacturing and market share of intelligent platforms. The competitors mainly reflect the homogenization price competition and not improve the technical content of bicycles. [28]

5. Conclusions

5.1. Result

According to empirical research, in the resource sharing network created by maker space Platform, the number of employees, business area, number of partners, activities, service investment, R&D investment, etc. are significantly positively correlated with the total venture capital of start-ups;, government subsidies, number of partners, number of activities, service inputs, etc. have a significant contribution to the revenue of maker space operations; entrepreneurial financing, business area, government subsidies, and the number of employees in the company contribute to intellectual property rights. In the mass creation space, if the shared resource network is divided according to the attributes of different social subjects, it can be divided into the collective creation platform circle, the entrepreneurial subject circle, the policy, and the public research circle. The variables verified by empirical verification are classified into the pass diagram according to the creation of the platform, the entrepreneurial circle, the policy, and the public research (see Figure 2).
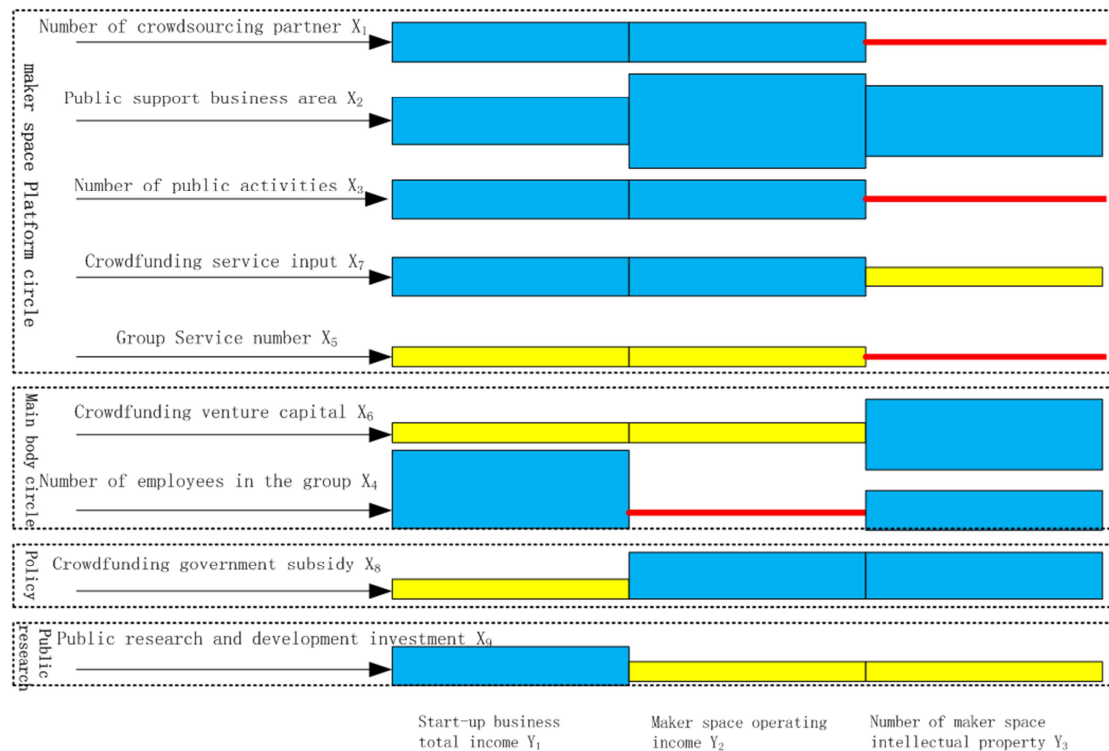
Figure 2. Input-output path diagram based on resource sharing.

5.2. Enlightenment

5.2.1. Enlightenment for the Input of the Collective Platform

According to the path diagram of the joint creation of resources sharing network of maker space, maker space platform should further build an open collaborative partner network, more effectively use open office space or free laboratory resources, and widely organize entrepreneurial salons, entrepreneurial lecture halls, and entrepreneurial training. Entrepreneurship training activities such as camps, road shows, and investments can effectively stimulate income growth. However, at present, the number of crowd-sourcing partners X_1 and the number of public assistance activities X_3 have no statistical correlation with the number of intellectual property rights Y_3, indicating that the number of cooperation between the crowd-sourcing partners and the scientific research institutions is insufficient, and the activities related to scientific research activities in the public welfare activities also need to be improved. The number of crowd service X_5 contributes a low proportion to the revenue of maker space Y_2. Indicating that the current ability of the maker space service personnel to rely on professional services to increase value is weak, and the professional level of the resource sharing network of the maker space platform needs to be improved. In addition, the policies related to the resource sharing network of maker space play an important role in the prosperity and sustainability of the current resource sharing network. The maker space platform circle must not only become the workspace, social space and cyberspace of innovative entrepreneurs, but also become a space for sharing scientific and technological resources, and also become a platform for innovative entrepreneurship to receive preferential policy funding.

5.2.2. Enlightenment on the Investment in the Start-up Circle

The crowd-funding venture financing X_6 contributed more to the public intellectual property rights Y_3, indicating that the financing target is clear, and the crowd-funding venture financing X_6 has effectively promoted the improvement of core competitiveness. The number of employees in the crowded enterprise X_4 has made outstanding contributions to the total revenue of the start-up enterprise Y_1 and the number of intellectual property rights Y_3. It can be seen that "the key to innovation and creation lies in human beings", and the role of people as the subject of social entrepreneurship should be fully exerted. The crowd-funding venture financing X_6 has a low contribution to the total revenue of start-up enterprises Y_1 and the operating revenue of maker space Y_2, and it shows that for start-ups, most of them are currently in the investment phase, and the total amount of financing is greater than the total income. The output effect has not been reflected.

5.2.3. Implications for Supporting Policy Investment

Crowd-funding government subsidy X_8 has a certain proportion of contribution to maker space operation income Y_2 and the number of maker space intellectual property Y_3, but the contribution to the total revenue of the start-up enterprise Y_1 is low, explain that the government's funding policy and tax policy still have space for further optimization. According to Friedman, lowering the investment income tax in the early stage of the venture can effectively stimulate the

supply of investment, and the re-tax incentives will be greatly reduced by the mature period. [27] At present, resources sharing network of the maker space is in the initial stage, which is the best time to increase policy stimulus. In addition to funding maker space, the government should also formulate support policies for start-ups, such as venue-free rent, tax incentives, financial support, talent introduction, industry transplantation, and cultivation guidance.

In addition, resource sharing network of maker space makes the ecological environment have obvious difference between the startup and the startup team, and the support policies should be treated differently. Most start-ups have low turnover in the early stage of development. They are typical low-profit enterprises. It is recommended to reduce income tax. There is a difference between the financing support policies of the startup team and the start-ups. It is recommended to set up different loan guarantee funds, provide different conditions for the guarantee of business guarantee loans, provide loans with reference to the benchmark interest rate or implement different financial discounts to help the entrepreneurial team survive and startups grow. [28]

5.2.4. Enlightenment from the Research and Development Investment

The contribution of the research and development investment X_9 to the public intellectual property number Y_3 is not high, and this cautionary conclusion needs to be highly valued. Under the background of "Internet +", the pattern of technological innovation has changed. The original closed-type innovation model with internal scientific research personnel as the research subject and its own laboratory as the carrier turned to the open innovation model with the industry-university-research network alliance as the main body and the shared laboratory as the carrier and the users to participate extensively. In thiscontext, the speed of research and development is accelerating, and the results of intellectual property rights are easily imitated or copied. As a result, many companies are reluctant to carry out original innovation and research and development, resulting in a low proportion of financing actually invested in research and development, and core intellectual property needs to be improved. In the end, it can only lead to excessive homogenization competition such as price wars and simple imitation. Effectively protecting maker space intellectual property rights in the context of the new economy is the key to the continued prosperity and growth of the space-sharing network.

In short, in the resource sharing network of maker space, the impact of crowd-sourcing, public support, crowd-funding, public research, and crowds on the total revenue of start-ups, the revenue from the maker space, and the number of intellectual property rights are not same. In the view of resource sharing, increasing the number of employees, the number of partners, R&D and service investment will help increase the total revenue of start-ups; Increasing the business area, government subsidies, and number of public assistance activities will help increase the operating revenue of maker space e. Increasing entrepreneurial financing, business area, government subsidies, etc. are conducive to increasing the maker space intellectual property rights.

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