Scientific Management of Agricultural Innovation Space Based on the Principle of Efficient Resource Allocation-A Case Study of Guangqing Agricultural Innovation Space

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Abstract: Based on the principle of efficient resource allocation, 0-1 integer programming, this paper tries to make a reference to the resource allocation of Guangqing's agricultural creation space. The results show that scientific management methods can save costs and improve work efficiency, thus providing a good scientific management tool in practical work.

1. Brief Introduction of Guangqing Agricultural Innovation Space

In order to improve the development quality of Qingyuan's agricultural industry, We will promote the revitalization and development of villages, support and encourage farmers to find jobs and start businesses, broaden the channels for increasing income, encourage more social subjects to join in rural innovation and start businesses, and create a space for agricultural innovation through government guidance and support and independent operation of enterprises. Guangqing agricultural innovation space is a new type of entrepreneurial service platform and industrial factor gathering place in the agricultural field. It mainly includes two parts: physical workspace and virtual cyberspace, providing an interactive entrepreneurial platform for settled enterprises to integrate physical workspace and virtual cyberspace. The project platform builds a modern agricultural industry development ecology and promotes in-depth cooperation and collaborative innovation among enterprises by gathering leading agricultural enterprises and advantageous enterprises in various fields such as incubators, agricultural technology, scientific research institutions, e-commerce, advertising design, literary creation, finance, logistics, cold chain, cooperatives, large agricultural households, agriculture-related tourism enterprises, etc.

As the core service provider, Integrating resources such as the government, leading agricultural enterprises and professional organizations of productive services, Provide professional services such as policies, agricultural technology, property rights transactions, Internet, channels, finance, cold chain logistics, cultural creativity, eco-tourism, etc. for the platform, Form an industrial

ecological closed loop, realize the efficient mutual circulation of energy flow, material flow, information flow and capital flow, reduce the overall cost of the industrial chain, improve the overall competitiveness of the industry, promote the interaction, cooperation and innovation of various agricultural factors, form an efficient and high-quality agricultural industrial chain, and realize the improvement of agricultural quality and efficiency and the sustained income increase of farmers.

2. Application of Integer Linear Programming

Linear programming is widely used in military operations, economic analysis, management and engineering technology. In order to reasonably utilize the limited human, material and financial resources to make the best decision, scientific basis is provided. Integer 0-1 programming plays an important role in linear programming. On the one hand, many practical problems, such as assignment problem, land selection problem and delivery problem, can be reduced to such programming. Using 0-1 programming method, many nonlinear programming problems can also be expressed as integer programming problems, so many people devote themselves to the research in this direction. The following is an example of some problems in Guangqing's agricultural creation space, using the method of 0-1 integer programming to explore how to improve work efficiency (Tang Weihuan. 2016).[1] For example, M. Akif Bak, & Cihan Aksop. (2008) presents various examples of institutional rules for UPAEP universities using integer linear programming models.[2] Zheng. W & Le M. et al. (2019) from the perspective of airport resource utilization efficiency, objective linear 0-1 integer programming model is constructed for gate assignment problem, and a dynamic time window algorithm based on objective function priority is designed by using the idea of divide and conquer .[3] The 0-1 integer programming algorithm is used to determine the network node distribution of the underground logistics system. (Fang Longxiang & Yu Xueyu.2019).[4] Wang Hongguo & Chen Huowang, et al. (2003) founds a 0-1 integral programming model for science and technology project management problem by applying mathematical programming method.[5]

3. Talent Selection in the Expert and Talent Service Pool

Guangqing agricultural innovation space is also called the cradle of the birth of "small bosses of agriculture-related enterprises in the new era" and the field school of "new professional farmers". At present, it mainly carries out project promotion, investment promotion, talent service, agricultural big data operation and brand operation in public areas of agricultural products. Among them, one of the talent services is to support the introduction of leading talents and expert talents. Guangqing agriculture innovation Space to Carry out Talent Training. In view of the insufficiency of the existing research, through the example, using the 0-1 integer programming model in the management operations research, has established the mathematical model to the enterprise staff recruitment question (Hu Ying. 2009). [6] We will widely collect teachers and experts who are suitable and may become talents and services in Guangqing Agricultural Innovation Space. Because experts and teachers have different levels, professional fields, training time, training contents, teaching design, etc., we need to establish a database of experts, talents and teachers. We can use integer linear programming to select experts and teachers who meet the conditions we need and are excellent in the database. For example, there are currently 10 talent pool data that can be employed as expert teachers: each agriculture-related start-up enterprise that needs services

is equipped with a talent service group of "agricultural technology + management consulting" as shown in the following figure:

Table 1: Agricultural Technology Management Consulting Service Group hypothetical 3 variable.

NO.	Position	Gender	Age	Education	Enterprise years	Service Score	Comprehensive Ability Score
1	Entrepreneur	Male	40	Master's degree	17	88	9
2	Entrepreneurial mentor	Female	32	Master's degree	10	86	8
3	Entrepreneurial mentor	Male	34	Doctor	12	90	10
4	Agricultural technician	Male	28	Undergraduate	7	86	7
5	Agricultural technician	Female	26	Undergraduate	5	83	6
6	Entrepreneurial mentor	Male	30	Master's degree	8	88	8
7	Entrepreneur	Female	37	Doctor	15	86	10
8	Entrepreneurial mentor	Male	33	Master's degree	11	89	9
9	Agricultural technician	Male	25	Undergraduate	4	82	5
10	Agricultural technician	Female	26	Undergraduate	4	85	6

An agriculture-related start-up enterprise encountered a bottleneck in breeding or management, Need the support of technical guidance and management consulting services, There must be more than 2 agricultural technicians, There are no more than 2 business mentors, 1 entrepreneur, no less than 80% master's degree or above, no more than 40 years of average age, no more than 5 years of service in front-line professional enterprises, and no less than 85 points of service evaluation. In order to make the selection comprehensive score ability of talent service members higher and meet the above decisions, the following hypothetical variables can be made:

Table 2: Hypothetical Decision Variable.

Variable	Take value	Representational meaning	Take value	Representational meaning
Code 1 is X1	1	The first person was admitted	0	The first person was not admitted.
Code 2 is X2	1	The second person was admitted.	0	The second person was not admitted.
Code 3 is X3	1	The third person was admitted.	0	The third person was not admitted.
Code 4 is X4	1	The fourth person was admitted.	0	The fourth person was not admitted.
Code 5 is X5	1	The fifth person was admitted.	0	The fifth person was not admitted.
Code 6 is X6	1	The sixth person was admitted.	0	The sixth person was not admitted.
Code 7 is X7	1	The seventh person was admitted.	0	The seventh person was not admitted.
Code 8 is X8	1	The eighth person was admitted.	0	The eighth person was not admitted.
Code 9 is X9	1	The ninth person was admitted	0	The ninth person was not admitted.

| Code 10 is X10 | 1 | The tenth person was admitted | 0 | The tenth person was not admitted. |

According to the above assumptions, a mathematical model can be established:

Objective function: MaxZ=9X1+8X2+10X3+7X4+6X5+8X6+10X7+9X8+5X99+6X10

Constraints:

$$
\begin{cases}
\sum_{j=1}^{10} Xi = 5 \\
X4+X5+X9+X10 \geq 2 \\
X2+X3+X6+X8 \leq 2 \\
X1+X7=1X1+X2+X3++X6+X7+X8 \geq 5*80\% \\
(40X1 + 32X2 + 34X3 + 28X4 + 26X5 + 30X6 \\
\quad + 37X7 + 33X8 + 25X9 + 26X10)/5 \leq 40 \\
(17X1 + 10X2 + 12X3 + 7X4 + 5X5 \\
\quad + 8X6 + 15X7 + 11X8 + 4X9 + 4X10)/5 \geq 5 \\
(88X1 +86X2 +90X3 +86X4 +83X5 +88X6 \\
\quad +86X7 +89X8 +82X9 + 85X10)/5 \geq 85 \\
Xj=0 \text{ or } 1, j=1, 2, 3... 10
\end{cases}
$$

According to the above objective function and constraint conditions, the known data can be input into the table by Excel tools and arranged logically. The maximum value of comprehensive ability is obtained by solving the program. Through calculation, it can be seen that the comprehensive ability score of the selected five members of the best "agricultural technology management consulting" talent service group is 41. Finally, it is determined that the five members of the talent pool experts meet all our requirements, namely, No.1, No.3, No.4, No.8 and No.10. Their positions are 2 agricultural technicians, 2 business mentors and 1 entrepreneur respectively.

4. Teacher Assignment and Curriculum Planning for Entrepreneurship Training

Guangqing agricultural innovation space plays the role of a space platform, coordinating and supporting universities, research institutes and government resources to jointly carry out youth entrepreneurship training, e-commerce training, agricultural technology training and other work. Wu Lijun, & Tian Cunfu (2004) focus on problem of seat allocation in mathematical modelling, 0-1 programming models of seat allocation are established by using relative index, and the solution method of the models is given. [7] The following examples are the contents of teacher assignment and curriculum planning for entrepreneurship training. For example, the trainees learn five typical working modules in the first training course. Each module needs to be guided by a teacher, and each teacher can only be responsible for guiding one module link. However, each teaching teacher should design the course time for each module according to his own time and professional skills. For example, if five teachers are selected to teach one of the courses, how to allocate the teaching items for the best assigned time as the shortest period is designed?

Table 3: Hypothetical Variables of Curriculum Planning and Teacher Assignment Problem

Instructor	Training Module 1	Training Module 2	Training Module 3	Training Module 4	Training Module 5
Mr. Wang	10	12	15	9	11

Mr. Zhang	12	8	10	8	7
Mr. Liu	7	15	13	7	9
Miss Li	11	9	6	10	8
Mr. Zhao	6	14	11	9	10

According to the data in the above figure, we can list the decision variables, objective functions and restrictions as follows:

Decision variables:
The decision variables of the assignment problem are expressed by labeling. X11 indicates that Teacher Wang is assigned or not assigned to complete the training module 1. X12 means responsible for completing training module 2.

Objective function:

$$MinZ=10X11 + 12X12 + 15X13 + 9X14 + 11X15 + 12X21 + 8X22 + 10X23 + 8X24 + 7X25 + 7X31 + 15X32 + 13X33 +7 X34 + 9X35 + 11X41 + 9X42 +10X44+8X45 + +6X43 + 6X51 + 14X52 + 11X53 + 9X54 + 10X55$$

Restrictions:

$$\begin{cases} X11+X12+X13+X14+X15=1 \\ X21+X22+X23+X24+X25=1 \\ X31+X32+X33+X34+X35=1 \\ X41+X42+X43+X44+X45=1 \\ X51+X52+X53+X54+X55=1 \\ X11+X12+X13+X14+X15 \leq 1 \\ X21+X22+X23+X24+X25 \leq 1 \\ X31+X32+X33+X34+X35 \leq 1 \\ X41+X42+X43+X44+X45 \leq 1 \\ X51+X52+X53+X54 + X55 \leq 1 \\ Xij \geq 0, \ i=1, 2, 3, 4, 5 \ j=1, 2, 3, 4, 5 \end{cases}$$

Use excel input the corresponding data into the form, use programming to solve, after adding the constraint condition to the minimum value, after solving, this semester according to the design of the best assigned teachers and curriculum arrangement is56 hours, 11 hours of training module one taught by Mr. Li and Mr. Liu taught 15 hours of training module 2, Mr. Zhao taught 11 hours of training module 3, Mr. Zhang taught 4 hours of training modules 4, and Mr. Wang taught training modules 5 to 11 hours.

5. Product Logistics Distribution Best Path Problem

Guangqing agricultural innovation space has the main functions of Qingyuan Agricultural Products Exhibition, Information Collection and Release, Press Release, Property Rights Transaction, Cold Chain Logistics Distribution, Big Data Analysis, Agricultural Products Storage, Logistics, E-commerce and Quality Inspection, The construction of agricultural products exhibition and circulation logistics park, the development of Internet plus logistics platform, the exploration of online and offline integrated logistics trading platform and e-commerce sales center

and other diversified "production and marketing" gathering areas have become Qingyuan agricultural products exhibition window and an important platform for brand promotion in public areas. At ordinary times, it involves ordinary storage area, refrigerated storage area, processing and distribution area, e-commerce transaction service area, etc. In view of the lack of overall pursuit of the express industry, especially the high cost and low efficiency of the "last one mile" distribution link, scholars proposed to implement the terminal joint distribution mode between e-commerce and express delivery enterprises, and studied the location-routing problem of terminal outlets in the terminal joint distribution mode. [8] Among these problems, the optimal route planning problem is involved. It is assumed that the distribution place of the logistics section is located in place A, starting from place A, delivering goods to places B, C, D and E, and finally returning to place A. How will the distribution route be arranged to minimize the total time cost? It is known that the time spent between different places is shown in the chart.

Table 4: Assignment and planning problem hypothesis variable

	Ground A	B ground	C ground	D ground	E ground
Ground A	/	5	6	10	7
B ground	8	/	5	9	8
C ground	6	10	/	5	9
D ground	7	6	6	/	4
E ground	15	6	7	8	/

Set the target function:

$$MinZ = 5X_{12} + 6X_{13} + 10X_{14} + 7X_{15} + 8X_{21} + 5X_{23} + 9X_{24} + 8X_{25} + 6X_{31} + 10X_{32}$$
$$+ 5X_{34} + 9X_{35} + 7X_{41} + 6X_{42} + 6X_{43} + 4X_{45} + 15X_{51} + 6X_{52} + 7X_{53} + 8X_{55}$$

Constraints:

$$
\begin{cases}
5X_{12} + 6X_{13} + 10X_{14} + 7X_{15} = 1 \\
8X_{21} + 5X_{23} + 9X_{24} + 8X_{25} = 1 \\
36X_{31} + 10X_{32} + 5X_{34} + 9X_{35} = 1 \\
7X_{41} + 6X_{42} + 6X_{43} + 4X_{45} = 1 \\
15X_{51} + 6X_{52} + 7X_{53} + 8X_{55} = 1 \\
X_{21} + X_{31} + X_{41} + X_{51} = 1 \\
X_{12} + X_{32} + X_{42} + X_{52} = 1 \\
X_{13} + X_{23} + X_{43} + X_{53} = 1 \\
X_{14} + X_{23} + X_{34} + X_{54} = 1 \\
X_{15} + X_{25} + X_{35} + X_{45} = 1 \\
X_{ij} = 0 \text{ or } 1 \ (i=1, 2, 3, 4, 5, j=1, 2, 3, 4, 5)
\end{cases}
$$

We will use Excel programming solution to solve the above problems. Our goal is to find the minimum delivery time, that is, the minimum value, and the 0-1 variable is whether to select this variable, then input the constraint conditions in turn in the constraint conditions, and finally solve and draw a conclusion.

Table 5: Best Path Problem Result of operation

	A	B	C	D	E
A	0	1	0	0	0
B	0	0	1	0	0
C	1	0	0	0	0
D	0	0	0	0	1
E	0	0	0	1	0

Finally, it can be seen from the figure after solution that the minimum time we can take to start from place A and finally return to the center is 28Minutes, the best path is A-B-C-E-D-A.

6. Conclusion

With farmers as the center, Oriented by industrial demand, Supported by disciplines and specialties, Adhering to innovation leading entrepreneurship, strengthening the combination of policy guidance and independent entrepreneurship, strengthening the combination of achievement transformation and double innovation, strengthening the combination of public welfare and marketization, and gradually building a low-cost, convenient, all-factor and open comprehensive service platform that accurately serves the "three rural" and entrepreneurship teams are the construction goals of Guangqing Agricultural Innovation Space. Based on the principle of efficient resource allocation, Based on 0-1 integer programming, This paper tries to make a reference to the resource allocation of Guangqing's agricultural creation space. The results show that scientific management methods can save costs and improve work efficiency, thus providing a good scientific management tool in practical work.

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