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The Evaluation of Venture Capital in the Biotech Investment of Taiwan Rice-Bran Polysaccharide

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Abstract

This study aims to develop a better decision mechanism of venture capital on biotechnology industry. It is expected that the research results will help new ventures to obtain more funds smoothly, and the success rate of the venture capital industry will be further improved. This will be an important factor for the smooth development and success of the polysaccharide technology in the biotechnology industry. The empirical result of this study shows that Taiwan's venture capital industry should give priority to Macroeconomic Factors, Business Model, Import and Export Trade Variables, Industrial Policy and Management System and other factors that affect the success of startups when evaluating Rice-Bran Polysaccharide biotechnology investments.

JEL classification numbers: D40, D72, G11, O31, Q16
Keywords: Taiwan Biotech and Biopharmaceutical Industry, Venture Capital, Polysaccharide Technology, Modified Delphi Approach, Fuzzy Analytic Hierarchy Process.

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1. Introduction

With the development of human civilization, environmental pollution and toxic chemicals produced by food processing continue to accumulate in the human body. The mental and work stress that modern people have faced cause the rapid aging of human tissue cells, and the function of various organs in the body decreases day by day. However, some strategies are very limited in their application. This forces people to consider the way to use medical technology and pharmaceutical technology to break through the current methods and strategies to improve the quality of medicine. This is also the main reason of the gradual increase in various previously unknown diseases in recent years. In recent years, new drug R&D and drug synthesis technology have advanced by leaps and bounds.

More than 20,000 drugs are successful synthesized each year. Some of these drugs are used to treat diseases in the human body. Increased frequency and dosage of some antiviral or antibacterial drugs increase the resistance of pathogens, so that the new drug soon loses its original efficacy. Some drugs are subject to government regulations, commercial interests, and insurance payment systems, therefore can not be widely used or used. Therefore, in recent years, medical research has gradually shifted from treating to preventing. The development of preventive medicine has made modern people gradually recognize that prevention is more important than treatment. As a result, major pharmaceutical companies or biotech companies are beginning to notice how to find ways to promote human health from nature while working on new drugs or new medical technologies. Many traditional herbs or formulas have been developed with new medical value. Among them, polysaccharides are the focus of medical research in recent years.

Among traditional Chinese medicines, many kinds of edible mushrooms are listed as longevity medicines, which are rich in protein, fat, essential amino acids, minerals, polysaccharides, triterpenoids and fungal lysozyme. Polysaccharide is a biopolymer. β-D-glucan is a glucose polymer which primarily bonded with β-1,3 and side-bonded with β-1,6, is found in fungi, oyster mushrooms and algae. The polysaccharide is a biopolymer with a considerable amount of natural matter. The presence of polysaccharides in microorganisms is a short-chain small-molecule polysaccharide complex produced by Rice Bran, a unique patented process of Shitake Enzyme. There are also a large class of intracellular polysaccharides, structural polysaccharides and extracellular polysaccharides. Intracellular polysaccharides provide the energy and carbon source needed for microbial growth. The basic form of polysaccharides were architected by structured polysaccharides. Extracellular polysaccharides are viscous substances attached to the outside of the cell.

Polysaccharides have a high status in traditional medicine for many years. Many studies have confirmed that polysaccharides derived from rice bran and mushroom mites have been found to have a major role in the activation of the immune system in the blood circulation, such as immune stimulating, anti-inflammatory, anti-allergic, and anti-oxidant effects. It also regulates (BRM) balances immunity and

increases the production of natural cytokines (cytokinases), promote the quantity and activity of B-cells and T-cells, increase the activity of NK cells, inducing the natural apoptosis of cancer cells, reduce the amount of chemotherapy drugs, reduced drug volume, reduce the serious side effects of chemotherapy drugs, prolong life and improve quality of life. Among others, polysaccharides also have functions of anti-cancer, anti-hypertensive, chronic diseases, bronchitis, blood sugar lowering, immune enhancement and cholesterol lowering. The development of modern science and technology not only enables people to have a deeper scientific understanding and the health value of polysaccharides.

But also make the development of polysaccharide-related technology practical for everyday life. Therefore, many capable biotechnology and pharmaceutical companies invest huge research personnel and resources to achieve breakthroughs and innovations of related technologies in polysaccharide production. Many of them have a team of startups or research institutes. They urgently need all kinds of resources and funds in the early stage of their business. Without the support of strong fixed assets or intangible assets, these start-ups or R&D teams have difficulty obtaining financial assistance from traditional financial industries or banks. Therefore, working with venture capital or angel investors seems to be a very reasonable option.

The National Venture Capital Association (NVCA) defines Venture capital as the following: Venture capital is an institute invested by professional investors and resources to emerging, fast-growing and highly competitive companies. The venture capital industry has played an indispensable role in global economic activity in the past 70 years of history. In 1946, the first private venture capital company of the world was established, and a new term venture capital (Venture Capital) was born. In the same year, the first modern venture capital company, American Research and Development Corp. (AR&D) was founded. In the 1990s, high-tech companies that developed information technology and biotechnology supported by venture capital companies began to list in large numbers. This also triggered a large-scale development of high-tech industries and venture capital industries. Generally speaking, companies invested by venture capital firms have better business performance than other newly established companies. In terms of biotechnology and the medical industry, these businesses performance includes total income of the company, income from sales of products, royalties, testing and experimental services (Hall and Bagchi-Sen, 2002). As a result, many newly established biotech companies are looking for venture capital firms to invest.

Undoubtedly, polysaccharide-related technologies have successfully attracted the attention of the public and investors, both in biotechnology and medical or other manufacturing processes. However, the development of these new technologies are accompanied by many uncertain factors and risks. These newly established high-tech companies may face various difficulties in capital investment, resource allocation, efficiency improvement, government policies, technology research and development, environmental protection and industrial upgrading. These difficulties and uncertain risks may affect the survival of new companies and the success or

failure of venture capital cases. The entire venture capital processes include how they look for and analyze investment cases, invest in funds, assist management and when to exit investment cases.

These all require a lot of capital and time costs. In order to avoid losses and increase profitability, venture capital firms must carefully and scientifically to evaluate each investment case. Venture capital companies will face many problems when conducting investment evaluations. When investing in the polysaccharide biotechnology industry, what are the benefits for the company itself? Can venture capital apply previous investment experience to invest in the polysaccharide biotechnology industry? In what way does venture capital help manage the invested company during the process? How to choose sources with better ability and credibility that are suitable for venture capital firms to invest? How do the development stage and form of the invested company affect venture capital? When evaluating the investment case of polysaccharide biotechnology companies, these issues need to be considered.

The first chapter of this study is an introduction to the development background, research motivation, purpose and research structure of polysaccharide biotechnology and venture capital industry. The second chapter is literature review, discussing the overview of venture capital industry, venture capital evaluation process, and venture capital evaluation factors. The third chapter is the research method.

This research collects the literature on venture capital evaluation mechanisms. Its implementation and statistical methods are roughly the same as the traditional Delphi approach. The modified Delphi approach was used to identify a number of key evaluation criteria and sub-criteria for venture capital firms and polysaccharide biotechnology companies. Murry and Hammons (1995) proposed a modified Delphi approach. The difference is that Murry and Hammons (1995) omits the complicated steps of the first round of open questionnaires. In this study, the modified Delphi approach is used to establish hierarchical analysis structures and expert questionnaires. In this study, we obtain the hierarchical weights and rankings of each criterion and sub-criteria by Fuzzy Analytic Hierarchy Process. The fourth chapter is the empirical results and analysis, which can be used as a reference for venture capital companies in the evaluation of polysaccharide biotechnology companies. The final chapter is the conclusion, describing the main findings, contributions, and future research directions of this study.

2. Literature Review

2.1 The Impact of Venture Capital on Startups

General speaking, venture capital is one of the types of business operations, and its operations are both investment and financial. Venture capital investments are also characterized by high risks and high returns. The operation mode of the venture capital business is basically to raise a sum of funds and invest exclusively in start-up companies with development potential and rapid growth. In 1983, Taiwan issued

the "Rules for the Management of Venture Capital Undertakings", and the Development Fund of the Executive Yuan and the Bank of Communications allocated NT $ 2.4 billion as a seed fund for the purpose of leading private participation in the establishment of venture capital companies. Half of the thirteen venture capital companies established before 1990 were dominated by government funds, and have a strong policy significance. Since the mid-1990s, a large number of high-tech industry professionals or early-stage venture capital professional managers have raised funds to enter the venture capital industry.

Of course, the development of the venture capital industry is not smooth. The bursting of the US technology stock bubble in 2000 also represented a severe blow to American high-tech companies that have led the tide for two decades. Silicon Valley venture capitalists in the United States invested more than $100 billion in venture capital in 5,608 companies in 2000, but in 2001 only $37 billion in venture capital. Taiwan's venture capital industry has been hit hard, and has been forced to use a more rational attitude and scientific analysis to determine capital investment.

The investment purpose of venture capital is not to obtain the company's long-term operating rights. After a period of operation, the venture capital company resells or lists the value-added ventures to obtain investment returns and exits the company. In addition to organizing a professional team to evaluate the physical fitness and prospects of the invested company, the venture capital company will also control the investment risk by diversifying the investment target. Venture capital also invests capital in unlisted companies that need to be restructured or merged. Assist these companies to complete reorganization or mergers and acquisitions, increase the company's value, and venture capital will also profitably exit.

Schildt, Maula and Keil (2005) and Covin and Miles (2007) pointed out that external corporate venturing investment is often regarded by companies as one of the important strategic options. By investing in other companies, the company can realize the expansion and construction that the company can afford, so that the company can update existing operating activities, enter new markets or master related technologies for new product development. Schildt, Maula and Keil (2005) also finds that corporate venturing mode and technological relatedness have significant effects on the likelihood of explorative learning.

Hellmann and Puri (2002) further pointed out that venture capital is far more active than traditional financial intermediary investment institutions in actively participating in the management of new venture companies; regardless of human resource policies, operating systems and internal organization, Employee stock option plans, marketing channels and other aspects, venture capital investment is actively invested in assisting new ventures to improve the physical fitness of the enterprise and enhance the value of the company.

Research by Bouresli, Davidson and Abdulsalam (2002) showed that the involvement of US venture capital can lead to more independent startup boards and equity structures for startups, which can greatly help startups to promote corporate governance. Inderst and Mueller (2009) pointed out that the average investment amount of US venture capital is twice that of European venture capital, which has

long created a differentiated development of the new ventures supported by the two. Kim and Heshmati (2010) pointed out that with the blessing of venture capital; the development of new startups can inject strong growth momentum, shorten the time to market for companies, maintain core technology competitive advantages, and then improve corporate operating performance and market survival rate.

2.2 External Environmental Factors Affecting Venture Capital

In the past literature, the discussion on the factors that affect venture capital investment is very limited, and it only focused on external environmental factors. Covin and Slevin (1991) finds that the advantages of a firm-behavior perspective on entrepreneurship are discussed, as are the theoretical and managerial implications of such a perspective. Zahra (1993) examined the association between a firm's external environment, corporate entrepreneurship, and financial performance. Jeng and Wells (2000) analyses the determinants of venture capital for a sample of 21 countries. The decisive factors for the vigorous development of the venture capital industry are an active exit mechanism, legal and tax-beneficial policies and an innovative cultural spirit. Some scholars also believe that the region and place where a company is established can also be a factor for evaluating venture capital.

Kenney, Han, and Tanaka (2004) stated that the United States federal government has aided many universities and research institutions with money to invest in a large number of R & D and regional industrial development. This is a key factor in the success of Silicon Valley, the Boston 128 Highway region, and the US venture capital industry. Cumming and MacIntosh (2003), Cumming (2008) and Ball, Chiu and Smith (2011) focus on the considerations, control rights and market conditions when venture capital exits. The empirical research of Nahata (2008) also pointed out that cultivating innovative enterprises and improving their physical fitness depend on establishing an investment environment that fosters innovative growth. The results from these studies can help executives in selecting specific entrepreneurial activities that match the demands of success in their business environment to improve their company's performance.

2.3 Internal Characteristics of Startups Affecting Venture Capital

Of course, there is also some literature analyzing the internal characteristics of startups that venture capital should consider. Empirical research by Hellmann and Puri (2000) showed that innovative firms are more likely to receive venture capital funding than imitator firms. At the same time, with the advantages of venture capital in talent, technology, capital, vision, financial management, etc., innovative entrepreneurs can quickly give creative concepts to new application opportunities in science and technology, and through manufacturing and marketing to show their strengths in the consumer market and seize opportunities.

Lerner's research (2000) confirmed that the number of invention patents granted by startups has an advantage in attracting venture capital. Hellmann, Lindsey and Puri

(2007) examines bank behavior in venture capital. Start-up companies in the early stages of their establishment are less likely to receive financial assistance from the banking industry. If these start-ups are not favored by venture capitals, their unique creativity or technology, product development and marketing will stagnate. Lindsey's research (2008) showed that startups in the "seed stage" or "creation stage" are less likely to be successfully listed or acquired, and may even be forced to liquidate. Fulghieri and Sevilir (2009) pointed out that the more abundant venture capital; the more entrepreneurs can extract more value from the existing resources of venture capital. Driven by interests, entrepreneurs will inevitably make every effort to fulfill their responsibilities, so that the dream of entrepreneurship can come true. Some studies focused on venture capital investment considerations in the human resources of startups, including entrepreneurs and members of startup teams. Senge (1990) emphasized that the startup team participates in individual members' enrolling, engagement, commitment, based on the vision of the envision. The investors and the team of investee companies reviewed the initial operating performance and re-drawn a new vision, and promised new performance indicators with the new team.

Kenney et al. (2004) took Japanese companies as an example. Lifelong employment system, and the operating characteristics of the chaebol and the illiquidity of elites will lead to the entire socio-economic system cannot effectively stimulate high-tech entrepreneurship and entrepreneurship. Kim and Heshmati (2010) stated that the criteria for entrepreneurs to identify entrepreneurs as venture capitalists are business model, related industry work experience, and personal ambitions. Kim and Heshmati (2010) also pointed out that start-up companies guarantee successful development of core technologies through patent, copyright, trademark law, trade secret, confidentiality procedure and contractual provision. These core technologies will build obstacles to market entry and maintain technological competitiveness. Gompers, Kovner, Lerner and Scharfstein (2010) presents evidence of performance persistence in entrepreneurship. Successful entrepreneurs must have market timing ability. In addition, serial entrepreneurs with entrepreneurial experience have a higher chance of success than first-time entrepreneurs.

2.4 Evaluation Mechanism for Venture Capital Investment in new Venture Biotechnology Companies

In the past time, some of the literature focused on exploring assessment criteria of venture capital firms for biotechnology and high-tech industries, Lerner(1994), Zahra(1996), Coombs and Deeds(2000), Deeds, DeCarolis and Coombs(2000) and Baeyens et al.(2006).

Lerner(1994) examines three rationales for the syndication of venture capital investments, using a sample of 271 private biotechnology firms. Lerner(1994) indicates that syndication is commonplace, even in the first-round investments. Experienced venture capitalists primarily syndicate first-round investments to venture investors with similar levels of experience. In later rounds, established

venture capitalists syndicate investments to both their peers and to less experienced capital providers. Zahra(1996) provides a study of corporate-sponsored and independent biotechnology ventures. Zahra(1996)reports the results of a study that explored the differences in the technology strategies and performance of corporate and independent ventures. The biotechnology industry was chosen to test the study's hypotheses, using 112 ventures.

Coombs and Deeds(2000)empirically tested the relationship between three signaling mechanisms (scientific capabilities, firm location and top management team international experience) and the amount of capital raised through international strategic alliances. The number of patents held by the firm, firm location and the number of products in stage III of development were found to be significant. Implications for managers and researchers are discussed. Deeds, DeCarolis and Coombs (2000)develops a model of new product development which is tested on a sample of 94 pharmaceutical biotechnology companies. Deeds, DeCarolis and Coombs (2000) hypothesize that new product development capabilities are a function of a firm's scientific, technological, and managerial skills. To test this relationship, Deeds, DeCarolis and Coombs (2000) develop several firm specific measures in an attempt to triangulate in on the core construct of firm specific new product development capabilities. Baeyens et al.(2006)analyses venture capitalists' selection process in biotechnology ventures. Biotech ventures operate in an extremely risky environment making this an interesting research setting. The majority of venture capitalists exclude certain biotech sectors ex-ante because of regulatory uncertainty, the long development process to a market ready product and the difficulty to understand the technology. The more thorough due diligence process focusses on financial, market and technology criteria. These documents propose a number of evaluation criteria for corporate finance, business model, human resources, product advantages and industry prospects respectively. There is almost no literature on venture capital companies for polysaccharide biotechnology industry.

3. Research Steps and Methodologies

Literature review and modified Delphi approach were aims to construct the hierarchical framework on this study. Following by the establishment of hierarchy architecture, fuzzy analytic hierarchy process (FAHP) was used to calculate overall weights and priorities of the elements. The explanation of main study procedure is as follow:

Step 1. Defining study subject, question description and study purpose.
Step 2. Collecting and arranging related articles.
Step 3. Using modified Delphi approach separates hierarchy process structure to become 5 assessment criteria and 24 sub-criteria.
Step 4. Using analytic hierarchy process structure to develop professional questionnaire.

Step 5. Using FAHP to proceed analysis and gains the weight and arrangement of criterion and sub-criterion.
Step 6. Having empirical analysis and conclusion.

3.1 Modified Delphi Approach

Aims on the Delphi approach developed in the nineteen-forties, twentieth century. The study method is an anonymous questionnaire method that uses several times of questionnaire issuing to collect opinions from all experts. On the other hand, The Delphi approach composes the common views from experts using description the statistics to present. The experts cannot discuss and connect to each other's; they only can contact with researchers.

The experts' opinions, researchers can gradually receive the consensus decision method of predicting results. The successful factors of the study method are expert panel, including reliability and validity, anonymity, feedback control, consensus, and the role of the researcher. Besides, Couper (1984) thinks that there are three important factors to complete Delphi approach: for enough time, the competent of participants, and the will of attendance and inductive questionnaire compiling. The study process of Delphi approach is defining main topic, choosing participating experts, processing the first round, second round and third round of questionnaires and the of analysis.

Until today since development, Delphi approach has been widely applied by the study of arts and social science of education, commerce, politics and international environment. Delphi approach is a prediction and analysis method that commonly be used by the most of researchers of social science in modern society. Murry and Hommons (1995) submit the operation method of Delphi approach. The concrete implementation method of Modified Delphi approach and statistics method, and traditional Delphi approach are almost the same. The difference is that Murry and Hommons (1995)omit the complicated process of opening questionnaire test in the first round. Through the results of the study from related references, the projects of researchers or the conclusions of expert interviews are directly developing to structure questionnaire. Modified Delphi approach the study and to eliminate the conjecture toward opening questionnaires and increase the recovery ration of questionnaires. Moreover, no matter using Delphi approach or Modified Delphi approach, researchers should carefully avoid experts who incline to choose partial information and adventure attitude during acceptance testing. Experts who participated study process should judge independently and not be affected by the others, so the result of the study can be accurate.

3.2 Fuzzy Analytic Hierarchy Process

Van Laarhoven and Pedrycz (1983), using the concept of fuzzy to solve the values in the pair wise comparison matrix with subjectivity, imprecision and vagueness…etc in traditional Analytic Hierarchy Process (AHP), who stated Fuzzy Analytic Hierarchy Process. Literature review and Delphi technique were adopted

to construct the hierarchical frameworkon this study. Following by the establishment of hierarchy architecture, each evaluator respectively enables to give pair wise comparison matrices of the ultimate goal and criteria by a nine-point scale. To ensure the logic judgment of expert or evaluator fulfills the consistency, Consistency Ratio (CR) is used to measure (Wind and Saaty, 1980).

$$CR = \frac{CI}{RI} \tag{1}$$

Consistency Index(CI) in which $\lambda_{\max}$ is the maximum eigenvalue, obtains n-dimension of the matrix.

$$CI = \frac{\lambda_{\max} - n}{n-1} \tag{2}$$

For randomly generated weights, Random Index(RI) is the average index. The level of Consistency of matrix is satisfying if the value of CR is less than 0.1.

Buckley (1985) reported the adoption of geometric mean to integrate the opinions of experts enables to enhance consistency and precision of factor judgment. The score of geometric mean from all survey respondents is made up as the middle value of TFN on this study. The largest value and the smallest value of score among all survey respondents are made up respectively as the upper bound and lower bound of TFN. Subsequent to the combined opinions from all experts, the fuzzy positive reciprocal matrix is built immediately.

Lambda-max method reported by Csutora and Buckley (2001) was applied on this study to calculate fuzzy weights. According to the fuzzy positive reciprocal matrix, there are 6 main calculated procedures:

1) Take the judgment matrix $T_m = [m_{ii'}]$ with the grade of membership as 1 to seek crisp weight W_m.

$$W_m = \left(W_{1m}, W_{2m}, ..., W_{im}, ..., W_{nm}\right) \tag{3}$$

2) Take the judgment matrices $T_l = [l_{ii'}]$ and $T_u = [u_{ii'}]$ with the grade of membership as 0 to seek the lower bound weights W_l and upper bound weights W_u respectively.

$$W_l = \left(W_{1l}, W_{2l}, ..., W_{il}, ..., W_{nl}\right) \tag{4}$$

$$W_u = \left(W_{1u}, W_{2u}, ..., W_{iu}, ..., W_{nu}\right) \tag{5}$$

3) Take the crisp judgment matrix T_m to proceed Consistency Test.

4) Seek adjustment coefficient to ensure the weight as fuzzy number.

$$Q_l = \min_{1\le i\le n}\left\{\frac{W_{im}}{W_{il}}\right\} \tag{6}$$

$$Q_u = \max_{1\le i\le n}\left\{\frac{W_{im}}{W_{iu}}\right\} \tag{7}$$

5) Seek adjustment lower bound weights W_l^* and adjustment upper bound weights W_u^*.

$$W_l^* = Q_l W_l \tag{8}$$

$$W_u^* = Q_u W_u \tag{9}$$

6)Integrate W_l^*, W_m and W_u^*, to obtain fuzzy weights $\tilde{W}$.

$$\tilde{W} = \left(W_l^*, W_m, W_u^*\right) \tag{10}$$

$\tilde{T}_1 = (l_1, m_1, u_1)$ and $\tilde{T}_2 = (l_2, m_2, u_2)$ are hypothesized as two TFNs. Chen (2000) reported the vertex method can be applied to define the distance between two triangular fuzzy numbers (TFNarithmetical method of which is as equation (11).

$$d\left(\tilde{T}_1, \tilde{T}_2\right) = \sqrt{\tfrac{1}{3}\left[(l_1 - l_2)^2 + (m_1 - m_2)^2 + (u_1 - u_2)^2\right]} \tag{11}$$

The use of distance formula is able to make fuzzy number be defuzzier as R.

$$R = \frac{d}{d^- + d^*} \quad \text{where } d^- = d\left(\tilde{T}, \tilde{T}^-\right) \text{ and } d^* = d\left(\tilde{T}, \tilde{T}^*\right) \tag{12}$$

The best case value is set up as $\tilde{T}^* = (1,1,1)$, and the worst case value is as $\tilde{T}^- = (0,0,0)$. The defuzzier is the subsequence of proceeding fuzzy number and produces the adequate index, the benchmark of comparison. On this study, the value of R stands for the value in the wake of defuzzier. The larger the value of R, the more precedential sequence the factor stands for.

4. Empirical Results

4.1 Hierarchy Process Structure

According to the relevant literatures and the operation results of Modified Delphi Approach, this study builds up the hierarchical analysis structure of study subject. Table 1 shows 5 item of criteria and 24 items of sub-criteria as below.

Table 1: Hierarchical Analysis Structure

Level I Subject	Level II Criteria	Level III Sub-criteria
Venture Capital Evaluation for the Biotech Investment of Taiwan Rice-Bran Polysaccharide	A. Corporate Finance	A1. Capital Structure
		A2. Financial Statement
		A3. Credit Records
		A4. Initial Investment
		A5. Government Investment and Subsidy
	B. Corporate Management	B1. Entrepreneurial Stage
		B2. Business Model
		B3. Marketing Strategy
		B4. Internal Management
		B5. Management System
	C. Human Resources	C1. Entrepreneurship
		C2. R&D Team Background and Capabilities
		C3. Management Team Capabilities
		C4. External Allies' Resources
		C5. Internal Training Program
	D. Product Advantages	D1. Product Technology Uniqueness
		D2. Intellectual Property Rights
		D3. R&D Expenditure
		D4. Follow-up Products
		D5. Production Quality
	E. Industry Prospect	E1. Macroeconomic Factors
		E2. Industrial Policy
		E3. Market Analysis
		E4. Import and Export Trade Variables

4.2 FAHP Results Analysis

Among these questionnaires, 21 copies were issued to experts in the industries of Taiwan enterprises. Then, 20 copies were retrieved; therefore, the overall response rate of effective questionnaires is 95.23%. The results of the analysis are shown in the followings. According to the study method, fuzzy pairwise comparison matrix of each criterion in level 2 is compiled as equation (13).

$$T_2 = \begin{bmatrix} (1,1,1) & (0.20,1.02,6.00) & (0.17,1.30,5.00) & (0.14,1.97,5.00) & (0.17,1.18,6.00) \\ (0.17,0.98,5.00) & (1,1,1) & (0.17,1.39,6.00) & (0.17,1.59,7.00) & (0.14,1.13,6.00) \\ (0.20,0.77,6.00) & (0.17,0.72,6.00) & (1,1,1) & (0.20,1.32,5.00) & (0.17,0.97,5.00) \\ (0.20,0.51,7.00) & (0.14,0.63,6.00) & (0.20,0.76,5.00) & (1,1,1) & (0.14,0.78,6.00) \\ (0.17,0.85,6.00) & (0.17,0.89,7.00) & (0.20,1.03,6.00) & (0.17,1.28,7.00) & (1,1,1) \end{bmatrix} \quad (13)$$

Accordingly, the fuzzy weights of each criterion in level 2 are showed as equation (14) to equation (18).

$$W_A = [0.14 \quad 0.25 \quad 0.25] \quad (14)$$

$$W_B = [0.13 \quad 0.23 \quad 0.26] \quad (15)$$

$$W_C = [0.15 \quad 0.18 \quad 0.24] \quad (16)$$

$$W_D = [0.14 \quad 0.14 \quad 0.26] \quad (17)$$

$$W_E = [0.14 \quad 0.20 \quad 0.28] \quad (18)$$

The fuzzy pairwise comparison matrices of sub-criteria under the criteria of corporate finance, corporate management, human resources, product advantages and industry prospect in level 2 are compiled respectively as equation (19) to equation (23).

$$T_{31} = \begin{bmatrix} (1,1,1) & (0.25,1.30,5.00) & (0.20,1.24,5.00) & (0.17,1.47,7.00) & (0.25,1.72,7.00) \\ (0.20,0.77,4.00) & (1,1,1) & (0.17,1.07,5.00) & (0.17,1.35,6.00) & (0.14,1.34,7.00) \\ (0.20,0.81,5.00) & (0.20,0.94,6.00) & (1,1,1) & (0.17,1.06,6.00) & (0.17,1.59,6.00) \\ (0.14,0.68,6.00) & (0.17,0.74,6.00) & (0.17,0.94,6.00) & (1,1,1) & (0.14,1.29,5.00) \\ (0.14,0.58,4.00) & (0.14,0.74,7.00) & (0.17,0.63,6.00) & (0.20,0.77,7.00) & (1,1,1) \end{bmatrix} \quad (19)$$

$$T_{32} = \begin{bmatrix} (1,1,1) & (0.14,0.56,4.00) & (0.17,1.14,6.00) & (0.17,0.77,4.00) & (0.14,0.85,6.00) \\ (0.25,1.80,7.00) & (1,1,1) & (0.20,1.85,5.00) & (0.33,1.66,6.00) & (0.14,1.30,6.00) \\ (0.17,0.88,6.00) & (0.20,0.54,5.00) & (1,1,1) & (0.17,0.98,4.00) & (0.14,1.19,7.00) \\ (0.25,1.29,6.00) & (0.17,0.60,3.00) & (0.25,1.02,6.00) & (1,1,1) & (0.14,2.01,5.00) \\ (0.17,1.18,7.00) & (0.17,0.77,7.00) & (0.14,0.84,7.00) & (0.20,0.50,7.00) & (1,1,1) \end{bmatrix} \quad (20)$$

$$T_{33} = \begin{bmatrix} (1,1,1) & (0.20,1.26,6.00) & (0.17,1.29,5.00) & (0.14,2.01,7.00) & (0.17,2.48,7.00) \\ (0.17,0.80,5.00) & (1,1,1) & (0.20,1.17,5.00) & (0.25,1.76,6.00) & (0.25,2.42,6.00) \\ (0.20,0.77,6.00) & (0.20,0.86,5.00) & (1,1,1) & (0.50,2.07,5.00) & (0.17,2.57,6.00) \\ (0.14,0.50,7.00) & (0.17,0.57,4.00) & (0.20,0.48,2.00) & (1,1,1) & (0.14,1.38,6.00) \\ (0.14,0.40,6.00) & (0.17,0.41,4.00) & (0.17,0.39,6.00) & (0.17,0.73,7.00) & (1,1,1) \end{bmatrix} \quad (21)$$

$$T_{34} = \begin{bmatrix} (1,1,1) & (0.25,1.18,6.00) & (0.14,0.88,5.00) & (0.20,2.36,6.00) & (0.20,1.83,6.00) \\ (0.17,0.85,4.00) & (1,1,1) & (0.17,0.61,5.00) & (0.25,1.74,6.00) & (0.17,1.47,7.00) \\ (0.20,1.14,7.00) & (0.20,1.64,6.00) & (1,1,1) & (0.33,2.52,7.00) & (0.17,2.11,6.00) \\ (0.17,0.42,5.00) & (0.17,0.58,4.00) & (0.14,0.40,3.00) & (1,1,1) & (0.17,0.67,2.00) \\ (0.17,0.55,5.00) & (0.14,0.68,6.00) & (0.17,0.47,6.00) & (0.50,1.49,6.00) & (1,1,1) \end{bmatrix} \quad (22)$$

$$T_{35} = \begin{bmatrix} (1,1,1) & (0.20,1.27,6.00) & (0.25,1.30,7.00) & (0.17,2.30,6.00) \\ (0.17,0.79,5.00) & (1,1,1) & (0.20,1.37,4.00) & (0.14,1.51,6.00) \\ (0.14,0.77,4.00) & (0.25,0.73,5.00) & (1,1,1) & (0.17,1.67,5.00) \\ (0.17,0.44,6.00) & (0.17,0.66,7.00) & (0.20,0.60,6.00) & (1,1,1) \end{bmatrix} \quad (23)$$

Accordingly, the fuzzy weights of sub-criteria under the criteria of corporate finance in level 2 are as equation (24) to equation (28).

$$W_{A1} = [0.18 \quad 0.26 \quad 0.26] \quad (24)$$

$$W_{A2} = [0.15 \quad 0.21 \quad 0.24] \quad (25)$$

$$W_{A3} = [0.16 \quad 0.21 \quad 0.25] \quad (26)$$

$$W_{A4} = [0.14 \quad 0.18 \quad 0.25] \quad (27)$$

$$W_{A5} = [0.14 \quad 0.14 \quad 0.26] \quad (28)$$

The fuzzy weights of sub-criteria under the criteria of corporate management in level 2 are as equation (29) to equation (33).

$$W_{B1} = [0.15 \quad 0.16 \quad 0.25] \quad (29)$$

$$W_{B2} = [0.21 \quad 0.29 \quad 0.29] \quad (30)$$

$$W_{B3} = [0.16 \quad 0.17 \quad 0.27] \quad (31)$$

$$W_{B4} = [0.18 \quad 0.22 \quad 0.25] \quad (32)$$

$$W_{B5} = [0.16 \quad 0.16 \quad 0.33] \quad (33)$$

The fuzzy weights of sub-criteria under the criteria of human resources in level 2 are as equation (34) to equation (38).

$$W_{C1} = [0.11 \quad 0.28 \quad 0.28] \tag{34}$$

$$W_{C2} = [0.13 \quad 0.24 \quad 0.25] \tag{35}$$

$$W_{C3} = [0.15 \quad 0.24 \quad 0.26] \tag{36}$$

$$W_{C4} = [0.10 \quad 0.13 \quad 0.23] \tag{37}$$

$$W_{C5} = [0.10 \quad 0.10 \quad 0.26] \tag{38}$$

The fuzzy weights of sub-criteria under the criteria of product advantages in level 2 are as equation (39) to equation (43).

$$W_{D1} = [0.13 \quad 0.25 \quad 0.27] \tag{39}$$

$$W_{D2} = [0.12 \quad 0.20 \quad 0.26] \tag{40}$$

$$W_{D3} = [0.14 \quad 0.30 \quad 0.30] \tag{41}$$

$$W_{D4} = [0.11 \quad 0.11 \quad 0.18] \tag{42}$$

$$W_{D5} = [0.14 \quad 0.14 \quad 0.27] \tag{43}$$

The fuzzy weights of sub-criteria under the criteria of industry prospect in level 2 are as equation (44) to equation (47).

$$W_{E1} = [0.17 \quad 0.34 \quad 0.34] \tag{44}$$

$$W_{E2} = [0.15 \quad 0.27 \quad 0.29] \tag{45}$$

$$W_{E3} = [0.16 \quad 0.24 \quad 0.27] \tag{46}$$

$$W_{E4} = [0.16 \quad 0.16 \quad 0.34] \tag{47}$$

4.3 Final Fuzzy Weights and Defuzzier Values

After that, the fuzzy weights of each criterion in level 2 multiplied by the fuzzy weights of each sub-criteria. The defuzzier values (R) of each sub-criteria and final fuzzy weights are presented in Table 2.

Table 2: Final Fuzzy Weights and Defuzzier Values

Rank	Sub-Criteria	Final Fuzzy Weights	Defuzzier (R) Values
1	E1. Macroeconomic Factors	(0.0248,0.0656,0.0941)	0.0673
2	B2. Business Model	(0.0279,0.0676,0.0760)	0.0606
3	E4. Import and Export Trade Variables	(0.0222,0.0304,0.0943)	0.0580
4	E2. Industrial Policy	(0.0215,0.0534,0.0800)	0.0566
5	B5. Management System	(0.0217,0.0381,0.0859)	0.0552
6	A1. Capital Structure	(0.0252,0.0638,0.0638)	0.0539
7	E3. Market Analysis	(0.0228,0.0464,0.0748)	0.0523
8	D3. R&D Expenditure	(0.0192,0.0418,0.0780)	0.0520
9	C1. Entrepreneurship	(0.0156,0.0517,0.0691)	0.0503
10	B4. Internal Management	(0.0246,0.0506,0.0653)	0.0496
11	B3. Marketing Strategy	(0.0218,0.0403,0.0720)	0.0490
12	A3. Credit Records	(0.0222,0.0507,0.0614)	0.0476
13	A2. Financial Statement	(0.0209,0.0523,0.0593)	0.0471
14	D1. Product Technology Uniqueness	(0.0176,0.0356,0.0708)	0.0466
15	C3. Management Team Capabilities	(0.0220,0.0438,0.0628)	0.0459
16	C2. R&D Team Background and Capabilities	(0.0188,0.0447,0.0623)	0.0454
17	B1. Entrepreneurial Stage	(0.0200,0.0379,0.0664)	0.0454
18	A4. Initial Investment	(0.0192,0.0437,0.0615)	0.0448
19	D5. Production Quality	(0.0202,0.0202,0.0711)	0.0439
20	D2. Intellectual Property Rights	(0.0167,0.0279,0.0682)	0.0434
21	A5. Government Investment and Subsidy	(0.0199,0.0353,0.0634)	0.0433
22	C5. Internal Training Program	(0.0149,0.0184,0.0646)	0.0394
23	C4. External Allies' Resources	(0.0153,0.0243,0.0561)	0.0362
24	D4. Follow-up Products	(0.0150,0.0153,0.0471)	0.0297

According to Table 2, based on the analysis results of the FAHP expert questionnaire, the venture capital industry invests in the evaluation mechanism of Taiwan Rice-Bran Polysaccharide biotechnology. The most important first five items are E1. Macroeconomic Factors (R value = 0.0673), B2. Business Model (R value = 0.0606), E4. Import and Export Trade Variables (R value = 0.0580), E2. Industrial Policy (R value = 0.0566), and B5. Management System (R value = 0.0552). The top five of Sub-Criteria belong to Group B and Group E in Level II Criteria. This shows that the experts interviewed paid special attention to the content of Corporate Management and Industry Prospect. Starting from the 6th Sub-Criteria (A1 Capital structure, R value = 0.0539), there are Sub-Criteria of other groups. It is worth noting that, including E3 Market Analysis (R value = 0.0523), the Sub-Criteria of Criteria Group E has a high weight score. These empirical results reveal that the experts surveyed generally believe that external economic factors and policies have seriously affected the investment decision of the venture capital industry in Taiwan's biotech startups. This result echoes the industrial characteristics of the biotechnology industry with high-risk investment, long research and development, susceptibility to policy influences, and susceptibility to international economic fluctuations. If the general environment is not good or the international economic situation is uncertain, the venture capital industry can easily stay away from investment cases in the biotechnology industry. This may also be related to the global economic situation deeply affecting the direction of capital flow and investment willingness. When the systemic risks of the financial market increase, the venture capital industry will not rush to invest in investment cases that have no special highlights or low profit guarantees. And regardless of the economic environment, government policy support will always provide practical help for the survival of new companies and the development of new technologies. Of course, the venture capital industry will be more assured to invest funds and resources in projects supported by government policies. In addition, the B2. Business Model and B5. Management System in the Sub-Criteria also received high weight scores. This shows that the venture capital industry attaches great importance to the operating models and actual projects of biotech startups. Projects in the biotechnology industry are all-encompassing. It can't be denied that many pseudo-biotech startups that are not so high-tech have tried hard to pack themselves. The technological developments involved in these ventures are often not realized in the contemporary era. Even some venture capital cases are difficult to avoid suspected fraud or illegal money. The venture capital industry still has to choose clear and feasible development projects and new products or new technologies that have the possibility of profit, without blindly investing.

Also, Sub-Criteria E3. Market Analysis (R value = 0.0523), D3. R&D Expenditure (R value = 0.0523) and C1. Entrepreneurship (R value = 0.0503) are not low in weight scores, ranking 7th and 9th. Broadly speaking, E3. Market Analysis and D3. R & D Expenditure has a great correlation with the overall economic factors and the operating profit models and product operation items of individual companies. Therefore, obtaining a higher weight score is also a reasonable result. Sub-Criteria

C1. Entrepreneurship has not received a low weight score, but it still can't be among the best. This also shows that when assessing investment cases, the venture capital industry is increasingly focus on startup's external economic and environmental factors and the company's actual business model. Entrepreneurship, traditionally valued, is no longer a guarantee of success in venture capital. Relatively, although the personal characteristics of Entrepreneurship and entrepreneurs can bring confidence to investors, investors seem to be more concerned about specific performance results.

The five Sub-Criteria ranked by weight score are D2. Intellectual Property Rights (R value = 0.0434), A5. Government Investment and Subsidy (R value = 0.0433), C5. Internal Training Program (R value = 0.0394) , C4. External Allies' Resources (R value = 0.0362) and D4. Follow-up Products (R value = 0.0297). This shows that the experts tested did not think that the patents and intellectual property rights currently owned by biotech startups, and whether the company has government investment, will be their main considerations. The main reason is that the investment objects faced by the venture capital industry in this field usually do not have products and technologies that are immediately profitable. And obviously, at the stage of venture capital investment, these new start-up companies can not provide specific guarantees for the subsequent product or technology development. At the same time, the venture capital industry also believes that government funding and technology investment is not a guarantee for the success of biotechnology startups. In the early stage of the company's establishment, there were too many factors that could lead to the company's poor management or even its failure. Based on past experience, in the investment cases of government funds and technology investment, the cases that ultimately ended in failure are not few. After all, investment cases that require government funds and technology investment in the early stages of development are usually highly forward-looking, but also highly risky. These investment cases cannot be favored by private investment in the early stage. Moreover, C5. Internal Training Program and C4. External Allies 'Resources also received low weight scores. The main reason is that in the early stage of development of a new company, the R & D and business management team has just been established, how to keep the company alive is the top priority. Internal Training Program should be an important issue that will only be encountered after the sustainable development of enterprises. Biotech companies had few opportunities to obtain External Allies 'Resources at the beginning. Obtaining investment from the venture capital industry will not only enable new venture biotechnology companies to obtain funding, but more importantly, obtain External Allies 'Resources. This is undoubtedly an important opportunity for the sustainable development of the company. However, this is also an issue that enterprises need to pay attention to after entering the development period. Therefore, the venture capital industry does not need to use External Allies 'Resources as the basis for whether an investment case is worth investing.

In addition, it is worth noting that the Defuzzier Values obtained by all the Sub-Criteria in the hierarchical analysis structure do not differ greatly from each other.

The Defuzzier Values of the first and last Sub-Criteria are only 0.0376. It can be seen that such Sub-Criteria may also make it difficult for experts to choose. The difference in weight scores obtained by each Sub-Criteria is not too different. After all, the situation of each new venture and the investment cases faced by each venture capital company are different. The opinions provided by the experts tested in this study certainly differ.

5. Conclusions and Recommendation

We can find out that from an expert perspective, the industry prospect and corporate management will be the most important consideration for the company's continued survival. The empirical result of this study shows that when Taiwan's venture capital industry evaluates Rice-Bran Polysaccharide's biotechnology investment, Macroeconomic Factors, Business Model, Import and Export Trade Variables, Industrial Policy and Management System should be considered at the first place.

Another layer of meaning, business management should focus on business model breakthroughs and innovations; especially venture capital investment should focus on the evaluation of decision-making mechanisms in the business model of the enterprise, and listed as an item with a high proportion of investment weight. This subverts the biased thinking of the general venture capitalist to assess the company as the most important assessment item in corporate finance. The company's profit and loss statement and balance sheet represent the past performance of the company, not the future prospects.

In the past, the actual success rate of investment projects executed by venture capital firms in the past few decades may be only 10%-20%. Various traditional financial data and standardized analysis methods are provided as the basis for decision-making through analysis reports of professional investors. Venture capital professionals are influenced by traditional methods, experiences, self-awareness, or subjective consciousness, resulting in a low investment success rate in the venture capital industry for decades. Therefore, the current study specifically uses Taiwanese rice bran polysaccharide as a case study. This study aim to develop a better decision mechanism of venture capital on biotechnology industry. It is expected that the research results will help new ventures to obtain more funds smoothly, and the success rate of the venture capital industry will be further improved. This will be an important factor for the smooth development and success of the polysaccharide technology in the biotechnology industry.

The MATLAB software was used in the study to analyze the actual data to obtain the data results generated by the Fuzzy Analytic Hierarchy Process (Fuzzy AHP). The results of the study show the hierarchical weights and rankings of various evaluation criteria such as corporate finance, business model, human resources, product advantages and industry prospects. This study uses a hybrid approach that attempts to capture research that was not possible in the past, either qualitative or quantitative. The results of this study have made a major breakthrough contribution to the improvement of the success rate of venture capital investment in

biotechnology industry. The main reason is to re-establish the method of analyzing the key factors of decision-making and establish an effective evaluation mechanism. Different professionals also improve the correctness and appropriateness of the expert questionnaire.

The results of this study also complement the practical reasons why academics in the field for decades have not been able to truly confirm the low success rate of investment in the venture capital industry. This major breakthrough will greatly increase the success rate of the venture capital industry investing in biotechnology industry technology.

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