

Review of Feasibility Study

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ABSTRACT. *Feasibility study is a comprehensive system analysis approach for project decision-making, which gradually becomes a basic procedure before projects implementation. This review introduces the emergence, application and development of feasibility study at home and abroad, summarizing the current situation of feasibility study, analyzing its existing problems and laying the foundation for further study.*

Keywords: feasibility study, project evaluation, project decision-making

1. Introduction. Feasibility study is a scientific analysis approach to evaluate the project's potential for success. By investigating the project from technical, economic, social and other aspects, comparing the possible scenarios and predicting the economic and social benefits after the project completion, feasibility study examines the technical advancement and versatility, the economical rationality and profitability as well as the operational possibility and feasibility of the project. It appeared first in economic evaluation in order to objectively and rationally uncovers the strengths and weaknesses of an existing business or proposed venture, opportunities and threats present in the environment and the resources required to carry through [1-2], whose main purpose is to assess whether a project can be achieved or succeeded.

As a comprehensive science, feasibility study involves the knowledge in three areas, technical, economic and natural science. It has been widely used in the enterprise investment, engineering projects, research subjects and infrastructures [3]. In general, its functions are as followed:

It is the basis for the project investment decision and the preparation of feasibility study

report.

- (1) It is the basis for fundraising and applying for loans.
- (2) It is the basis for signing a contract or agreement with other departments.
- (3) It is the basis for designing, ordering, and preparation during the period of pre-construction.
- (4) It is the basis for developing new technology or equipment to be used in the project, as well as the basis for topographic, geographical, industrial test. The development plan of new technology or equipment cannot be formulate until it is proved feasible.
- (5) It is the basis for environmental impact assessment and building permit applications.
- (6) It is the basis for project post-evaluation.
- (7) It is the basis for business management, such as organizational management, institutions settings, labor capacity, and staff training and so on.

With the development of science and technology , market economy and management science, feasibility study theory has been continuously enriched and developed and has become the Internationally accepted project evaluation method.

2. The Emergence of Feasibility Study and Its Application in Western Countries. The term “feasibility” first appeared in 1624, with the meaning of “capability of being done or being made; practicability”. The study to test practicability is called “feasibility study” [4].

2.1. Generation and Development Nascent Stage (the late 1800s to the mid -1950s). In the end of the 18th century, Benjamin Franklin analyzed and evaluated the projects by listing the positive (benefits) and negative (costs) factors, measuring them separately and then conducting comprehensive evaluation. In 1844, Jules Dupuit [5], a French engineer, first propounded the concept of consumer surplus in his on the Measurement of the Utility of Public Work, but it was the English economist Alfred Marshall [6] who gave the concept its fame in the stream of economics. The idea of consumer surplus laid the foundation for cost-benefit analysis and became the prototype of feasibility study. In the 1930s, for the first time, the United States conducted the feasibility study in the development of Tennessee River and obtained a satisfactory result. In the process of controlling flood, the US followed a principle that the project is feasible once the benefits overweigh the costs. In 1936, the United State congress passed the Flood Control Bill, officially stating that the evaluation of the flood control and waters exploitation projects should carry out cost-benefit analysis. Since then, the method has been widely used in various public projects and played an important part in the construction area. However, during this period, the investment decisions are made relying on financial evaluation, that is, the success or failure of a project is decided by the comparison of its income and expenditure. With the developing society, simple financial evaluation cannot meet the diversified demands of society, government and enterprises.

2.2. Development stage (the 1950s to the late 1960s). From the 1950s to the late 1960s, feasibility study began to analyzing the economic benefits from the microscopic and macroscopic view instead of focusing on financial analysis. In 1950, the United States

published River Basin Project Economic Analysis of the Practical Methods [7], setting out the principles and procedures for cost-benefit analysis, as well as the relationships between the project benefits and gross national product. Later, the Dutch econometrician Jan Tinbergen [8] first proposed the use of shadow price in economic evaluation, improving the economic evaluation theory. In 1965, the United States implemented the Program Planning and Budget System (PPBS) [9] to link budgets, program design and project decisions. Government was required to review all kinds of plans by cost-benefit analysis. Although the system has not been sustained for a long time, it promoted the application of cost-benefit analysis in other areas.

2.3. Theoretical Improvement Phase (since the 1970s) . In 1968, the economists I·Little and J·Mirrlees [10] compiled Project appraisal and planning for developing countries [11] for Organization for Economic Co-operation and Development (OECD) and proposed the Little-Mirrlees approach(L-M approach or OECD approach).

In the 1970s, the feasibility study was further developed. In 1972, P·Dasgupta, A·Sen and S·Marglin wrote Guidelines for Project Evaluation [12] for United Nations Industrial Development Organization. They put forward UNIDO approach, which laid the foundation for the development of feasibility study.

Soon after, the United Nations published the Manual on the Use of Consultants in Developing Countries (1972) [13], Extracts of Industrial Feasibility Studies (1973) [14] and other Guidance Documents which promoted the progress in feasibility study theory.

In 1975, the World Bank researchers Bruce, van der Tak and Squire published The Economic Evaluation of Projects [15]. The book presented a new methodology called S-V-T approach or S/T approach and gave a detailed derivation of the calculation of the shadow price and the weight in the social analysis. It argues that financial analysis is the first step in project evaluation progress, and then economic analysis, and finally social analysis, among which financial analysis is the basis for project decision-making. The S-V-T approach and L-M approach share the similar view on the main problem.

In 1977, the United Nations Industrial Development Organization and Industrial Development Center for Arab States published Manual for Evaluation of Industrial Projects [16], in which the project evaluation is divided into commercial profitability evaluation and national profitability evaluation. And it initiated the concept of social analysis which was considered the best way to evaluate projects at that time.

In 1978, in order to provide developing countries with a tool to improve the quality of investment advice and to make contribution on the standardization of feasibility studies, the United Nations Industrial Development Organization published Manual for the preparation of industrial feasibility studies [17]. The book defines the main content and calculation methods of feasibility study. At this point, the theoretical framework of feasibility study has been formed and the book has been spread to the world as a basis for the establishment of feasibility analysis standards. In accordance with the book, many countries conduct feasibility study on construction projects. At the same time, international financial institutions such as International Monetary Fund, the World Bank, International Development Association and International Finance Corporation and so on, put the

feasibility study as a necessary condition for loan applications. The requirement also makes countries perform feasibility study in the new construction, renovation and expansion projects. During the process, feasibility study has been popularized.

At the same time, since the 1980s, due to the development of modern industry and the deterioration of the natural environment, it had been found that industrialization had a tremendous impact on the environment and social life. Therefore, economic development has gradually shifted to coordinative development of economy and society. Social impact assessment (SIA) began to use in developed countries. However, the theoretical framework of SIA has been immature yet and it still needs to be further studied. [18]

3. The application and development of feasibility study in China.

3.1. Embryonic Stage (the 1950s or the 1st Five-Year period). Soon after the foundation of People's Republic of China, in order to promote the development of national economy and the cause of socialism, China carried out a large-scale economic construction centered on 156 key construction projects during the 1st Five-Year period. To ensure these projects completed on time, combined with Soviet Union construction procedure with the practice in construction projects, China formulated the fundamental construction procedures, including feasibility study of construction in the preliminary stage. In 1951, the State Finance Committee issued Interim Measures for the Administration of Capital Construction, which is the first official document about capital construction procedures and project management since the founding of new China. With the basic idea "design first, construction second", the policy paper put forward several methods similar to feasibility study, such as program research, construction submissions, technical and economic analysis and so on. In 1956, the State Council issued Decision on strengthening the design work, proposed design is an essential part of capital construction. Under the circumstances, various engineering design institutes flourished and take lots of design tasks.

3.2 Stagnation Stage (the 1960s to the 1970s). During the Great Leap Forward and the Cultural Revaluation, the construction process was negated. The preparation in the pre-capital construction was weakened. Many construction projects violated the economic laws, ignoring economic benefits and causing huge economic losses.

3.3. Recovery and Development Stage (since the late 1970s to the present) . After the 3rd Plenary Session of the 11th Central Committee of the CPC, the traditional capital construction procedures have been taken seriously. In 1978, the State Planning Commission, the State Construction Commission, the Ministry of Finance jointly issued the Regulations on capital construction procedures", stipulating that from planning to completion, a project should go through the following stages, preparing of planning assignment, selecting of construction site, making survey and design with approval, organizing construction after approval of preliminary design being approved and listed in the national annual plan, finishing the project according to the design, conducting acceptance, and delivering.

After 1980, China resumed its activities in the World Bank. In accordance with international practice, the World Bank required constructions projects to provide feasibility study report as the qualification for loan application, which arouse attention to feasibility

study. In January 1981, the State Council promulgated the Provisional Regulations on the Introduction of Technology and the Importation of Equipment, which clearly stipulated that all technical introduction and equipment importation projects should formulate project proposals and feasibility studies, and provided the contents of feasibility study as well as the catalog of its attachments. In 1982, the State Planning Commission requested attention to the preliminary work of investment projects, incorporating internationally accepted "feasibility study" into the capital construction process. In the same year, the State Council approved the establishment of the China International Engineering Consulting Corporation (CIECC).

In February 1983, the State Planning Commission formulated and promulgated Interim Measures for the Administration of the Implementation of the Feasibility Study on the Construction Projects [19], making systematic provisions on the scope and preparation process of feasibility study report as well as the content of the project economic evaluation, reiterating that feasibility study is an important part of pre-construction and the basic section of the capital construction process. The interim measure clearly pointed out that in the feasibility study stage, if the project economy is unreasonable, it may be rejected, thus paving the way for the application of feasibility study in China. This regulation is still under implementation. In the same year, China Investment Bank prepared Industrial Loan Project Evaluation Manual (Trial) [20], which played an exemplary role in China's project evaluation.

In 1985, the State Science and Technology Commission, the State Council Technical and Economic Center wrote *Economic evaluation method for feasibility study on industrial construction projects* -enterprise economic evaluation [21].

In 1987, the State Planning Commission and the Ministry of Construction issued Economic Evaluation Methods and Parameters on Construction Project, with the second edition published in 1993 and the third in 2006. Since then, the national ministries have issued documents one after another, detailing the feasibility study within their respective jurisdiction.

In 1988, China began to conduct the post-project evaluation, and gradually formed a set of post-evaluation methods with Chinese characteristics.

In April 2002, the State Planning Commission formulated and promulgated the Guidelines of Investment Project Feasibility Study [22]. The book has summed up the lessons of feasibility study since the domestic reform and opening up, learning from the experience of international feasibility study, striving to meet the actual situation in China, and following the international practice as much as possible.

In July 2004, the State Council promulgated Decision on Investment System Reform. According to the principle of "the one making investment, decisions, or benefits is who takes the risks", the examine system on projects with government directly or indirectly investment and the approval system on the project without government investment, which have a significant impact on feasibility study in China.

On September 15, 2004, in accordance with The Administrative License Law of the People's Republic of China and Decision of the State Council on the Reform of the

Investment System, the National Development and Reform Commission (NDRC) formulated the "Interim Measures for Examining and Approving Enterprises Investment Projects" for the purpose of standardizing the examination and approval by the government of enterprises' investment projects.

In 2008, the National Development and Reform Commission (NDRC) issued Administrative Measures for the Post-evaluation of Projects Funded by the Central Government (for Trial Implementation). It is required that the project feasibility study report and the main contents of the approval documents should be compared with the actual results achieved after the completion of the project to find gaps, sum up lessons, put forward the reasonable suggestions, and continuously improve the level of investment decision-making and investment benefits.

4. The Theories and Present Situation of Feasibility Study.

4.1. The Western theories on feasibility study. Since the 1980s, feasibility study has gradually penetrated into various fields. It has been widely discussed in the basic theory, methodology and application.

Many researchers have analyzed the uncertainty and risk of project investment in detail, perfecting the feasibility study theory. In 1967, Myers and Marquis [23] conducted a series of empirical studies on market and technical risks, which was acknowledged by the academic community as the budding of research on evaluation indicator of venture capital. Afterwards, Tyebjee and Bruno [24] contributed the further advancement of evaluation indicator research for venture capital projects, and analyzed the US venture capital project from five dimensions, namely market attractiveness, management capability, product irreplaceability, ability to resisting environmental threats and the ability to cash out. However, their study still remains at the qualitative level, lack of the support of quantitative analysis. Moriarty and Komik argued that the most significant indicators of project evaluation are market indicators and technical indicators, while Souder and Bethay, the scholars of the same period, believed that commercial, market and technical indicators are more important. Beley divided the indicators into six categories: technology, capital, design, cost and schedule, support systems and external factors [25]. Ross, Margaret Lee Hamel [26] argued that in the assessment of venture capital projects, various factors had different weighs and priorities. Management enjoyed the highest priority, followed by marketing, product R&D, financial management, and production management. Some scholars believe that technical risk assessment in high-tech projects is a critical part, which determines the success or failure of the project. Robert Polk [27] and his team designed a complex venture capital evaluation system, including 58 variables. By research they found technology risk assessment played an essential part in the prediction of the success or failure of high-tech projects. Bygrave [28] also believed that the management capability is generally applicable indicator in the assessment of venture capital projects, while other indicators such as the market, R&D and financial management should be taken into account combined with the specific circumstances of the industry.

The classic works of risk assessment contain Multi-objective decision analysis with

engineering and business applications [29] by Ambrose Goicoechea, Don R. Hansen and Lucien Duckstein, Nonlinear Decision Weights in Choice under Uncertainty [30] by George Wu and Richard Gonzalez, Risk Assessment in Construction Schedules [31] by B. Mulholland and J. Christian, Correlations of Copulas for Decision and Risk [32] by Robert T. Chemen and Terence Teilly, Risk Analysis for Large Projects-Models [33] by Dele Cooper and Chris Chapman and so on.

In addition, some researchers have done an in-depth study of the economic evaluation of investment projects. For example, James E Smith published Evaluating Income Streams: a Decision Analysis [34]. Graig R. Fox and Amos Tversky published A Belief - Based Account of Decision under Uncertainty [35]. Suzuki published Theory and Application of Economic Analysis [36]. Yutaro Ito published Analysis on Economic Indicators [37]. He divided the economic indicators into growth indicators, safety indicators and profitability indicators and made detailed analysis on each indicators. S. Thomas Ng and Yoki M.W Wong [38] put forward a systematic evaluation model for the feasibility study of PPP project.

In the decision analysis method of project investment, Myer [39] proposed the real-option method. T. L. Saaty [40] put forward an analytic hierarchy process (AHP) method which can be used in multi-objective evaluation decision.

As a basis for feasibility studies, technical economics also make great progress. James L Riggs and Thomas M West pointed out the relationship between technology and economy as well as the issues among static and dynamic assessment, uncertainty risk and program selection in their Essentials of Engineering Economics [41] published in 1986. In terms of prediction, Spyros Makridakis and Steven C. Wheelwright published Forecasting Methods and Applications [42], discussing the prediction methods and their advantages and disadvantages, and giving guidance on their application. The Japanese residential newspaper published Long-term Forecasting of Residential Investment, analyzing the analysis of the demand for housing towards the 21st Century. These studies provide the theoretical basis and application cases for the further development of feasibility study and development.

4.2. The domestic theories on feasibility study. According to the focus of the feasibility study, the theoretical and practical essays can be divided into the following aspects:

In the project economic evaluation, a large number of scholars improve the economic evaluation by combining the evaluation with real projects. Wu Deqiang, Li Shanping published Economic Analysis of Investment Project [43]. Lin Xiaoyan, Xu Xiaofeng and Ren Li published Economic and Social Evaluation of Construction Project [44]. Li Xingsu, Zhang Jianguo put forward the application of the project investment decision model. He Xuguang and Wang Huanxou fixed the internal rate of return. Xu Jiuping proposed the optimization model of the economic effect evaluation function. Guo Siliang [45] further improved the evaluation model, joining the real option method, designing an comprehensive technical and economic evaluation model for IT investment project. Meng Lisha[46] argued that real options law can access the value of network enterprises more objectively.

In the aspect of forecasting theory, Wang Mingtao [47] analyzed the accuracy and

validity of qualitative prediction. Ge Xinquan discusses the periodic regression analysis. Yang Guiyuan and Tang Xiaowo [48] proposed the loss function prediction method, Wang Jing, Liu Liangdong and Wang Zuoyi summed up on forecast combination.

In the aspect of risk analysis, Liu Changyong [49] designed a set of risk assessment system for investment project, in which the business and marketing were the two most important indicators, but the entrepreneurial management was ignored. Tang Yanzhao [50] constructed a comprehensive evaluation framework for the feasibility evaluation system of venture capital project. After that, Chen Guodong [51] came up with the construction method of venture capital project evaluation index. Du Haipeng [52] published Real Estate Investment Risk and Prevention. Shi Xiaojun, Li Jian, Li Hui [53] compared and analyzed the main risk assessment methods of project investment. Li Hongjun, He Yabo discussed the dynamic risk of financing. Hu Zhigen and Xiao Kuanxiong put forward the dynamic risk analysis model of investment planning. Qiu Liquan and Gui Liangjun put forward some suggestions on the investment risk decision method.

In addition to the traditional feasibility evaluation approach, Yin Hang [54] introduced BP neural network method into the feasibility study, and conducted the technological economic feasibility evaluation system of scientific and technological transformative project based on BP neural network. Li-yin Shen [55] proposed a feasibility study approach based on the principle of sustainable development in view of the less concerned about the social and environmental performance in the current construction projects. Huang Shan and Zhang Xuejun [56] overcame the shortcomings of the traditional TOPSIS sorting method, putting forward a new TOPSIS sorting method based on relative entropy, and carrying out case study in the feasibility study of a highway construction project.

In the combination of the theory and practice of feasibility study, Geng Yongchang and Wang Guangyuan [57] published Engineering Feasibility Study: Theory, Method and Application in 2007. On the basis of summarizing the theory and practice of feasibility study in China, the book analyzed the major theoretical issues. In order to promote the spreading and application of Economic Evaluation Methods and Parameters for Construction Project issued by the National Development and Reform Commission and the Ministry of Construction, Wan WeiWu, Liu Xinmei, Sun Wei [58] published Feasibility Study and Project Evaluation, describing and expanding the feasibility study theory and the application of economic evaluation methods and parameters. Wang Yong wrote Investment Project Feasibility Analysis- Theoretical Essentials and Case Analysis in 2008, summarizing the characteristics of various types of investment projects. Feng Bin, Han Yulai and Li Xiaojie [59] discussed the methods for project investment decision in the preliminary stage, its feasibility study and risk assessment in the book Project Investment Decisions.

Besides, in terms of project practices, many scholars have combined feasibility studies with their majors and projects to promote the application and development of feasibility studies in various fields. Xue Quanman and Huang Shuqin [60] made a feasibility analysis on the landscaping project of North No.2 Road in Zhuhai Gaolan Port Economic Zone, and discussed the feasibility content of landscape engineering projects. Liu Ruijin [61] analyzed

the implementation of rubber forest carbon sequestration project in Guangxi, and systematically analyzed the feasibility of domestic rubber forest carbon sequestration projects. Zhang Yan and Zhang Shaoliang [62] studied the Shanxi International Energy CCUS project for coal - bed methane exploitation, which provided the basis for decision-making of CCUS coal-bed methane mining project. Ma Yuefeng and Guo Xiaohui [63] evaluated the feasibility of rare earth products with the uncertainty analysis, and verified its validity.

5. The existing problems of feasibility study.

5.1. Feasibility study is a mere formality. For a long period of time, the feasibility study has been considered to be time-consuming, laborious, feeble and even unnecessary work. In the process of investment decision-making, the first is drawing conclusion, and then conducting feasibility study. So the final results must be feasible and determined. In addition, due to the feasibility study report of construction projects is the qualification of getting government approval and applying for loans to the bank, in order to be approved and raise more funds, some projects do everything possible to put together the facts to draw the conclusion of the feasibility in order to obtain higher levels of approval, to raise more funds, often the feasibility study report into Batch "research report, do everything possible to put together the facts to draw a feasible conclusion. At the same time, the requirements for feasibility study are too general, lack of operational guidelines, leading the formalistic feasibility study.

5.2. Feasibility study has no force of constraint. In China, feasibility study is an important part of capital construction process. However, in practice, it is common to change the feasibility study report at will. At the same time, due to some project approvers lacking in professional knowledge, the unqualified feasibility studies report can often muddle through. In these circumstances, feasibility report cannot impose the constraints on the project.

5.3. Feasibility study process is not standardized. In the feasibility study, it is necessary to form a special feasibility study group composed of various professionals to carry out the analysis in scientific, technical, economic and other to determine whether the project is feasible or not. However, some projects don't set up a feasibility study group. As a result, the feasibility study reports are hastily prepared by the project applicants. Even if the feasibility study group is set up, the group usually lacks experts. Besides, in reality, the feasibility study group members are often designated by superior department. The designated members conduct feasibility study by their subjective experience rather than scientific methods, leading to the unreliable conclusions.

5.4. The content of feasibility study is incomprehensive. In the preparation of the feasibility report, project leaders tend to focus on the technical feasibility analysis instead of the market research [64]. Therefore, the market research in feasibility report is too general to evaluate. Due to lack of specific data and scientific argument, some feasibility reports are difficult to help the project decision-making and evaluation. At the same time, the methods and indicators of some projects are not reasonable and reliable enough,

reducing the credibility of the feasibility study. In addition, because of some projects not matching the country's long-term development program or not taking the regional industry characteristics, the public benefits into account, the conclusions of the feasibility report usually failed to achieve the desired economic and social benefits.

6. Conclusion. This paper systematically introduces the development, the main theories and the existing problems of the feasibility study. Feasibility study is a comprehensive study involving technical economics, management and natural sciences. In order to ensure its scientific, impartiality and validity, it is necessary to ensure the authenticity and objectivity of the collected data, the accuracy and rationality of the research methods and parameters, the reliability of the research process specification.

REFERENCES

- [1] Justis, R. T, Kreigsmann, B. The feasibility study as a tool for venture analysis. *Business Journal of Small Business Management*, vol.17, no.1, pp.35-42. 1979.
- [2] Georgakellos, D. A., Marcis A. M. Application of the Semantic Learning Approach in the Feasibility Studies Preparation Training process. *Information Systems Management*, vol.26, no.3.pp:231-240, 2009.
- [3] Sun Hong. Review of Investment Project Feasibility Study. *Journal of North China Electric Power University (Social Sciences)*. No.6, pp:231-240.2008.
- [4] Feasibility.<http://www.oed.com/view/Entry/68797?redirectedFrom=feasibility#eid>.
- [5] Jules Dupuit. *On the measurement of the utility of public work*. London: Macmillan Press, 1952.
- [6] A • Marshall. *On the consumer surplus*. Elsevier Inc, 1901.
- [7] U.S. Ministry of Construction. *River Basin Project economic analysis of the practical methods*. 1950.
- [8] Zhang Yu. *Project Evaluation Practice*. Beijing: China Financial Publishing House.pp:12- 13, 2004.
- [9] U.S. Ministry of Construction. *Planning Program Budget System (PPBS)*. 1964.
- [10] Ge Baoshan. Wu Wankang. *Project Evaluation*. Beijing: Tsinghua University Press, pp:9, 2004 .
- [11] I.M.D. Little and J.A.Mirrlees. *Project appraisal and planning for developing countries*. Heinemann Educational Books, 1974.
- [12] P.Dasgupta, A.Sen and S.Marglin. *Guidelines for Project Evaluation*. UNIDO, United Nations Publication, New York, 1972.
- [13] United Nations Industrial Development Organization. *Manual on the Use of Consultants in Developing Countries*. New York: United Nations Industrial Development Organization. 1972.
- [14] United Nations Industrial Development Organization. *Extracts of Industrial Feasibility Studies. Industrial Planning and Programming Series*. New York: United Nations Industrial Development Organization. 1973.
- [15] Bruce, van der Tak and Squire. *The Economic Evaluation of Projects*.1975.
- [16] UNIDO-IDCAS. *Manual for Evaluation of Industrial projects*.1980.
- [17] Grabowsky K. *Manual for the preparation of industrial feasibility studies*. United Nations, 1978.
- [18] Yu Junnian. *Feasibility Studies and Project Evaluation*. Beijing: University of international Business and

- Economics Press. pp: 2-3, 2011.
- [19] The State Planning Commission. *Interim Measures for the Administration of the Implementation of the Feasibility Study on the Construction Projects*. 1983.
 - [20] China Investment Bank. *Industrial Loan Project Evaluation Manual (Trial)*. 1981.
 - [21] The State Council Technical and Economic Center. *Economic evaluation method for feasibility study on industrial construction projects -enterprise economic evaluation*. 1985.
 - [22] The State Planning Commission. *Guidelines of Investment Project Feasibility Study*. 2002.
 - [23] Myer S . Determinants of corporate Borrowing. *Journal of Financial Economics*. Vol.5, No.2, pp: 147- 176, 1967.
 - [24] Tyzoon T. Tybjee , Albert V Bruno . A Model of Venture Capitalist Investment Activity Management Science. 1984.
 - [25] Beley V. The role of venture capital in the creation of public companies : evidence from the going-public process. *Journal of Financial Economics*. Vol.27,No.2, pp:447-472, 1990.
 - [26] Ross, Margaret Lee Hamel . An exploration into the role of marketing in the venture capital investment evaluation process of high-technology startup companies. Dissertation for Ph.D. Degree. 1987.
 - [27] Robert Polk , E. Plank Richard , A. Reid David . Technology Business Markets. *Industrial Marketing Management*. 1996.
 - [28] Bygrave, William D, Jeffrey A Timmons. *Venture Capital at the Crossroad*. Boston: HBS Press. 1998.
 - [29] Ambrose Goicoechea, Don R. Hansen, Lucien Duckstein. *Multi-objective decision analysis with engineering and business applications*. New York: John Wiley and Sons. pp. 519, 1982.
 - [30] George Wu & Richard Gonzalez. Nonlinear Decision Weights in Choice under Uncertainty. *Management Science*, Vol. 45, 1999.
 - [31] B. Mulholland & J. Christian. Risk Assessment in Construction Schedules. *Journal of Construction Engineering and Management*, Vol.125, No.1, pp: 8- 151, 1999.
 - [32] Robert T. Chemen & Terence Teilly. Correlations of Copulas for Decision and Risk. *Analysis Management Science*, Vol. 45, 1999.
 - [33] Dele Cooper & Chris Chapman. *Risk Analysis for Large Projects-Models. Methods and Cases*. John Wiley & Sons Ltd, pp: 20- 141, 1987.
 - [34] James E. Smith. Evaluating Income Streams: a Decision Analysis. *Management Science*, Vol. 44, 1994.
 - [35] Graig R. Fox & Amos Tversky. A Belief - Based Account of Decision Under Uncertainty. *Management Science*, Vol. 44, No. 7, pp: 879 – 895, 1998.
 - [36] Suzuki. *Theory and Application of Economic Analysis*. Japan: Academic Press. 1990.
 - [37] Y Ito. *Analysis on Economic Indicators*. Japan: Doyukan press. 1996.
 - [38] Ng S.T., Wong Y, et al. A Structural Equation Model of Feasibility Evaluation and Project Success for Public-Private Partnerships in Hong Kong. *IEEE Transactions on Engineering Management*. Vol.57, No.2, pp: 310-322, 2010.
 - [39] Myer.S. C. Determinations of Corporate Borrowing. *Journal of Financial Economics*. 1977.
 - [40] Saaty T L. *The Analytic Hierarchy Process*. Hill, Inc, 1980.
 - [41] James L. Riggs, Thomas M. West. *Essentials of Engineering Economics*. America: Mcgraw-Hill, Book Company. 1986.
 - [42] Spyros Makridakis, Steven C. *Wheelwright. Forecasting Methods and Applications*. New York: John Wiley & Sons, Inc. 1978.

- [43] Wu Deqiang, Li Shanping. *Economic analysis of investment project*. Beijing: Petroleum Industry Press. 1998.
- [44] Lin Xiaoyan, Xu Xiaofeng, Ren Li. *Economic and Social Evaluation of Construction Project*. Beijing: China Industry and Commerce Press. 2000 .
- [45] Guo Siliang. Research on Technical and Economic Evaluation Model of IT Investment Project and Its Application. *China Management Informationization*, vol. 13, No.19, pp: 85-88, 2007.
- [46] Meng Lisha. Applicability Study of Real Options on Net Companies Investment Appraisal. *Science & Technology Progress and Policy*, vol. 21, No.1, pp: 130- 133, 2007.
- [47] Wang Mingtao, Accuracy and Validity Analysis of Qualitative Forecasting Method. *Prediction*. No.2, pp: 44-46, 1997.
- [48] Yang Guiyuan, Tang Xiaowo. A New Predictive Evaluation Method - Loss Function Method. *Prediction*. No.3, pp: 38-40, 1998.
- [49] Liu Changyong. Study on Investment Evaluation of Venture Capital in Taiwan. Report of Enterprise Management Department of Taiwan Sun Yat - sen University. 1996.
- [50] Tang Yanzhao. Comprehensive Evaluation Index System Design of China High-tech Venture Capital. *Science & Technology Progress and Policy*. No.2. pp: 155- 157, 2003.
- [51] Chen Guodong. Investment Performance Evaluation of Venture Fund Management Company in Taiwan . *Productivity Research*. No.19, pp: 40-42, 2008.
- [52] Du Haipeng. *Real Estate Investment Risk and Prevention*. Beijing: Economic Science Press.1998.
- [53] Shi Xiaojun, Li Jian, Li Hui. Comparative study on the main methods of project investment risk assessment. *Technoeconomics & Management Research*. No.6, pp: 25-26, 1998.
- [54] Yin Hang. Evaluation on Technological Economic Feasibility of Scientific and Technological Transformative Project Based on BP Neural Network Method. *Science of Science and Management of S. & T*. Vol.29, no.5, pp: 99- 106, 2008.
- [55] Shen L Y, Tam V W Y, Tam L, et al. Project feasibility study: the key to successful implementation of sustainable and socially responsible construction management practice. *Journal of Cleaner Production*. Vol.18, no.3, pp: 254-259, 2010.
- [56] Huang Shan, Zhang Xuejun. Relative Entropy Analysis on Highway Construction Feasibility Project Evaluation. *Journal of Engineering Management*. Vol.31, no.3, pp: 97- 101, 2017.
- [57] Geng Yongchang, Mao Guangyuan. *Engineering Feasibility Study: Theory, Method and Application*. Beijing: Higher Education Press.2007.
- [58] Wan Weiwu, Sun Xinmei, Sun Wei. *Feasibility Study and Project Evaluation*. Xi'an: Xi'an Jiaotong University Press.2008.
- [59] Feng Bin, Han Yulai, Li Xiaojie. *Project Investment Decisions*. Beijing: China Electric Power Press.2008.
- [60] Xue Yuanman, Huang Sheqin. Discussion on the Garden Construction Project Feasibility Study Report —Taking the Landscaping Project for the North 2nd Road in Zhuhai Gaolan Port Economic Zone as an Example. *Chinese Landscape Architecture*. Vol.28, no.7, pp: 115- 118, 2012.
- [61] Liu Ruijin, Wei Hongjie, Wu Zhixiang et al. Feasibility Analysis of Rubber Forest Carbon Sequestration Project under Clean Development Mechanism - Reference from Guangxi Forestry Carbon Sequestration Project. *China Tropical Agriculture*, vol. 3, pp: 75-79, 2013.
- [62] Zhang Yan, Zhang Shaoliang. Economic feasibility analysis of CCUS project for coal - bed methane

exploitation. *China Mining Industry*, vol.11, pp: 25-27, 2015.

[63] Ma Yufeng, Guo Xiaohui. Application of Uncertainty Analysis in Rare Earth Products Investment Project. *Friends of Accounting*, No. 13, 2017.

[64] Fu Jingjing, Wang Yang. Feasibility Study and Its Improvement in China . *Chemical Techno-Economy*. vol.23, no.2, pp: 28-31, 2005.