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ENLIGHTENMENT TO TAIWAN INTELLIGENT PARK FROM FRENCH COMPETITIVENESS PARK EVALUATION MECHANISM

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Abstract. *When the French technology parks faced a transformation, the strategy of the competitiveness parks adopted by the government was its most distinctive part, which took the evaluation mechanism of the park to eliminate the objects with poor performance which did not meet the country's overall research and development. Fuzzy Delphi method was used in this study, and we analyzed the degree of recognition of the park evaluation items in the expert questionnaire as the preliminary study of the park evaluation mechanism of developing Science Parks in Taiwan.*
Keywords: Intelligent Science Park, Competitiveness Park, Evaluation mechanism, Innovation strategy

1. **Introduction.** For the science parks or technology parks with a scale and history in the world, no matter where they are, or on a different timeline, they are different from each other due to the difference of the time of development, scales, industry features and clustering patterns. Even they are within the same park in the same country or area, they all have changes and differences facing the problems in the various time intervals, of the roles they play, of the countermeasures in response to the environment, and of the direction which the government policy supports. The only thing that remains constant is the problems and challenges of the park transformation requirements. The policy characteristics of both Taiwan and France is strategic task-oriented, which follows Lawrence Kohlberg's mode, that is the government intervenes economic development through public enterprises and science and technology research institutions, laws and regulations [1]. In an increasingly competitive world situation, France confronts the problems of EU conceptual framework, the form of greater integration of the European research district and the sixth EU research framework program. They launched the "Competitiveness Park" (les Pôles de compétitivité) industrial policy in 2004, which aims to play an important role in the economy and the academic performance within the region to propose encouraging and supporting policies. Competitiveness Park is a particular region which combines the companies, research laboratories or centers, and training institutions through cooperation (common development strategy) to enhance the collaboration effect; the partners include national governments, nations and localities providing the service and support which needs the relevant members of the competitive park (DGE, 2014). The direction of reform implementation which France adopted may be divided into six facets: the reform of education, the reform of study, the revitalization of the industry to protect national economy health and ease the financial burden of enterprises, the promotion of the technology transformation of scientific and technological achievements through national legislation,

breaking down of the distinction between public and private research, the expansion of construction of technology transformation services platform, and the improvement of science and technology evaluation system. The most distinctive part of the competitiveness park policy is the evaluation mechanism of the park which may eliminate the objects with poor performance which failed to meet the country's overall research and development. The transformation and development of the Science Park in Taiwan may take reference of the evaluation model established in France, and offer rewards and incentives with attraction and power while eliminating the weak to exchange for the strong ones to maintain the competitiveness and the ability to activate to the parks. It shall be the reference mode when developing the future intelligent parks. Therefore, Fuzzy Delphi method was adopted in this study. The professional knowledge and experience of experts and scholars were used to initially develop the Park Competitiveness Evaluation Index System. Through the experts' opinions and suggestions of the related industries, a preliminary understanding of the fitness, accessibility and evaluation of the evaluation index shall be conducted.

2. **Theory and Methods.** Some economic literature has provided many discussions about "competitiveness" for evaluating the competitive positions of nations in the past years (Porter et al. [2-4]; Aiginger [5]; Ezeala-Harrison [6]; Garelli [7,8]; Blanke et al. [9]). These papers focus on and form the theoretical basis for how to evaluate the competitiveness of countries and regions and elaborating proposals for adopting appropriate strategies. In this study, we took Fuzzy Delphi method proposed by Ishikawa [10], which may improve the unstable situation due to the differences from the experts' terms and explanations, and then reduce the times of repeated questionnaires. With the expertise and experience of the experts, we took the repeated questionnaires and feedback of fuzzy Delphi method to obtain the experts common knowledge as the basis of the group decision-making. When the experts' opinions in the questionnaire reach the consistency, it may have the experts' opinions fall into an interval of views. However, this interval implies ambiguity which the traditional Delphi method did not take consideration of, and it is very easy to contort experts' opinions and suppress different ideas in order to strike the consistency. Murray et al. [11] cited the vague concept into Delphi's theory for the first time to improve this shortcoming. The threshold value can be adjusted by the decision-maker; when there are too few factors left, the threshold value can be lowered. The Delphi Team has decided: this study will perform an indicator questionnaire on "Park Competitiveness Evaluation Index", through the Fuzzy Delphi to select the assessment indicators of each system, with 10 people on the team. The respondents should meet at least one of the following principles [12].

A. The professionals actually engaged in the planning and design of architecture.
B. The personnel engaged in teaching or research on the topics related to this study.
C. Someone whose professional background is related to the topics of this study.
D. Someone who currently has considerable reputation in the related fields domestically.
E. Someone who has published articles or reports related to or similar to the topics of this study.
F. Managers who currently actually work inside the Science Park.
G. Someone who is concerned about this study or has sufficient professional expertise or knowledge of the topics of this study.

3. **Implementation Steps.** The relevant documents and information obtained in-depth interviews were taken for a reference to develop the Park Competitiveness Evaluation Index System initially. A preliminary understanding may be obtained using the opinions and suggestions of the related industries experts, including the fitness, the degree of accessibility and evaluation of the evaluation index.

3.1. **Fuzzy Delphi questionnaire.** We designed Fuzzy Delphi questionnaire and collected experts' opinions. Based on the created great facets system, we collected questionnaire data from 10 experts. Through interviews with experts to collect the competitiveness evaluation index, provide the ones to be the first time index choices after the interviews. In the meantime, each expert gave the interval numerical ratings to the assessment items individually to eliminate the Park Competitiveness Evaluation Index. The design basis of the questionnaire is the five-point Likert scale, and the other columns of the questionnaire were opened for the experts to propose different proposition. For the semantic understanding of individual experts, five kinds of semantic scale were marked out. We may give $0 \sim 10$ of the fuzzy interval for cognitive differences in the rating scale.

3.2. **To establish double trigonometric functions.** Analyze the survey results and establish double trigonometric functions:

1) Establish conservative trigonometric functions C^i (C_1^i, C_2^i, C_3^i) and optimistic trigonometric functions O^i (O_1^i, O_2^i, O_3^i).
2) (C_1^i, C_2^i, C_3^i) expressed the minimum value of conservative cognition, conservative cognition geometric mean and the maximum value of conservative cognition of item i of the experts.
3) (O_1^i, O_2^i, O_3^i) expressed the minimum value of optimistic cognition, optimistic cognition geometric mean and the maximum value of optimistic cognition of item i of the experts.
4) Set the distance between C_2^i to O_2^i as the "expert agglomerate consensus interval".
5) The intersection interval generated between the X-axis by "conservative trigonometric functions" and "optimistic trigonometric functions" shall be "gray zone", which is also the distance between C_3^i and O_1^i.
6) G^i expressed the importance of the agglomerate consensus of item i to the experts.

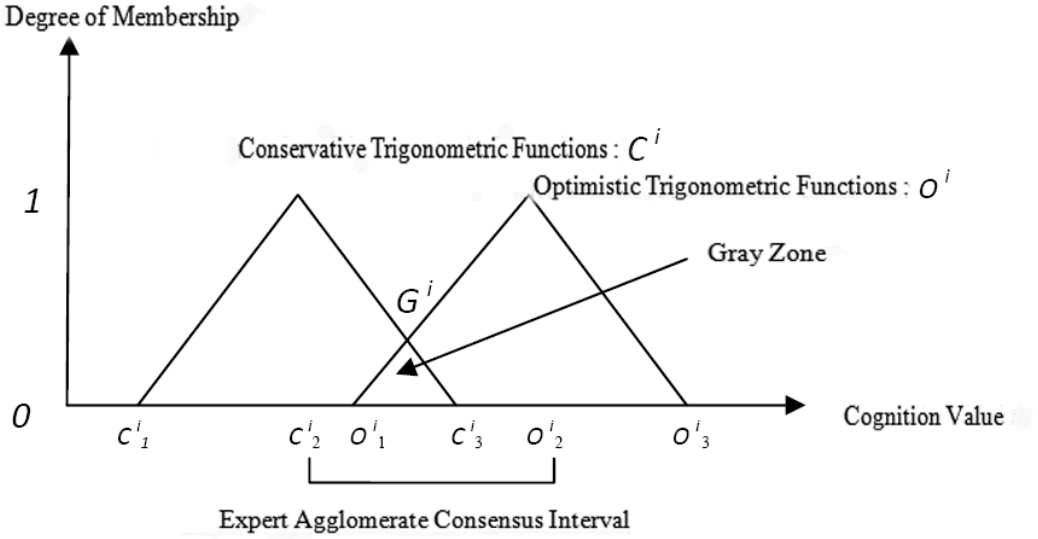

FIGURE 1. Double triangular fuzzy function graph [13]

3.3. **The analysis of park competitiveness evaluation index.** The principles for index selection proposed in the study shall meet two conditions: convergence and stability.

1) Convergence: G value is greater than G^* value.
2) Stability: it shall be in line with the two conditions, which are the intersection of "gray zone" generated by "conservative trigonometric functions" and "optimistic trigonometric functions", and "expert agglomerate consensus interval" shall be greater than "gray zone".

TABLE 1. The strategies of the competitiveness evaluation index's description table

Analysis of possible situation	Whether the consensus is built	Meaning	Countermeasure
I. "Conservative trigonometric functions" and "optimistic trigonometric functions" did not produce the intersection.	Expert Group did not agglomerate consensus to the index item.	The index produced instability.	*Using* $\bar{G}$ *test*: $\left(\bar{G} = \frac{C_2^l + O_2^l}{2}\right)$ 1. $\bar{G} > G^*$, *Convergent but unstable. A second questionnaire shall be conducted.* 2. $\bar{G} < G^*$, *the index may be excluded.*
II. "Conservative trigonometric functions" and "optimistic trigonometric function" produce the intersection, and "expert agglomerate consensus interval" is greater than "fuzzy interval".	Expert group has built consensus on index items.	The index has stabilized. G value is greater than G^*.	$F^i(X_j) = \{\int x\{\min[C^i(X_j), D^i(X_j)]\}dx\}$ $G_i = \{X_j \mid \max\mu_{F^i}(X_j)\}$
III. "Conservative trigonometric functions" and "optimistic trigonometric function" produce the intersection, but "expert agglomerate consensus interval" is less than "fuzzy interval".	The extreme value differences of the agglomerate consensus of expert groups to the index item are too large.	The index produced instability. If G value is greater than G^*, it is convergent, but not stable. A second stability questionnaire is required for the consistency.	*Using* $\bar{G}$ *test*: $\left(\bar{G} = \frac{C_2^i + O_2^i}{2}\right)$ $\bar{G} > G^*$ *Convergent but unstable. A second stability expert questionnaire shall be conducted.*

3) G^* is the basis of the importance of agglomerate consensus generated for the "agreement" of various experts. The G^* in this study is 74.5.

For the index item of the third situation, a second expert questionnaire was conducted, and we were looking for the index item which may agglomerate the experts' consensus. In this questionnaire, the mean opinion range of the conservative averages of the first questionnaire was provided to the experts as a reference, until all assessed index items which were not excluded may reach a stable agglomerate consensus.

3.4. **Questionnaire design.** An unstructured approach was adopted for the first time, and the Delphi Group was interviewed for the comments, and we prepared the second questionnaire in accordance with the comments. For the content of the first questionnaire, we prepared a questionnaire on the basis of the literature review and expert interviews. In addition to the content of the questions, all respondents were communicated in advance with the approaches of filling the answers. Before preparing the park competitiveness evaluation index in this study, we have collected many articles related to the field through literature analysis to sort out a systematic assessment item, and 20 indexes were obtained. Furthermore, the 20 indexes were distinguished in levels, and the park competitiveness evaluation index was covered in 20 internal indexes, and the 20 internal indexes were covered under the six facets (Table 2). The design basis of the questionnaire is the five-point Likert scale, and the other columns of the questionnaire were opened for the experts to propose different proposition. For the semantic understanding of individual experts, five kinds of semantic scale were marked out. We may give $0 \sim 10$ of the fuzzy interval for cognitive differences in the rating scale. If the convergence of index items is equal to or over 74.5 point, it can be the competitiveness evaluation index.

TABLE 2. Intelligent Park competitiveness evaluation index selection and judgment

Facets	Index Items	Convergence (G)
Production and quality of science and technology	New knowledge Publications	86
	Academic Conferences	88
Academic influence and attractiveness	To participate in domestic and international research programs	88
	To Invest in the future programs	87
	To build the platform of alliance cooperation	86
	To organize national and international seminars	88
	Personnel structure	89
	Awards	85
Impact on society, economy and culture	To participate in social activities	78
	Patents and sample design	86
	Nonprofit science popularization activities	80
Unit organization and daily management	Personnel working behaviors shall comply with the organizational strategic objectives	82
	To provide a favorable environment for the growth of personnel	81
	To provide regular counseling channels	78
Personnel technology research and training	Providing relevant professional and technical training	85
	Providing opportunities to have assignment training	76
	Training programs to meet the future development direction	81
Science and technology policy and prospects evaluation of the future objective contract	The development direction meeting the goal of main value	82
	To assess if the target contract may comply with the developing trend	78
	To provide the selecting topics through a competitive selection	76

4. **Conclusion.** The value of the Science Park transformation focuses on the enhancement of the innovative main network, and the construction of innovation-friendly space. The key lies in the breakthrough of the limitation of time and space. Using an innovative relationship, a virtual geographic neighboring network interaction other than actual things transforms the idea of science and technology parks into the coordinating region cooperation of the science and technology and industrial parks. The selection and evaluation mechanism may maintain more competitive vitality and balance the resource as well.

Science Park transformation policy should be a long-term innovation policy in a country; therefore, the completion of the policy system and the legal protection of the system shall be established firmly before promoting the policies. The development of management and intellectualization of the Science Parks in Taiwan may refer to France to establish an evaluation mode segmented staging circulation. From the independent evaluation, an independent committee may be held regularly by some experts from government, industry and academy to conduct an open and transparent process of assessment, to not only reward the outstanding performance and innovative bodies, but also to offer attractive

and energetic rewards and incentives, meanwhile to eliminate the weak and exchanges for the strong, which shall be the reference models for the intellectualization development of the future Science Parks.

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